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MIDGET TUBES FOR TELEVISION

# Popular Wireless & Television Times

MORE NEW LIGHT VALVES
By CARDEN SHEILS

EVERY WEDNESDAY PRICE 3D

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TIMELY AID
THAT'S THE SPIRIT
WELL PLAYED, SIR

# RADIO NOTES & NEWS

HIGH DUDGEON
CORKING IDEA
AROUND AND ABOUT

### That Monday Feeling

EVEN those who approach perfection in physical fitness are not proof against that kind of cold-pudding-and-stale-beer feeling that steals over the world's workers on a Monday morning.

All the more then is the B.B.C. to be commended for trying to brighten up our Mondays by relaying top-line American turns every week at 8.30 p.m., from New York, Hollywood, and other clusters of the bright lights. A new series of first-class variety, featuring Eddie Cantor, Kate Smith and other names to conjure with, starts on October 18th, and the Tatsfield receiving station is already tuned-up and on its toes to get the greatest possible programme clarity.

Felix Greene, the B.B.C's New York representative, is to be congratulated on having fixed up the relays, which will include—it is hoped—all the best laughter-raisers of the U.S.A.

### Timely Aid

AN extremely interesting reminder of Marconi's early difficulties appeared recently in the *Western Mail*. It was the facsimile of a cheque for £25, sent in January, 1899, to Mr. G. S. Kemp, Marconi's chief assistant, by his brother Mr. John F. Kemp, a Cardiff business man.

The cheque was in response to a letter which stated that monetary difficulties were hampering the pioneer work on wireless development; this was two years after the Bristol Channel had been bridged by radio, and two years before the triumphant conclusion of the preliminary phases by the bridging of the Atlantic.

Mr. John F. Kemp, who sent this timely and encouraging cheque, is now in his 90th year. I envy him the thrill he must get every time he turns that cheque over and reads the names endorsed on the back—*George S. Kemp* and *G. Marconi.*

### Point Counterpoint

BELOW are two extracts from recent letters to *The Times* which will amuse you.

Under the heading "B.B.C. Refinement," the first letter states:

*As an example of the "naiceness" of the B.B.C.'s mind, may I quote from a recent* cri de coeur—*an SOS on Saturday night last—when instead of a "wet nurse" or "foster mother," "a source of supply of human milk for new-born twins" was asked for.*

*Could "refainement" move further along the path to the lunatic asylum without actually forcing an entrance?*

Second letter (from Broadcasting House) states:

*The reason why we did not use "wet nurse" or "foster mother" was that we were asked to make a wider appeal. Human milk is, for instance, not uncommonly sent, in such urgent cases, from a hospital in bottles.*

MY WORD — By THE EDITOR

## PROGRAMME RESEARCH

**The B.B.C. continues to run little juries of listeners. And no doubt it will continue to operate in accordance with the findings of these only in so far as they coincide with its own views and ideas.**

**But, in any case, it is rather wasted effort. A small selection of those who respond to an invitation to act as critics cannot constitute a truly representative body of listeners. What about all those millions who don't take up invitations of any kind like that? Perhaps because they are too busy or uncertain regarding their movements to be able to tie themselves down to a fixed schedule of listening. Or because they feel that it is toying with the problem, anyway.**

**Still, when all is said and done, the principle is right. The B.B.C. should endeavour to discover the likes and dislikes of those whom it is supposed to serve. Also it ought to try to model its programmes accordingly. At least, to some considerable measure.**

**There is, in fact, room for a department of listener research at the Big House. But it would fail if the will to serve did not form the motive of its existence, or if its work were ignored by programme executives as seems to be the case with the Little Listener Juries.**

### Flying Doctor's Adventure

MORE than once I have referred to the good work done in Australia by the "flying doctor" who visits the remoter settlements by plane in response to requests sent by radio.

A few weeks ago it was feared that disaster had overtaken him, for nothing was heard of the plane after it had left on one of these visits of mercy. Air Force pilots were instructed to join in the search, and after seven days they found their man, who had made a forced landing in wild country, and kept himself alive by the good fortune of finding a cow stuck in a bog. He killed the cow and lived on it, but when found could not have lasted much longer.

### That's the Spirit

NO doubt you read about the B.B.C. television programmes having been blotted out by severe interference not long ago. But did you know that the spirit world had been blamed for this?

One listener wrote a long document on the subject, showing how human and spirit telepathic influences, upset by ultra-short-wave radiations, would interact and produce electro-magnetic effects that would give rise to blots and noises exactly like those which spoilt the television programmes.

He showed that the time, type, and wavelength all corresponded to this form of interference having been responsible. But the B.B.C. engineers are still looking for an adjacent high-frequency machine as the likeliest culprit, in the belief that misplaced volts, amps or ohms are at the root of all evil.

### Well Played, Sir

WHEN Henry Hall and his B.B.C. Dance Orchestra gave their final broadcast from the studio recently they ended a remarkably long and friendly association. For five and a half years they had regularly cheered listeners, during which time they had played over 3,000 different tunes—and played them well.

Henry had some justifiable pride in claiming that over 200 stars of the radio, stage, concert platform and films had appeared in his programmes from time to time. He now enters a new career with the boys who have served him so well, and my readers will join in the general desire to wish him good luck.

### Criticism in a Big Way

EVERYBODY who heard the B.B.C. appeal to their audience to help them by listening to light entertainment for twelve weeks guessed that there would be little difficulty in getting the necessary

(*Continued overleaf.*)

# THE PLAYER WHO SAW THE CONDUCTOR "LAST YEAR"

1,000 critics for such a scheme. Do not we all love to sit upon the seat of judgment?

It was hoped that considerably more than 1,000 would apply, so that the widest possible variety of places and positions in life would be represented in the final selection. But our national desire to criticise had been under-estimated, for in the event nearly 50,000 applications were received, all eager.

It has been decided, therefore, to double the number originally fixed on, and to have 2,000 of these sit-at-home critics, who will tell the B.B.C. regularly what they listened for and how they liked it.

I shouldn't be surprised if 2,000 well-aimed criticisms do our winter programmes a lot of good.

### High Dudgeon

ALTHOUGH much of the maintenance work on B.B.C. masts is done by the regular employees it is sometimes necessary to employ a steeplejack. On one occasion a particularly tricky piece of work had to be carried out at a great height, and the engineer in charge went along to have a word with the steeplejack about it before the ascent.

They discussed ways and means, scaffolding and so forth, and then the engineer said: "I can't say I envy you, having to work at that height above ground."

"Oh I shall enjoy it," said the steeplejack. "You see, I've been working on a cathedral for two months, and you've no idea how nice it will be to feel free to swear as much as I like again." And then he added anxiously. "There's no chance of its getting out on the Regional programme, is there, sir? I don't want no more rows from the missus about my language."

### The Good Conductor

SIR ADRIAN BOULT'S easy command of the B.B.C. Orchestra is well known, but when he conducts in the provinces there cannot always be such effortless co-operation between instrumentalists and conductor. It is said that on one occasion one of the performers, a very fat man, was so anxious to observe every wave of Sir Adrian's baton that he gave his small neighbour on the platform no proper chance at all to see the conductor. Later, conscience smote him a little, so he leaned down to the little man and said: "Can you see Sir Adrian all right?"

"Er, no," said the truthful neighbour. "But that's quite all right. I saw him last year."

### Corking Idea

AT the annual meeting of the International Pigeon Board, held recently in Manchester, concern was expressed at the numbers of accidents caused to racing pigeons and other birds by electric cables and wireless aerials.

The birds fail to see bare wires, but experience proves that they will nearly always succeed in avoiding a wire which has a series of corks threaded on to it at intervals.

It was suggested that representations should be made to the Postmaster General regarding the possibility of enforcing the corking of aerials in the neighbourhood of pigeon lofts, but I am sure that if more listeners realised the dangers to the birds they would on their own initiative willingly fit corks.

No decent chap wants his aerial to endanger the birds, or to spoil his neighbour's sport, especially if he knows that corks fitted in the way suggested have no harmful effect on radio reception.

## BROADCASTING TOPICALITIES

The microphone visits Thurstons, the famous billiards saloon, on October 28th, to broadcast in the National programme a description of the Handicap Snooker Match. The observer for the B.B.C. will be Willie Smith, a former snooker and billiards champion.

The arrangements for broadcasting a snooker match are simple but effective. A microphone is provided for the commentator and, to add to the realistic atmosphere, two others are placed, one over the table to pick up the impact of the balls, and another for the marker, so that the listeners can hear the marker calling the score. Those listeners who have been to Thurstons will be able to recognise the voice of Charlie Chambers, who is a celebrated character there and invariably marks for all the famous matches.

* * *

In the evening of October 19th, marking and honouring the afternoon's opening of the Stagshaw transmitter, a "Scrapbook" programme of special interest to listeners in the North-East will be broadcast from Newcastle (Northern programme). It is called "Stagshaw Looks Back," and the realistic retrospect will bring out again some of the outstanding programmes which have been given to radio audiences since broadcasting began in that area fifteen years ago.

* * *

The artists in Dance Cabaret (West of England programme) from the Royal Bath Hotel Ballroom, Bournemouth, on October 20th, will include: Walsh and Barker (the sophisticated stylists of song and satire); Greta Keller (popular cabaret star); Carlos Ames (the wizard of the harp); and dancing to Harry Roy's Lyricals, directed by Maurice Kasket, with John Harris and Mona Brandon.

### Spirit Clue to Missing Concerto

MANY people besides music lovers will be interested in the Violin Concerto by Schumann which is shortly to be broadcast from the German stations, and by the B.B.C. next February with Jelly d'Aranyi as soloist.

Reference has already been made to it in the News Bulletin, and probably we shall hear more announcements at the time regarding the curious claims made about the finding of this manuscript.

The story is that some three years ago Jelly d'Aranyi and her sister became interested in the possibilities of communication with spirits, and received mysterious information about a previously unknown work for the violin. Schumann had requested the lapse of a hundred years before this work was played, but as a result of the spirit messages the ban has been lifted.

### Radio Gold-Finder

IT is quite a long time since we had news of a sure method of finding hidden gold by means of radio apparatus, so I was quite glad to see the recent report that a gentleman of Louisiana, U.S.A. has invented an infallible device for the purpose.

Details, as might be expected, are a little scanty. But it seems that waves from the apparatus are directed down into the earth, and listened for on a sensitive receiver. If there is no gold they go down through the earth, heading for the antipodes; but if they encounter gold ore or buried treasure they are reflected back to the surface, to make the receiver acquainted with the glad tidings.

Beyond this, nothing is known about the invention, except that its owner is very, very poor. So let us hope he has found a truly sovereign remedy.

### Around and About

THE Dutch East Indies is wondering whether the good old Malabar transmitters are not due for replacement. There is talk of building a new and bigger station at Dajuhkolor.

* * *

Russia and Finland recently agreed that a number of wireless direction-finding stations for ships should be erected in the Gulf of Finland.

### Wireless Confidence Trick

AT one time, before publicity killed the trick, it used to be a favourite dodge of thieves to put on peaked caps, call at houses where radio sets were installed, and say that they had been sent to put the sets right, or test them, or some such bunkum. The test van was always "just round the corner," and, of course, once they had taken the set they failed to return it.

A new variation has recently been tried. A suave gentleman lands on the doorstep, begs the lady's pardon for troubling her, but explains that there has been some wireless interference in the neighbourhood, and so all vacuum cleaners are being fitted, free, with silencers.

If the lady has a vacuum cleaner it can soon be adjusted—the fitting-van is just round the corner. (Good-bye to all that.)

So pass the word on to your womenfolk, and tell them that Ariel repeats the gipsy's warning—"Do not trust him, gentle maiden, though his voice be low and sweet."

**ARIEL**

# HUSH! NOT A WORD!

How to find out what has gone wrong with a receiver which has stopped working for no apparent reason at all.

By K. D. ROGERS

HOW many times have you come across the "Old Man River" type of set? You know, the set that "doan' say nuthin'" but just keeps on going without a sound coming from the loudspeaker.

Probably the silent set is the most annoying of all faulty receivers to deal with. You somehow feel that you have at least a starting-point when you have a receiver that insists on crackling, or howling, or motor-boating. But when it comes to dead and impenetrable silence, where are you?

I am assuming in this article that the set has "gone dead." It is not one of those of which the wife says, "It was going all right when I switched it off last night." It has unaccountably gone dead just before that variety turn you wanted to hear.

The set that went overnight is usually plagued with a burned-out valve, or a fuse that has broken, or a resistance that has broken or a poor switch contact; the reason being that the mechanical action of switching off is also accompanied by cooling of parts carrying current and with the cooling comes contraction and the parting of the ways for filament, heater, fuse wire, or resistance wire.

## TESTING THE SPEAKER

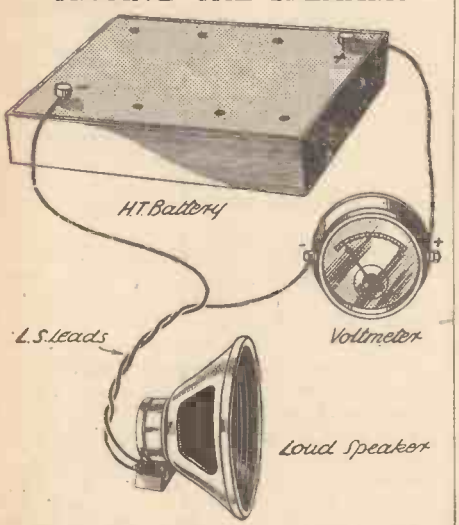



Fig. 3. Testing the loudspeaker to see whether there is a complete circuit through it.

The set that suddenly sulks is another pair of shoes—to use a familiar metaphor. It may be a valve, it may be a resistance, or even a fuse—I have known many of the last named go under the excitement of anticipation of a really good programme; it is wonderful how such a sudden and unexpected, even rare, strain will upset an otherwise decent receiver—but the fit of the sulks may be due to other things, and unless you start to look for the seat of the trouble systematically you may be all night finding it, with considerable lost time.

The time-honoured method of carrying out a preliminary test of a battery set is to pull the H.T. plug out at the negative end and keep on touching the socket with it. Those who are experienced can often tell by the degree of sound made in the speaker (if any sound at all) which stage holds the nigger in the wood-pile.

A more satisfactory method is to remove the valves or their H.T. plugs one by one with the set on, starting at the H.F. end—this does not include the output valve in a mains set, owing to the risk of voltage rise causing damage to the power pack—and the valves or the plugs are plugged in and out quickly to see if they make a click in the speaker. When a valve or plug is found that does not make a click it will usually indicate that there is trouble in that circuit. In any case, I should run over the valves for filament or heater continuity with a voltmeter and small battery in series.

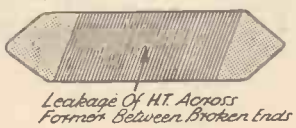



Fig. 2. One way in which a resistance's value can increase considerably.

### Using a Milliameter

Best of all for the valves themselves, and for the anode circuits, is the milliammeter test. Place the milliammeter in series with the valve, next to the valve itself and see what reading you get (Fig. 1). If it is nil, then the trouble is in that circuit between valve and H.T. If the reading is low it is worth trying the voltage between valve anode and cathode. The valve may have lost emission, but that does not usually take place suddenly, nor does it result in no signal. If the anode voltage is low, you have probably got a leak to earth somewhere or else some part of the circuit has "gone high resistance." That can be caused by a faulty anode resistance—one of the composition type having increased its resistance, or one of the wire-wound type having broken and the anode voltage being carried across by a trace of sooty material caused on the resistance former by the arcing which took place when the resistance burned out. (Fig. 2.)

If all anode circuits give low or nil readings, suspect the power supply.

If you have a gramophone switch on the set you should try the pick-up before any other test. If it works it shows that the set is O.K. between the pick-up and speaker, and the trouble is in the detector or H.F. end. If it does not work it shows that PROBABLY the trouble is in the L.F. end, or in the H.T. circuit, for it is unlikely, except for H.T. or L.T., that the trouble would occur in two places at once—namely the H.F. and L.F. ends.

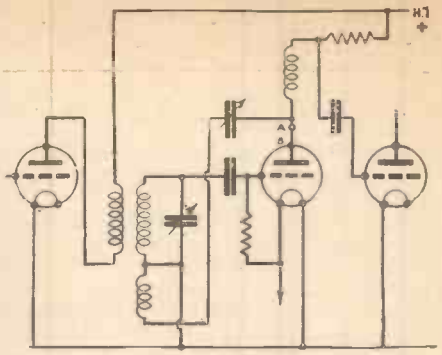



Fig. 1. The points A and B show where to insert a milliammeter for an anode circuit test.

Suppose your H.T. is O.K. and the L.T. by voltmeter test is O.K. If the anode currents of the valves are all right then the valves themselves are in order.

What next? Obviously the speaker itself must be suspected. Just try it across an H.T. battery for a moment to see if you get a click, if it is a battery set, but if the leads are O.K. it is doubtful if anything will have happened to the speaker, and the anode current test of the output valve will show if the loudspeaker leads are O.K. UNLESS YOU HAVE A CHOKE OUTPUT. If you have, try the speaker connected in any of the anode connections or in series with a battery and test for current. Don't use the milliammeter if you use a battery and no valve in series. You must use a voltmeter in series with the speaker, as shown (Fig. 3).

If the set works on pick-up turn your attention first to the aerial. It may have come unput somewhere, but if you are near a local station, or have a superhet, you will probably be able to tune-in without an aerial, so that unless the aerial has become shorted somewhere you will be able to check the set on H.F. without having to look at the aerial.

Suppose your anode currents and voltages are all right. What then? The grids are the next points to look after. Take the aerial off the aerial terminal and touch the detector grid circuit with it (via a condenser) on the side of the grid condenser remote from the grid. Signals? Good. Then try it on the anode of the previous H.F. valve. Signals again? Good. (Fig. 4.)

Try the aerial on each grid and anode

(*Continued overleaf.*)

## STAGE-BY-STAGE WORKING

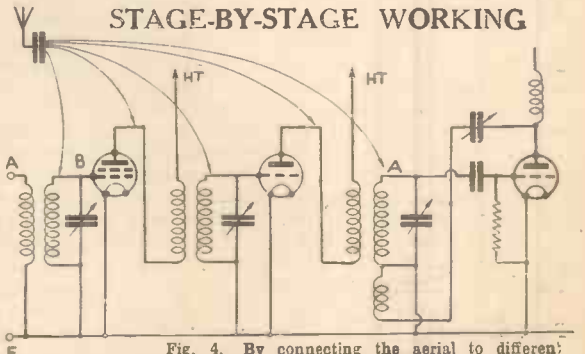



Fig. 4. By connecting the aerial to different points in the circuit, it is often possible to locate a fault in the H.F. stages.

## HUSH! NOT A WORD!

(Continued from previous page.)

working back until you come to the point where there is no signal. That circuit is probably the faulty one. It may have a disconnection or a short to earth somewhere.

In a battery set suspect the grid-bias connections. Those plugs are very fond of coming out. In a mains set the bias is probably O.K. It will be self-bias anyway, and if the anode current of the valve is O.K. you will find that the bias for that valve is also in order.

You must not overlook the possibility of a dirty valve leg contact. A grid leg that does not make contact with the valve-holder socket will stop signals. So will an anode leg that does the same. But there is a visual test for these, as you probably know. If the grid leg is not making contact, you will have no bias on the valve and the anode current should read too high. If the anode leg is not making contact, you will get no anode current reading, and the odds are that the anode voltage reading from the anode of the valve holder to earth or cathode will be too high.

### Check the Coils

Filament pins that do not make contact are not unknown, and you should test the filament voltage of a battery valve with the voltmeter actually touching the filament pins of the valve and not the filament contacts or terminals of the valve holder.

And if all these things are in order? If the speaker is O.K. and properly connected and if the pick-up works, the aerial is all right and yet no radio can be received? Have a jolly good "suspect" of the coil units. The switching may or may not be in order. Changing the wavelength may throw some light on the subject, so do not forget to work the wavechange switch. Your aerial test (Fig. 4 should help you here).

When you have found the place, you must take out the faulty part and either mend it yourself or get your dealer to send it to the makers. In the case of a faulty coil

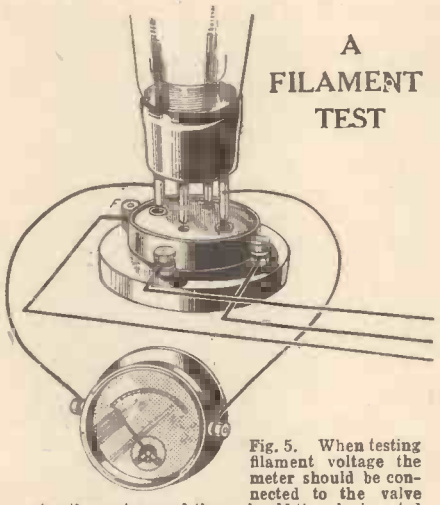



Fig. 5. When testing filament voltage the meter should be connected to the valve pins themselves and these should then be inserted in the sockets.

do not forget to test the windings for continuity with a battery and voltmeter, to see if it is the winding that is causing the trouble.

The coupling resistances of a set should be carefully tested if the anode current is nil in any stage. A broken-down by-pass condenser may have caused a burn out of one or more of the resistances. This will happen in a mains set more than a battery model.

L.F. transformer windings should be suspect in case of the trouble being found to lie in the L.F. end of the set, especially if the anode voltage and current of an L.F. valve are found to be wrong. There may be a break in the transformer winding causing no anode voltage, or there may be a short in the winding causing correct anode voltage and current but allowing no signal to pass across the next valve. In this case the anode tests will show up O.K. except that the pick-up will refuse to work, showing a break on the L.F. side.

Tapping the L.F. valve grids with a damp finger is a good test for L.F. stages. If there is no click in the speaker look out for trouble. A better test in a battery set is to move the bias plugs one by one, a lack of noise indicating the faulty stage.

### Go Carefully and Logically

In a mains set try shorting the bias resistance with a piece of wire and listening for the clicks. They should be pretty loud if all is in order.

And so we could go on, testing resistances and condensers in the set, and whether the H.T. supply to the set from the power pack shows on meter test to be faulty. Also the resistances and condensers in the power pack, not forgetting, of course, a first look at the rectifier.

But in all tests go carefully and logically. Don't just shove the meter tags here, there and everywhere. Think what you are doing and why you are doing it. And use insulated meter testing prods. You will obviate any shock that way, and a mains set can give you a nasty packet if you are messing about with the power pack without proper test prods.

## TECHNICAL JOTTINGS

### Items from an expert's notebook

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

I DARE say you know that electricity can be generated from certain kinds of crystalline substances by applying mechanical pressure to them in a suitable way; the original and most familiar example is the quartz crystal, and electricity produced in this way is known as "piezo-electricity." This phenomenon of the generation of electricity on the surfaces of the crystal due to mechanical strain was discovered about 1880 by, I think, M. Pierre Curie, whose name is so prominently linked with investigations into the science of radio-activity.

### Piezo-Electricity

For many years piezo-electricity was little more than a laboratory curiosity. Attempts were made to use this particular effect for the purpose of accurate measuring instruments for very minute quantities of electric power or mechanical power in the form of sound. It still remained, however, rather in the nature of a scientific curiosity.

Investigations have continued with a view to making this effect more of a practical thing; in particular, to find some kind of crystal and some arrangement by which the electricity generated could be very greatly increased in amount. In the earlier days the electricity required enormous amplification by means of valve amplifiers before it could be brought up to any amount that could be reasonably handled.

### Artificial Crystals

During the past few years great progress has been made in these experiments with piezo-electric substances, and other crystals, usually not natural but artificially produced crystals, have been found which give an enormously greater piezo-electric performance than natural quartz.

I should, perhaps, interrupt myself to mention that it is not just the novelty of this effect which makes it interesting; what gives it its practical importance is that, inasmuch as the effect is a molecular one, or is believed to be so, the mechanical and electrical forms of energy supplied (according to which way the crystal is working, whether it is working as a microphone or as a loudspeaker, to use a rough-and-ready illustration) bear a very close and faithful resemblance to one another. In plainer language, the device is much less apt to suffer from *distortion* effects than most of the electro-mechanical devices for the reception and reproduction of sound with which we are familiar.

### An Interesting Application

This, as I say, is its intrinsic merit and is the main reason why scientists have stuck at it for years with a determination to turn it into something really practical and so bring its intrinsic merit into practical use.

There are now a number of instruments of various kinds which make use of the piezo-electric effect, most of them, however, being devices which do not find their way into the hands of the man in the street.

An obvious application of this principle would be to the receiver of a telephone, or what is much the same thing, the reproducer unit of a loudspeaker. The other end of the scale, the microphone, which is, in general, a much more delicate device, has, as indicated already, been explored in the light of what is known of the piezo-electric property.

A very interesting practical use of a piezo-electric microphone is marketed by the B.T.H. people and is called by them the "Pezolectric" pick-up; it is claimed that this not only has an improved frequency-response, but that it gives an average output in excess of that of any other commercial pick-up on the market. In view of what I said about the faithfulness of the response of a piezo-electric device, whether used for turning mechanical energy into electrical eneryg or the other way round, you will see the value of a pick-up based on this principle.

### Electrical Recording

Electrical gramophone recording to-day has been brought to a very high pitch of

(Please turn to page 143.)

# MORE NEW LIGHT VALVES

By CARDEN SHEILS

## Details of the latest schemes for increasing the light available from a cathode-ray scanning device

THE "cold" light produced by the fluorescent screen of the normal cathode-ray tube is so feeble that any attempt to enlarge the picture by magnifying-lenses simply results in a loss of detail. Another drawback lies in the rather unnatural colour of the light, which makes it impossible to reproduce the picture in real black and white. Then, too, the screen itself is difficult to make and is easily damaged, or burnt out, by careless handling. Altogether the fluorescent screen is a distinctly weak point in the general make-up of the cathode-ray tube.

Attempts are now being made to find a substitute for it, particularly one which will allow the picture to be shown outside, instead of inside the cathode-ray tube, and in natural black-and-white tints. Fig. 1, for instance, shows a cathode-ray tube in which the usual fluorescent screen is replaced by a special kind of light valve, which permits both these effects to be secured.

### A NOVEL USE FOR SMOKE

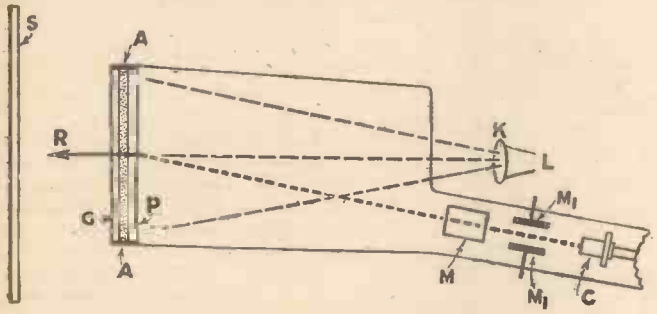



Fig. 1. Smoke forms the varying-intensity material in this ingenious light valve for television.

The end of the tube is closed by a flat sheet of glass, G, which is spaced slightly apart from a thin transparent and porous membrane, marked P. The space between the two is filled with smoke, the solid particles of which are too large to pass through the pores of the membrane.

**Charging the Particles**

A ring-shaped anode A surrounds the circular ends of the enclosed space and transmits a positive voltage to the contained smoke. Because each particle acquires a positive charge, they all tend to repel each other, and so are kept evenly distributed throughout the enclosed space.

In this condition the smoke screen is practically opaque, so that the rays of light, coming via a lens K from a lamp L located outside the tube, cannot pass through on to the viewing screens.

Suppose now that an electron beam from the cathode C of the tube is made to scan the smoke screen from side to side by the deflecting plates M, and from top to bottom by the deflecting plates $M_1$ in the usual way. The membrane P is sufficiently porous to allow the electrons to pass through, and to give a negative charge to the particles of smoke with which they come in contact. These negatively-charged particles are at once attracted to other particles in the neighbourhood which are still positively charged, and in this way a small but clear aperture is formed through which the rays of light from the lamp L can pass through, as shown at R, on to the viewing screen.

The aperture "follows the scanning beam" as it moves over the surface of the screen. As soon as the beam moves on, the aperture fills up again, because the permanent positive voltage on the anode A quickly neutralises the temporary effect of the electron stream.

**The Result**

The size or clearness of the aperture so formed depends upon the intensity of the electron stream, and as this, in turn, is controlled by the incoming signals, an image of the original picture is built up on the viewing screens by the varying light received from the lamp L.

The picture is, of course, reproduced in ordinary black and white, and can be enlarged by inserting a magnifying lens between the screen and the flat end of the tube.

Another plan for securing much the same result depends upon the use of a light-sensitive screen made up of a large number of small cells, containing doubly-refracting crystals in colloidal solution.

The construction of the screen is shown in Fig. 2. It consists of a thin glass case G divided up into horizontal compartments by a number of thin metal strips M. Arranged in line along each compartment are the cell electrodes, each of which consists of a tiny metal button B with two attached wires as shown. The buttons are arranged flush with the outer face of the glass, so that the scanning stream can make contact with them as it moves across the screen.

The whole container is filled with a colloidal solution of crystals which are subjected, through the small buttons B and their attached wires, to an electric field of force as the scanning stream of electrons sweeps over them.

A ray of light from an outside lamp is focused upon the screen in the same way as shown in Fig. 1, so as to pass through any transparent point that may be formed on to an external viewing screen. The light from the lamp is first polarised by a Nicol prism before it reaches the crystal "cells."

**Stopping the Polarised Rays**

In the ordinary way the tiny crystals of the solution arrange themselves anyhow—in higgledy-piggledy fashion—and in this condition they block out the ray of polarised light. But when the scanning beam comes into action it applies a charge to each of the buttons B, throwing them negative to the fixed voltage applied to the horizontal strips of metal M. The electric field so set up across the solution has the effect of forcing the crystals to fall more or less into line with each other.

In this condition they become transparent to the polarised ray of light, and allow it to pass through on to the viewing screen. Each button B, in effect, controls a miniature "light valve," which, like the well-known Kerr cell, varies in transparency with the strength of the signal voltage applied to it.

The result is that as the scanning beam moves over the screen, a number of small windows are opened up to allow the light from the lamp to pass through. Directly the scanning beam moves away, each window closes up again, because the crystals revert to their original higgledy-piggledy state as soon as the controlling force is removed.

The varying spots of light which do succeed in getting through combine, as before, on the viewing screen and build up an image of the incoming picture.

Thus it will be appreciated that these light valves open up possibilities of television systems with the big-picture advantages of mechanical methods and the no-inertia attributes of electron scanning. A cathode-ray tube is simply a light control.

### ANOTHER SCHEME

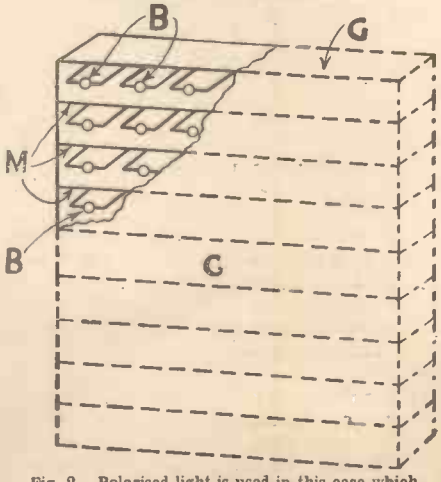



Fig. 2. Polarised light is used in this case which is similar in some ways to that shown in Fig. 1.

# THE DIAL REVOLVES

By Leslie W. Orton

ON 20 METRES—RADIO HELPS THE FILM PRODUCER —"THE MUSIC GOES ROUND AND AROUND"— INTERFERENCE FROM PLANES ON 10 METRES

NEWS of wars, and still more wars, has been blazed across our newspapers with dazzling rapidity of late, and many persons have had bad attacks of "nerves" as a consequence. One poor fellow I know has been brought to such a state that he daren't even drink China tea for fear of air raids. He lives in Colney Hatch, by the way!

Here is news of a different nature—a "peace station" will probably be opened in the Emerald Isle shortly.

Operating upon short waves, the cold cash necessary to run it will, I am informed, be obtained by the sale of air to rival advertisers. Therefore, don't be surprised if you hear a "Dab-'er-nose" programme followed by a powerful plea for peace. It will probably be the new station testing!

Incidentally, I understand that all that is holding up the venture at the moment are the preliminary arguments!

### A Mixed "Bag"

Hardened DX-er though I am, I've been shocked at conditions on 20 metres. Stations, like bills, have come in, and one has been about as welcome as the other, for the stations have been French!

Nevertheless, don't imagine that DX catches have been absent. Far from it, but the amount of energy necessary to log a few stations has been sufficient to drive a car from here to Australia and back—or so it has seemed to me!

I've kept my set "Dynamite" hard at it, and he has done his work well. From 6 p.m. onwards "Yanks" have filtered through at moderate strength, and between 11 p.m. and 1 a.m. I have logged CN8AM and CN8AZ (French Morocco), CE1CA and CE1AR (Chile), PY4CU (Brazil), LU7AG (Argentina), K4SD (Porto Rico), HK3UY (Colombia), CO2SR, CO3AG and CO6RM (Cuba), and a batch of North Americans. The best of these were VE1AR, VE1BY, W1AD, W1BLO, W2KSH, W2ABI, W3ASG, W3LM, W4AW, W5EW, W8PIW, W8GR, W8SF, W9WSP and W9BT. A real mystery was BHAS. Wonder whether the operator had just had a "Bass"!

Between 7 and 8 a.m. VK4OE, VK3FE, VK2XU and other Australian stations came in at moderate strength.

### Popularising Ultra-Shorts

In America ultra-short waves are frequently employed by film directors during the production of large-scale scenes such as the "Charge of the Light Brigade." (Reminds one of an electric account, doesn't it?) If something goes wrong, the director switches on the transmitter and scorches the ether with his criticism.

Listeners in the immediate vicinity may tune-in and hear the directors in operation. Besides learning a number of new and original words, they claim that the "programme" is generally far more entertaining than the completed film.

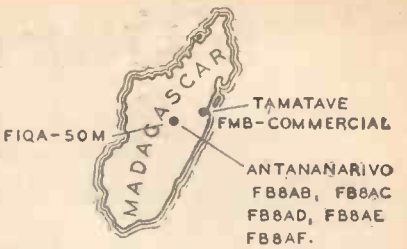
### What a Din!

By the way, I'm anxious to identify a station that broadcasts dance records on 29 metres as if its operator's life depended upon it. Indeed, the "music goes round and around" and no mistake!

Time and again I've tuned-in this station. At 11.45 the other evening I heard "When the Poppies Bloom Again," "East of the Sun," "Red Sails in the Sunset," and a batch of other tunes, but no announcements. Just as Rome burned whilst Nero fiddled, so my thoughts smouldered as that gramophone ground out tunes like a super sausage machine!

A pleasant surprise emanated from Newfoundland the other night when I tuned in a musical programme from VOGY (St. John's), on 20 metres.

Which reminds me that I mistook HP5J (Panama) for W2XE on 25 metres the other night. I had the thrill of my life when the announcer shattered my belief! Then my vivid imagination came into play. Visions of palms waving in the breeze, of beautiful senoritas—yes, and the effect of accidentally sitting on a cactus!—floated before my eyes.




Here are some good DX-ers for you to try for.

### Excellent 10-metre Results

Green with envy, I have to report that J. P. C., of Manchester, has knocked "Dynamite's" log silly this week.

A few of the stations heard by this enthusiast are W1HJJ, W1CAO, W1HVS, W1INB, W2FBO, W2FGV, W2FWK, W3BYF, W4DRZ, W4CYU, W5VA, W5GMY, W6BK, W7EMP, W8BSP and W9BBI—all districts in an evening.

Peeved by this success, "Dynamite" pulled in VU2CQ, VU2BH, W1COO, W1EDW, W1TT, W1WZ, W1COM, W2SLF, W3ZO, W3BW, W4EDD, W5SK, W8FK, W8KYY, W9FA, W9BKA, W9YLJ, W9JZ, W9ARA and G5KH (London); a telephone station on about 9·494 metres; and W1XKB (Boston), on 9·494 metres.

By the way, you have all heard the clitter-clatter made on 10 metres by passing cars. Well, living near an R.A.F. depôt, my worries are doubled by interference created by planes flying overhead.

SHORT-WAVE STATION IDENTIFICATION — By F. A. BEANE

# IN DARKEST AFRICA

THE Belgian Congo cannot claim to have a broadcast representative, although if one is anxious to secure reception of this country he may do so by either listening for the amateur OQ5AA of Tondu, in the popular 20-metre amateur band, or the commercial OPM on 29·58 m., or OPL on 14·97 m., both of Leopoldsville.

Nairobi, Kenya Colony, presents the famous old stand-by VQ7LO on 49·31 m., which needs but little introduction since its familiar 6-"pip" time signal, gramophone recording programmes, news bulletins and announcement, "This is Nairobi calling," are known to all. Until recently all programmes were concluded with "God Save the King," but this now appears to have been discontinued, and only the time signal is heard to mark the closing down at 19·15 G.M.T. This station is prompt to verify reception reports, providing they are carefully detailed and accurate.

### War Stations

War has brought into prominence a great number of what were once obscure stations; in Abyssinia ETB rapidly leapt to fame as a result of the Italian offensive, while, more recently, numerous "mushroom" transmitters have sprung up in Spain and its possessions.

In Santa Cruz, Tenerife, Canary Islands, is found EAJ43 of the Tenerife Radio Club operating on 28·98 m. daily with news of the Spanish war. Originally this station was known as EA8AB and announced itself as "Radio Club Tenerife," with a three-chime signal. Lately, however, they generally announce as "Radio Nacional Espana," while from 23.00 G.M.T. news is given in German, Italian, Portuguese, English and French, with about four minutes devoted to each language, no mention being made of the call or slogan "Radio Canarias." In English the announcement is given as "This is the National Broadcasting Station of Spain transmitting on all short wavelengths," or in other words EAJ43 broadcasts the "national" programme simultaneously with all other insurgent stations. Prior to 23.00 both male and female announcers are heard alternately. Incidentally, care must be taken to avoid confusion with another "Nationalist" operating on a slightly higher frequency.

### News From the West Indies

Recently I was thrilled by hearing my first transmission from Martinique, French West Indies. I was aware of the existence of an FZF6 of Fort de France and had often searched, in vain, for it on its official wavelength of 31·68 m., but it was only a week or so ago that I stumbled upon it for the first time. It was a stumble, too, for "Radio Martinique"—that is its title—presented a remarkably powerful transmission, not on 31·68 m., but on 31 m. Typical French accordion and dance music were heard, and at 00.40 (G.M.T.) the station call in French and Spanish, given by a male announcer, and then in English and German by a lady announcer. Five or six chimes followed, and then the strains of the "Marseillaise" brought the programme to an end. Quality was characteristically French, but strength varied spasmodically between R6 and R8–9, while the excitement was so intense that your guide found difficulty in jotting down the various items and announcements heard!

# ON THE SHORT WAVES

CONVERTERS FOR 10 METRES

By W. L. S.

THE converter for adding an ultra-short-wave range to a set which already covers the "ordinary" short-wave ranges is an entirely different proposition from an ordinary short-wave converter.

I have let you know my views several times on the straightforward autodyne circuit as a short-wave converter. As you know, I am not keen on it.

For ultra-short-wave work, however, an autodyne converter turns up trumps, and it is a beautifully simple method of adding efficient ultra-short-wave working to the list of advantages of an already good set.

The reason for this is not difficult to understand. Fix your intermediate frequency, and that figure represents the amount by which an autodyne converter must be detuned from the signal that it is receiving.

Remember that the function of a short-wave converter is to receive a signal *and* to produce a beat with it—say a beat of 465 kc., which is the popular intermediate frequency. If you use an autodyne, then your combined detector and oscillator has to produce that 465-kc. beat and detect the signal—in other words, as a detector it is 465 kc. off tune.

### Similar to a Single Valver

This is a serious matter on a frequency of, say, 7,500 kc. (40 metres). When we get down to 10 metres, however, it is only a quarter as serious. Detuning to the extent of 465 kc. when the frequency of the signal is 30,000 kc. is not a very inefficient matter. The resonance curve of the detector is probably quite as wide as that, anyway.

So we can come back to our beloved autodyne and evolve a really simple converter. The one I have shown in the diagram uses a screened-grid valve (or, if you like, an H.F. pentode). The circuit is just the sort of thing one would use for a single-valve receiver, with certain small deviations. For one thing there is no variable reaction control. The reaction condenser is replaced by a fixed condenser of ·0001 capacity.

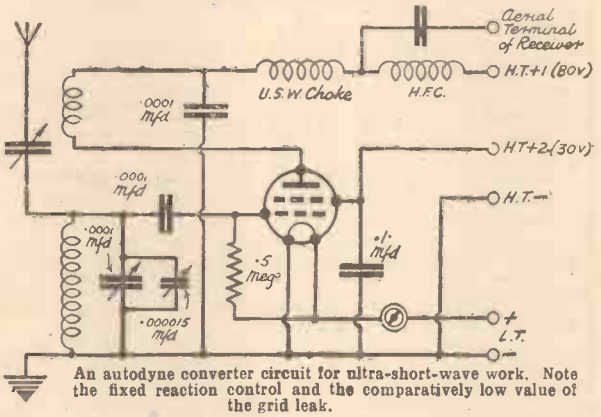
Next, in case this relatively large capacity should have the effect of making the thing howl at audio-frequency—as so many sets do when you increase the reaction control too much—the grid leak has been brought down to the unusually low value of half a megohm. It *may* possibly be advantageous to come down still farther—even as low as 100,000 ohms—but I have found half a megohm quite satisfactory.

Band-spreading has been provided, and there are two H.F. chokes in series. Otherwise the thing is an ordinary single-valve receiver.

The first of the chokes, i.e. the one nearest to the anode of the valve, must be an ultra-short-wave choke—just as one would use if the converter were a complete receiver. the other must be an effective choke at the intermediate frequency, for our converter "converts" the ultra-short-wave signals into signals with a frequency of 465 kc., or a wavelength in the region of 650 metres. Therefore, the kind of choke that you would use in an ordinary broadcast receiver is the kind to use here.

Your artificial signal is handed on to the following receiver through a fixed condenser

## FOR THE ULTRA SHORTS




An autodyne converter circuit for ultra-short-wave work. Note the fixed reaction control and the comparatively low value of the grid leak.

taken from the point between the two chokes. In addition to this connection it is essential that the converter and the set have a common earth or a common L.T. supply.

The set may be a short-wave superhet or an ordinary broadcast receiver with one or two good H.F. stages. To tell you the truth, when I drew the diagram and started writing this I was thinking chiefly of the man who has a good commercial short-waver which won't go below 17 metres or so. He wants 10 metres just as badly as you or I do, now that conditions are so good down there, and why not? If it is a short-wave superhet his best procedure is to tune it to the highest wavelength which it will cover, and then the addition of the converter makes it a double superhet. True, the first intermediate frequency will be considerably higher than 465 kc., and the efficiency of the autodyne as a converter will drop off again. Even so, however, one can get very good results and very little second-channel interference from an autodyne on ultra-short waves, although that can't be done on the more crowded short-wave bands. It is just as essential to get this converter working nicely as it is to look after the details of a complete receiver. However good your receiver may be, the converter will give poor results if it is prone to hand-capacity or instability of any kind. The band-spreading condenser is an absolute necessity for 10-metre work. Although the band is much wider than any of the other amateur bands, the Americans, in particular, don't make full use of the high-frequency end of it, and there are generally many stations crowded together within the space of 100 or 200 kc.

Quite apart from this, the condenser will naturally cover a wide range of frequencies and tuning will be correspondingly critical.

The H.T. voltage on the screen may be critical, although you have no smooth reaction control to worry about as you would have in a detector circuit. Most S.G. valves and H.F. pentodes seem to go best with about 30 volts on the screen, and this is the voltage I always use for a converter of this type.

### Varying the I.F.

Don't forget, if you are using it with a broadcast receiver, that you can carry out fine tuning by varying the intermediate frequency—i.e. the ordinary tuning control on the detector. And don't feel bound to stick to 465 kc. If you get better results by tuning the broadcast receiver somewhere up in the region of Radio Paris's wavelength, then by all means do so. The converter will be more efficient if you do choose a low intermediate frequency in that way.

The coils for the converter may be the ordinary commercial type which cover the range 8–16 metres, or you may make them yourselves, with about 1¼ or 1½ turns grid winding and two turns reaction. If you want to get down to 5 metres, you will probably be able to do so with one turn grid and 1½ reaction.

If your first attempt with the converter fails to produce any results, the most likely fault is that the detector-oscillator valve is not oscillating. It must, of course, be in a continuous state of oscillation if it is to hand on an "image signal" to the intermediate-frequency amplifier. Failure to oscillate must be treated in exactly the same way as you would treat the same fault on an ordinary detector—look to coil windings, grid condenser and leak, H.F. choke and H.T. supply. In many cases the last mentioned is the main trouble.

ON THE SHORT WAVES—*Page 2.*

# POINTS from the POST-BAG

W. L. S. Replies to Correspondents

E. K. W. (Liverpool) gently chides me with misquoting his recent letter about 5-metre work. He wrote, you will remember (or possibly you won't) about the possibilities of 5-metre reception in Manchester, and this, he says, is what he really said: G T L is a good marker station on 5 metres dead; G W 6 0 K P puts out a good signal from Snowdon; G 6 D O is crystal-controlled on 57 mc. exactly; G 6 G L puts out a strong signal from West Kirby; G 2 D C and G 5 M Q of Liverpool are also active.

Apparently my previous story became slightly garbled, and E. K. W. rightly points out that I attributed it to him. Apologies all round, and please take the above as a final intimation. By the way, G W 6 O K P only puts out that good signal from Snowdon during the week-ends when he is fortunate enough to be up there!

While we're in North Wales, let's talk about C. M. (Pwllheli). He tells me that he has a verification from V K 2 N O concerning reception of his 5-metre phone, which is open to inspection by any of the doubting Thomases. He also has 5-metre veri's from W 1 E E R, W 2 I I Q, W 2 I P H and three of them from W 2 J C Y. The home of 5-metre DX, Pwllheli! Good going. Incidentally, I recently worked W 2 J C Y on 10 metres, and his "identification"—W 2, Just Calling You—struck me as being one of the best I've heard.

### A New Society

Still Wales!. I am asked to announce that a new society has been formed under the title of The Tonyrefail and District Radio Society. Meetings are held on Mondays at 7 p.m. The secretary is Mr. E. Powell (2 B P W), of 44, Pritchard Street, Tonyrefail, Glamorgan, and anyone in the district who is at all interested is asked to communicate with him.

S. J. (Croydon) took my recent tip about listening on 20 metres round about breakfast time, and was rewarded by a new country—Ecuador, in the shape of H C 1 J B.

W. S. (E.3) has a single-valve short-wave receiver on which he can't get any reaction. His query is typical of many which I receive—at the rate of one per week—at least, and I almost invariably find that readers have got coils with the wrong connections. Or, if they have the right coils, they've probably connected them up all wrong.

Other possible things to look for are a short to earth in the grid condenser, disconnection in the reaction condenser (two lots of connections on the moving plates, instead of one on each set, etc.), and, of course dud valve or batteries below par.

It simply ought to be impossible to make a set that won't react. There *always* must be some major fault which should be easy to find. Cold comfort, I'm afraid, but that's all I can say in such cases.

More interesting dope to hand from J. E. (Leeds), mostly about ship stations. J. E.'s hobby seems to be the collection of veri's from ships, and he sends along a photo of a section of his wall. He has received letters or acknowledgments from more than seventy ships, most of which he followed for as long as three months.

J. E. comments on the beautiful notes put out by the ships of the Dollar line. He says "Listen on 27 metres at 07·35 and 18·35 G.M.T., and on 18 metres at 18·20 G.M.T., and you will hear Dollar ships working. They are equipped with "bug" keys as well as the ordinary type, and they also work duplex. Only the other night I heard one of them in the Atlantic, working with another near Honolulu at 35 to 40 w.p.m.

A. E. B. (Harringay) wants to know whether the "projected" two-H.F. unit will be all right in front of his 5-valve superhet. Certainly it will—I use it with great glee in front of my eight-valve superhet, and it's as good as another eight valves.

Although A. E. B. uses a super, he endorses my remarks about the comparative virtues of superhets and straight receivers. He had made up one of my 0–V–1 receivers and has added a further H.F. and L.F. stage to it. He finds the noise-level of this four-valver well below that of his 5-valve super.

G. C. N. (Manchester) writes in a long letter, all about "P.W." and mostly about these two pages. He says "I can't claim to be a typical reader, because that person doesn't exist. Doubtless we all want something different, but here's what *I* want—and believe me, there's no doubt whatever about that. I want you to go on as you are at present, as far as your first page is concerned. I generally find something to interest me each week—and I shouldn't grumble if it were only once in two weeks, because obviously the novice has got to have a look in sometimes.

"But I should like more amateur news. Not just stuff about how conditions are at the moment, and so on, but definite talks about particular stations—what they do, how they come in, their power, and so on."

Well, I've been thinking about making the amateur side of these notes a little more "personal" for some time, but really I don't think the average short-wave listener wants it that way. What do the rest of you readers want, anyhow? I can't thought-read, you know.

## R.S.G.B. MORSE PRACTICE TRANSMISSIONS

| | Time | Frequency | Station |
|---|---|---|---|
| Wednesday ... ... ... | 23.15 | 1,741 kc. | G 1 6 X S |
| Thursday ... ... ... ... | 22.00 | 7,184 | G 6 U A |
| Saturday ... ... ... ... | 23.00 | 7,145 | G 1 5 Q X |
| Sunday ... ... ... ... | 09.45 | 7,155 | G 1 5 U R |
| Sunday ... ... ... ... | 10.00 | 7,260 | G 5 J L |
| Sunday ... ... ... ... | 10.15 | 1,920 | G 6 V C |
| Monday ... ... ... ... | 23.15 | 1,741 | G 1 6 X S |
| Tuesday ... ... ... ... | 22.00 | 7,184 | G 6 U A |

These transmissions are organised by the Radio Society of Great Britain for the benefit of members wishing to learn the Morse Code or to improve their efficiency. All transmissions will be preceded by a telephony transmission. Matter will be transmitted from the pages of a back number of the T. & R. Bulletin, and the page number and month of issue will be given at the end of each test.

## AMATEUR BAND NEWS

Remarkable reception on 10 metres

JUST how much livelier is this 10-metre band going to get? It keeps on hitting new "high spots" every week-end—although it is really just as good during the week, except for the fact that there are not so many stations using it.

All four week-ends in September were terrific, and the first in October showed no signs of falling off. In fact, so marvellous have conditions down there become that, at last, the interference problem is giving the amateurs something to worry about.

The Americans, apparently, have been subjected to a new regulation, since all their phone stations have gone to the high-frequency side of the band—28,500 kc. and over. This leaves the low-frequency end, which is largely used by the Europeans, a little clearer, although the U.S.A. C.W. stations still use it.

I should like to assure everyone who reads this that it is not just a burst of hot air—it is real news, for the 10-metre band is producing transatlantic signals of a calibre that has never before been heard in the history of radio. It is no exaggeration to say that a good score of American amateurs on 10 metres have been producing stronger signals over here than most people have ever heard from any American broadcasting station on any waveband.

### A Surprising Fact

There are so many outstanding transmissions that it is rather pointless to mention call-signs. I might, however, just state the bald fact that W 2 J Q X (Pelham, New York) has been bending the diaphragms of my headphones in a way that they have never before been accustomed to.

Recent 5-metre discussions at a R.S.G.B. meeting brought to light the rather surprising fact that the super-regenerative receiver is thought very little of nowadays. Personally, I have always felt that it was eminently unsuitable for the reception of weak signals—and all long-distance signals are likely to be weak at first. I have had very good results on 5 metres with straight receivers, but I imagined that I was a voice crying in the wilderness.

Now it appears that scores of amateurs have been using straight sets, and finding them infinitely preferable to super-regens which kick up such a din that they kill off their own sensitivity.

The trouble is that straight receivers are only effective for receiving stable transmissions—and stable transmissions are few. The amateurs have been working in a vicious circle. Wobbulated transmissions, as they call them, were all right for super-regen. receivers, and *vice versa*. So there are two separate camps, and those with the good receivers can't receive the bad signals put out by those who favour the super-regenerator.

W. L. S.

# TELEVISION TOPICS—*Collected by A. S. Clark*

## "TELEFRAMES"

Items of general interest

### A SUCCESSFUL EXHIBITION

THE television exhibition at the Science Museum, South Kensington, which came to an end on September 21st, may be counted a great success. During its run from June 10th, over a quarter of a million people paid a visit to it.

Incidentally, the book and guide published by the Stationery Office in connection with this exhibition went out of print some time before the close of the exhibition, due to the huge demand for it.

* * *

### IDEAL FOR ITS JOB

Now that the new television tuning-signal picture has been in use for a while it is possible to say that it is ideal for its job. It is a modernistic grouping of cubes and circles and is well calculated to show up very quickly any inaccuracies in the adjustment of a vision receiver.

* * *

### MECHANICAL TIME BASE

At a recent scientific lecture, an interesting model was employed to illustrate the working of a gas-filled-relay time base.

The "charge" condenser was represented by a pivoted vessel into which water flowed in a constant stream just as the electrical charging current is kept constant. As soon as the water reached a certain level the vessel tipped up, emptied itself and then swung back again and commenced to refill. By means of weights the level reached by the water before the vessel tilted was varied, representing the application of varying bias voltages to the grid of the gas-discharge valve.

* * *

### WHAT IS WANTED

Still cheaper television receivers and more television transmitting stations are the two biggest requirements at present in speeding-up the progress of television. Longer programme hours is a close third.

Research work to cheapen the cost of television receivers or the processes of manufacture is likely to bring the biggest rewards in the new science.

* * *

### THE AMERICAN TESTS

The R.C.A.–N.B.C. television tests being regularly sent out from the aerial on top of the Empire State Building have produced clear pictures up to distances of 69 miles with considerable regularity. These transmissions are, of course, greatly helped by the commanding position of the aerial from which they are radiated.

* * *

### NEW TIME-BASE PATENT

What is virtually the application of A.V.C. to time-base circuits is contained in a patent held by Standard Telephones and Cables, Ltd.

A gas-discharge tube is charged through a pentode valve. The control grid, screening grid and suppressor grid are all automatically biased in such a way that any change of current flowing through the valve alters the bias in such a way as to maintain constancy of the current.

* *

### A TRUISM

In pressing for the early starting of some sort of television service, an American writer says: "Television is an evolution and not a single invention. It is a development that must come out of practical experience."

The B.B.C.'s experiences at Alexandra Palace prove this.

THE STUFF TO GIVE 'EM. A photograph taken at the Arsenal football ground during the recently televised demonstration of football tactics. This is the type of outside television item to develop. Let's hope a complete match will soon be practical television material.

## MAGNETIC FOCUSING ADVANTAGES

IN connection with the details of the Baird cathode-ray tube—the 15-in. "Cathovisor" which is available for home experimenters and constructors at 15 guineas, it is interesting to note the following advantages which are set out for magnetic scanning as used by this tube.

1. A much simpler electrode system, with consequent increased efficiency.

2. With combined magnetic scanning and focusing a marked economy results in the receiver, since the scanning oscillators are much simpler and cheaper.

3. A reduced number of pre-set controls in the television receiver.

4. With solenoid coil focusing adjustment can be made readily to prevent astigmatism.

5. Scanning equipment is readily replaceable without in any way affecting the tube.

6. In general, spot brightness alteration does not cause such serious de-focusing as in other types.

7. It is much easier to set up the tube and receiver on site with scanning and focusing equipment external to the tube.

8. Some of the high-voltage equipment is avoided with the electro-magnetic type tubes.

9. There are only four contacts to consider, in the tube cap and socket.

The necessary components for the electro-magnetic scanning and focusing of the tube are available from the makers.

Focusing is achieved by means of a solenoid coil held round the neck of the tube by a universal mounting. For line scanning a pair of air-cored coils are seated on the neck of the tube slightly closer to the screen than the focusing coil. For frame scanning an iron-cored electro-magnet is used.

## AERIAL DEVELOPMENTS WANTED

NOTHING is more certain in television than that we are only just on the verge of real knowledge about television aerials, both for reception and transmission. In a way this is rather a heartening thought for the experimenter of small means, since it means he can take part in television research without the need to possess a vision receiver.

With greater knowledge of the propagation of ultra-short waves will come greater knowledge of how to design aerials, and in connection with propagation the following experience is interesting: Fading from Alexandra Palace is sometimes quite considerable at a certain south-coast resort, while at other times it appears to be quite non-existent. The trenchant point is that when there is fading the vision and sound signals do not fade together, but keep in opposite step. As the vision strength goes down, the sound-signal increases and vice versa.

Another surprising item concerns transmitting aerials, and has been noted by B.B.C. engineers working with the mobile television vans. Naturally they have tried to devise efficient reflectors for the aerial so as to beam the transmissions on the receiver at Alexandra Palace. The beaming is not difficult in itself—the difficulty is apparently to do it without loss of side bands!

## "JOURNEY'S END"

"Journey's End," the famous war play by R. C. Sherriff, is to be televised on Armistice Day. The performance will last an hour and will occupy the whole of the evening transmission period.

The production of "Journey's End," which will be handled by George More O'Ferrall, will test the resources of the television studio, as every effort will be made to reproduce the atmosphere of the trenches so vividly portrayed in the play. It is hoped to include film sequences in addition to sound and other "effects."

# SEEN ON THE AIR

*News and Views on the Television Programmes by Our Special Radio-Screen Correspondent*

## L. MARSLAND GANDER

PINEWOOD FILM STUDIOS are about eighteen miles from Alexandra Palace, and when the B.B.C. gave television transmissions from them they set up a distance record. The "old bedstead," as the television aerial attached to the mobile unit is called, stood seventy feet aloft on a studio roof.

It resembles an ill-used spring mattress, and I hear that shortly a more efficient directional aerial is to be employed, beaming the transmission sharply on Alexandra Palace. If, as hoped, this increases the signal strength it will help to overcome the interference which is a recurring snag with these outside television broadcasts.

I learnt a lot at Pinewood. In the first place, the mobile unit is an expeditionary force. Fifty men were working on the transmission, some lent by the studios, but most sent by the B.B.C. When Capt. Richard Norton (managing director), Leslie Mitchell and Elizabeth Cowell were depicted walking together down the main street of Pinewood there was an astonishing scene which viewers did not see.

### Rather Primitive

The television camera and microphone were, of course, mounted on a trolley. The difference from film technique lies in the fact that numerous cables, fat and thin, connect the camera and microphones to the vans and they trail along for hundreds of feet behind the trolley. As the trolley is propelled backwards it is necessary to remove the cables out of the path quickly and silently.

So, when the trolley began to move, about thirty assistants pounced forward and began feverishly winding, looping and carrying. The method seems primitive, and one day I imagine that there will be automatic winding apparatus.

Maurice Chevalier's appearance was all too short, and it was a pity that he did not, as had been suggested, act as a guide in the first short tour that ended in the carpenter's shop. As it was, he merely stepped into the picture for a couple of minutes, with nod, beck and wreathed smile, and then was gone. "What! No light—no sets. It is wonderful!" said Maurice. Dissatisfied with this brief appearance, I sought him out later for amplification.

But before that I chased alongside the camera up to the carpenter's shop, where George Carney, who is appearing as a Lancashire carpenter in a new film, was interviewed. The trouble here was that the transmission was a little too realistic and a circular saw taking part in the proceedings practically drowned everything. Only Leslie Mitchell was audible.

### "Capturing" the Extras

There was a slight hitch en route when the camera failed to pick up, in passing, three young lovelies in crinoline dresses, examples of the "extras" who float about these ancient terraced lawns. However, they were captured and shepherded (to a chorus of girlish laughter) in front of the camera.

When I went in search of Maurice Chevalier my guide took me to a gigantic warehouse of a building with a great iron shutter outside that slid up and down silently; down (according to my guide) when shots were being taken within. I went inside and found myself in the empty shell of a theatre, a theatre with stage, balconies and boxes, but without seats in the dimly lighted auditorium.

I looked round this place and mentally gasped. Roughly it was four to six times as large as the studio at Alexandra Palace; and this was only *one* studio at Pinewood, where there are altogether five. I am told that there is a special lift in each studio to take the electricians to the roof, considered something of a luxury in filmland. These studios are claimed as the largest in Europe.

As I stood waiting in the twilight I fell to wondering how television ever could hope to produce anything comparable with the cinema-film in the single cupboard at Alexandra Palace that passes for a studio. Yet it is a fact that a relative of mine went to see a million-dollar film featuring two of the most glamorous stars of filmdom and came home full of expressions of disgust and boredom. She then saw a television show, produced at a fraction of the cost, watched it with the greatest interest and pronounced it a great deal better than the film and a "jolly good entertainment." Which goes to show the potentialities of television.

I was also able to make some further comparisons. The particular "set" which was being photographed was in the wings of this "theatre," and I could not actually see much of what was going on. But I heard something like this:

### A Complete "Shot"

A piercing scream. "I hope I never see you again." "Aren't you going to arrest him!" "Cut." The whole sequence, lasting about thirty seconds, was repeated at least six times while I waited. I knew that films consisted of a large number of short "shots" pieced together afterwards. But I had no idea that each sequence was so brief. This short scene must have been photographed a good many times before I came in, and goodness knows how long the rehearsals lasted!

I felt slightly depressed. We seem to be merely playing with television when the enormous resources of the film industry come into direct comparison with the restricted facilities of Alexandra Palace.

However, I was soon to experience a salutary revival of spirits. M. Chevalier was free and glad to see me. I found him excited and impressed by his brief television appearance. I will not attempt to reproduce his inimitable accent. What he said was that television was a grand chance for the real artist. You can fake in the broadcasting studio and you can fake and bluff still more on the screen. But you cannot bluff with television. It was exactly the same as the stage.

Without taking credit from the B.B.C. for an enterprising series of transmissions, I must make some criticisms. The programme value of some of the transmissions was small. The interviews with John Lodge and Rene Ray were too long, and I should have been better pleased if we had seen less machinery and more lovely close-ups.

## FILM STARS VISIT FILMLAND VIA THE TELEVISION SCREEN

Viewers were taken behind the scenes of filmland when the B.B.C. mobile television unit recently visited the Pinewood Studios at Iver, Bucks. Film stars actually on the sets were shown on the television screen. Here are June Knight (left), Vivien Duncan and Maurice Chevalier looking-in to part of the transmission on a Marconiphone "Mastergram" installed at the Pinewood Club.

FROM OUR READERS

# "BREAK-THROUGH": AN INTERESTING EXPERIENCE

The Editor, POPULAR WIRELESS.

Dear Sir,—Having read the letter from J. G. H. (Blackwood, Mon.), published Sept. 4th, I think the following may be of interest: I have been experimenting with home-built sets (S.W.) of simple design, both mains and battery, and in every one I have been annoyed by the persistent background of the London and/or Luxembourg programmes, sometimes quite audible in the loudspeaker.

This "break-through" is quite independent of wavelength, or whether the detector is oscillating or not, the only thing that has any effect on it is the volume control (you can imagine the nuisance). I was completely mystified till I discovered that I needed *no set at all* to hear London and/or Luxembourg—simply a pair of headphones connected to aerial and earth.

Then I assumed it to be pure "induction" from the "Broadcast Exchange" situated in my street, the wires from which pass very close to my house. I can think of no other solution, perhaps other readers can.

"DABBLER."

Holloway, N.7.

[This reader sends his full name and address but prefers not to have it published. ED.]

### NO SLIGHT INTENDED

**The Editor, "Popular Wireless."**

**Dear Sir,—Being a regular reader of "P.W." and a patriotic Scot, I beg to point out to you the incorrect use of the word "England," which I have noticed on several occasions.**

**In "Marconi—The Man and His Wireless," you say, "Three days before England declared war on Germany." England did not declare war on Germany. It was Great Britain, including Scotland, Ireland, and Wales.**

**Mistakes like these are looked on as insults by all true Scots, so I trust you will give this your consideration.**

**I, too, would like you to reserve a corner of your well-known paper for Short-Wave Reception in Scotland. This would be very helpful when the great area of this country is taken into consideration.**

**Wishing "P.W." every future success.**

**ARCHIE TEMPLETON.**

**Woodlea, Brocketsbrea, Lesmanagow, Lanark.**

### PARS ABOUT MARS

The Editor, POPULAR WIRELESS.

Dear Sir,—In the issue of "P.W." dated Sept. 25th, there appears a very interesting letter from Mr. P. Sugden on the subject of Mars and the possibility that Cosmic Rays are the efforts of Martians to communicate with us on Earth. May I first point out some inaccuracies he commits.

He states that Mars has a greater magnitude than the earth and therefore a greater force of gravity, on account of which the physical build of the Martians would be much superior to our own.

This is not so, for in actual fact the mean diameter of Mars is 4,230 miles compared to the Earth's 7,900 miles; the mass of Mars (and this is the factor on which the strength of the force of gravity depends) is ·105 of the Earth's and its mean density compared to that of the Earth is ·71.

With regard to the Cosmic Rays, it is certain that if they came from Mars they would easily be traced to their source by reason of their infinitesimally small wavelength, which makes them intensely directional. It is found, however, that these rays arrive on Earth from all directions, but with slightly greater intensity from the direction of the Milky Way.

## Another reader tells of receiving stations without valves, batteries or crystal detector!

Scientific opinion, though not yet unanimous, generally considers them to originate in the vast galactic nebulae which lie millions of light-years beyond our own galactic system, the Milky Way.

One last point: Mr. Sugden suggests that it is not possible to modulate a ray, but only to vary its intensity. To the best of my knowledge the method usually employed to modulate any H.F. radiation is by varying its intensity suitably. (Another way is by altering its frequency.) Incidentally, it has been found possible to modulate beams of infra-red, visible and ultra-violet light with speech currents.

In the light of these observations I do not think Mr. Sugden's theory can stand.

P. KORMAN.

136, Merton High St., Wimbledon, S.W.19.

### "ON" AND "OFF" FROM A DISTANCE

**The Editor, "Popular Wireless."**

**Dear Sir,—The description of a Remote-Control Switch in your issue of July 17th, inspires me to send you particulars of a similar switch I have had in use for some considerable time, which has the advantage of switching my set both on and off from any room. This has, I think, a distinct advantage over the "off" switch only, especially out here, where Home programmes are received very late at night, as undesired programmes can be switched off, and later on, a desired programme switched on from the bedside.**

**The idea of the switch can be readily seen from the sketches enclosed. The main item is an old bell, with the bell itself and the "make and break" removed. Two contacts are made from thin springy brass in place of the bell, and the "hammer" is bent at right-angles so that when current is passed through the electro-magnets, the ball of the striker-hammer engages the two contacts and so switches on the L.T. current. The sides of the "ball" are filed flat to give a better contact than if they were left round.**

**The small S.P.D.T. Switch is essential as, without it, the set could only be switched on via the relay.**

**Care must be taken that the two contact strips are of very light springy brass, otherwise they would hold the "ball" contact in between their "jaws" when the relay current was switched off.**

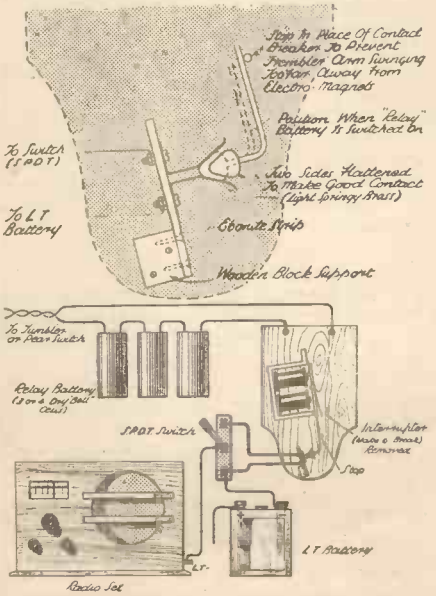
**Here's wishing many more years of prosperity and usefulness to good old "Popular Wireless"—my guide and mentor in all wireless matters since I started to "meddle" with them some fifteen years ago.**

**R. SINGLETON SALMON.**

**Pathregalla Estate, Potuhera, Ceylon.**

**[It should be noted that unlike the simple relay recently described in "Popular Wireless," the one described above takes current from the relay batteries the whole while the set is working.—ED.]**

A REMOTE CONTROL




These two diagrams show the construction (top) and connections of the remote control described by Mr. R. Singleton Salmon in his letter on this page.

## WIN A GUINEA

This sum is awarded each week to the sender of the letter which is best in the opinion of the Editor. All readers' letters stand a chance. This week the award goes to Mr. Singleton Salmon.

### EXPERIMENTERS' COMPONENTS

The Editor, POPULAR WIRELESS.

Dear Sir,—In the seventeenth year of radio broadcast, we still pay one shilling for anode resistors or stoppers, from four to twenty shillings for a valve, banknotes for speakers, etc. In no other branch of technique can it be seen that prices remain high with such an unheard of progress: watches, photographic boxes are sold for practically nothing.

The experimenter wants to build, and to try out. He does not build a set for the set in itself, but to get skill in building, and for enjoyment. When the receiver works well he has reached his goal; he begins with another. But, owing to his limited purse, the ability of experimenting stops far ahead of his anxiety to do so.

Combining the foregoing lines, I would say that the experimenter waits for *the cheap article:* one that does the job pretty well but (for makers' convenience, or as a compromise against the standard article) is *guaranteed for a certain period only.* No builder of durable receivers would use these cheap accessories, which could be given a different appearance: AND THE EXPERIMENTER WOULD BE ABLE TO TRY OUT FAR MORE CIRCUITS.

A. DE KRAAUW.

(Wireless operator, Dutch m/v Miralda, Ardrossan.)

Piet Paaltjesstraat 26, The Hague, Holland.

**HAVE WE HAD YOUR LETTER YET?**

**Remember, we like you to send us your views and experiences. They will interest other readers and you may win a guinea.**

# RANDOM RADIO REFLECTIONS

## By VICTOR KING

THRUSTING IDEAS ON PEOPLE :: MORE ABOUT CAR RADIO :: JUST A MAN!

### THEY KNOW!

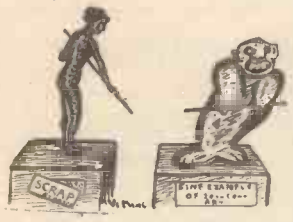
I HAVE just been perusing with amusement a handbook issued by the B.B.C., entitled "Design In Everyday Things." There is to be a series of talks this autumn bearing that same title, and this publication tells us what we are to expect.

And that seems to be a dogmatic gentleman who will tell us that it is rank bad taste or just hopeless ignorance for any of us to like anything that isn't "regimented," "standardised" or streamlined like the sets of "Things to Come."

"The anger of the untrained must be braved," he says in advance.

Well, here's a bit of anger-making stuff taken from his introductory diatribe:

"The average bungalow to-day wavers in appearance between 'bijou baronial' and the 'Tudoristic'; that is to say, it makes an exceedingly bad shot at looking like a stone castle built




Beauty must apparently be replaced by so-called modern art and craft.

for the wicked bad uncle in the pantomime or like a primitive timber and daub dwelling built for a medieval agriculturist. If the owner were logical he would wear cheap tin armour or hodden-grey. In fact, he wears a cap and a reach-me-down and maybe a bowler hat and a gent's suiting on Sundays, because he is neither a knight nor a villain, but Mr. Smith of 'Osocosy.' What odd frustrated dream is it that makes him put his home into such makeshift fancy dress?"

What odd, twisted reasoning is it that makes Mr. Anthony Bertram say such snobbish things about purchasers of nice little roses-round-the-door bungalows? And if *he* lives in one of those institution-like modern concrete constructions does he conform to dress reform?

The tiny minority, the self-styled leaders of culture and taste (in which our B.B.C. includes itself) is very sure that it is right in its opinions. And it wants to *condition* every other human being to similar aesthetic reactions in the kind of way Pavlov conditioned his dogs.

"And who is to be educated?" says the B.B.C. booklet. "Everybody, of course; but in particular the children."

*Of course.* Catch 'em while they are young. Make sure they aren't given a chance to think for themselves when they grow up. Get firmly implanted into their small heads that there is greater beauty in a concrete institution with window boxes than in a neat little detached bungalow with a tiny old-world garden.

"We must kill by ridicule the absurd 'ye olde worlde' cult that has infected English design with dishonesty . . . ." ". . . . . escape from the fetish of detachment." screams the B.B.C. booklet.

In short, we must destroy that individuality and freedom of thought that we have inherited from "ye olde worlde" that was Britain of past centuries.

Yet the New World (the U.S.A.) spends millions of pounds grabbing as much of our period stuff as it can! That make you think?

### AM I RIGHT?

I RECENTLY had some things to say regarding car radio. And, unlike some of the subjects with which I deal, it produced a lot of letters saying very little. (I'd rather have a few letters saying a lot that could be quoted and thus render it easier to fill my columns!)

However, I am pulled up by Mr. A. Sharp, of Liverpool, with a quite good point. Sharp lad is our Albert. He says:—

"In my opinion a portable set is no alternative to a fixed installation, for the simple reason that it won't pick up programmes while it is in the car, because of the steel bodies most modern cars have and which shield the waves. I know, because I've tried a portable in several different makes of modern car and either got no results or very poor results."

Well, Albert, your experience runs contrary to mine. I've tried several different portables in several different makes of modern car and my results have been pretty good. I wonder, though, if you have remembered that a portable is fairly sharply directional. I mean, one having its own frame aerial. You have to swing the set round so that it doesn't, at any rate, lie at right angles with the direction from which the programme you want is coming. Also, you mustn't lie it on its side.

Perhaps I am wrong, but my view is that even the most steeled-up of modern cars won't make a very complete screen against radio so long as it's got windows and a windscreen—which it generally has.

Anyway, what about having a cunning little external aerial fitted to the car especially for the portable when this is on board? Tell me, Albert lad, what about it?

But not an aerial like I saw on the roof of a private car a few days ago. A *thing* sticking up like the claws of a giant crab. It looked the result of a home-constructor's nightmare!

### PEACE AND QUIET

I'VE taken a little office in the City wherein to do my writing and other such work as does not demand the presence of such distracting things as radio sets.

Very carefully did I choose this little office. In a back street away from the thundering rumble and tearing hoots of London's traffic. Away from railways and tramways—anyhow, as far away as it is possible to go in the middle of the Big Town.

One afternoon I started to prepare a lengthy report on a certain piece of apparatus, a report which is eventually, I believe, destined for my Lords of the Admiralty—and may their brass buttons tarnish if they don't think it's a jolly good report!

Then, suddenly, a giant voice split the comparatively peaceful air. A wretched concern cottoned on to the idea of using public address and microphones for circulating orders amongst its workers. And those orders came blasting in on me in my little office. Weep for me, brothers!

### THE MAN'S CALLED——

I USUALLY visit my bank on Friday mornings and, of course, it is useless to endeavour to conceal my identity from the lads who handle my meagre earnings. They know who I am, what I am, and how I win my bread, and where my spondulicks come from.

Thus it is that quite often I get asked for a little advice. "I am thinking about buying a new set——" is the most frequent method of opening the attack. Not that I mind a scrap, unless I happen to be in a hurry.

Well, a few Fridays ago the manager popped out of his lair and beamed kindly upon me. I knew what was coming—a radio inquiry. It came. Set was giving some trouble. What did I think ought to be done about it. I gave an opinion, made a suggestion. On the following Friday I was buttonholed again, and informed that there was still a certain amount of trouble.

"Here's the milkman and the man about the wireless."

So I said I'd pop in sometime and have a look at the set. Would he warn the household of my possible descent upon it? He expressed immense gratitude and said he would do that thing.

When in due course I found myself in the neighbourhood of the bank manager's private lair, I made the call. I arrived at the front door a close head in front of the milkman. A little girl opened the door.

"I am Mr. Victor King, and I've come round to have a look at your daddy's radio. I think your mummy expects me," I said in my best man-talks-to-child manner.

She gave me a thoughtful look, glanced at the tradesman standing just behind me, and then went to the foot of the stairs and called out loudly:

"Mummy! Here's the milkman and the man about the wireless"!

So now you know!

# MIDGET TUBES FOR TELEVISION

By J. C. JEVONS

*The use of midget cathode-ray tubes for television reception is one which possesses definite advantages, but a difficulty which presents itself is that of satisfactorily magnifying the small image on the end of the tube. Below, our contributor discusses ways and means of doing this*

THE size of the cathode-ray tube is an important factor in keeping the cost of television receivers at their present high level. This is due not only to the expense of making the tube itself, but to the fact that, in order to scan a fluorescent screen of standard size, the high-tension supply required to focus and control the electron stream runs into several thousands of volts. Obviously this means an all-round increase in the initial cost of many of the component parts of the set, as well as in subsequent running costs.

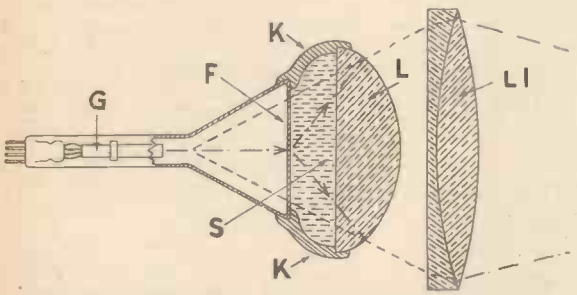



Fig. 1. In this arrangement the fluorescent screen is set close up against the flattened end wall, and is then combined with a special form of magnifying lens.

There is something to be said, therefore, for the idea of replacing the standard type of C. R. tube by one of midget size, in which the picture is reproduced on a smaller screen, which is made more effective optically so that it will stand enlargement up to ordinary size by using a special arrangement of magnifying lenses.

The advantages claimed for such an arrangement are many. In the first place the "midget" C.R. tube can be made at a price comparable with that of an ordinary wireless valve, and in the second place the provision of an improved optical system allows the use of lower operating voltages. This means a corresponding saving in the price of the rectifier, time-base unit, accessory coils, condensers, safety devices, and the like, and so opens up the prospect of marketing a television receiver at a figure very close to that of the ordinary broadcast set.

### Increasing Picture Size

The chief difficulty, of course, lies in the problem of enlarging the midget picture up to standard size, particularly in view of the fact that it has not been found practicable to apply any worth-while magnification to the picture produced on the fluorescent screen of the ordinary type of C.R. tube.

One way of tackling the problem is to use a midget tube of special design, in which the end of the glass bulb is made flat instead of round, and in which the fluorescent screen is set close up against the flattened end wall, and is then combined with a special form of magnifying lens.

This arrangement is illustrated in Fig. 1, where the fluorescent screen F, mounted against the flattened wall of the bulb, is scanned by the electron stream from the gun G of the tube in the ordinary way. In order to make the most of the available light from the screen, and to produce an image free from spherical aberration, it is necessary to space the screen F, the spherical lens L, and the enlarged image in a particular way, so that the first and the last are at "aplanatic foci."

It is not possible to design a lens so that it shall bring all the rays falling on it from any point on the optical axis to a definite focus on that axis, but it is possible to do this when all the rays come from a particular point, and the spacing shown in Fig. 2, where the fluorescent screen F and viewing screen V are at aplanatic foci, produce the desired result. The external lens, L1, is an ordinary projector interposed between the spherical lens L and the viewing screen V.

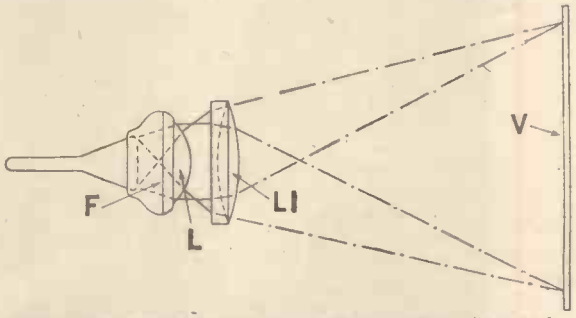



Fig. 2. The external lens L1 is an ordinary projector interposed between the spherical lens L and the viewing screen V.

In order to obtain the correct spacing, between F and L, the glass bulb of the C.R. tube is provided with a curved collar K, which, as shown in Fig. 1, fits over the ends of the spherical lens L and holds it firmly in position, so that its flat surface is parallel with the outer face of the tube. The space S so formed is filled with oil or other suitable liquid having the same index of refraction as the glass used both for the C.R. tube and the lens L. This ensures that the light from the fluorescent screen is not "bent" in its passage through the system, and also avoids loss from internal reflection as it passes across the various layers.

The provision of the layer of oil, in particular, prevents internal reflection occurring across the end wall of the C.R. tube. Usually this is responsible for a serious loss of light, and is one reason why optical magnification is scarcely worth while in the ordinary type of tube. In addition the special lens arrangement possesses a very wide "aperture," as indicated by the arrows, and therefore makes the most of all the light that is available.

Most fluorescent materials produce a light which is chiefly green, violet, or blue, so that chromatic correction is simplified, though it is possible to colour the oil in the space S to the extent necessary to correct for any pronounced fluorescent tint.

### An Alternative Scheme

An alternative form of magnifying lens, suitable for use with midget tubes, is shown in Fig. 3. In this case the end wall of the cathode-ray tube is given the usual curvature, instead of being made flat. This is, in fact, a better manufacturing proposition, as it helps to strengthen the bulb.

As before, the fluorescent screen F is deposited on the inner face of the end wall, so that it can be scanned by the electron stream in the usual way. The complex lens system previously described is, however, replaced by a single elongated lens L of solid glass, which fits close against up the outside wall. The inner face of the lens corresponds exactly with the curved end of the C.R. tube, whilst the outer face, marked A, is more sharply curved.

The length of the lens L, together with the curvature of its inner and outer surfaces, are carefully chosen so as to minimize spherical aberration. Although the original image projected on to the fluorescent screen F appears slightly curved, the final image produced by the more convex face A of the lens L is equally curved in the opposite direction, so that one counterbalances the other. This allows a very simple type of projector lens to be used between the tube lens L and the outside viewing-screen.

In order to prevent any falling-off of illumination, particularly towards the margins of the enlarged picture, the inside face of the lens is made to overlap the edges of the fluorescent screen F, as shown. Finally, one or more grooves, such as G, are cut around the circumference of the lens in order to prevent total internal reflection, and the consequent formation of "ghost" images.

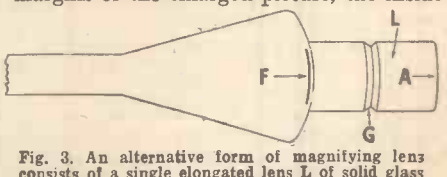



Fig. 3. An alternative form of magnifying lens consists of a single elongated lens L of solid glass which fits up close against the outer wall of the cathode-ray tube. The inner face of the lens corresponds exactly with the curvature of the end of the cathode-ray tube.

# ENTRANCED BY TINY WAVES

**Micro waves fascinate Marconi and others—Solving the mysteries of ultra-short waves—Strange antics of the miniature waves—New radio possibilities foreseen—Freak performances of micro waves—A new hope for television—Nature's various influences on the "baby" waves—Marconi's tests on board the Elettra—Marconi goes to sea to experiment—He reports in detail on ultra-short-wave observations—Lessons learned from micro-ray tests across English Channel—Old "ether" theory discarded—Marconi's surprise announcement to the Royal Academy**

NATURE imposes limitations on the ears and eyes, but man accepting the challenge is always trying to reinforce them to hear and see things outside their normal range by inventing instruments that detect the invisible and inaudible. The very sight of the ruddy Mars prods the star-gazer to wonder if some day man will communicate with celestial neighbours on a light beam or on some other magic channel. He dreams of interplanetary broadcasts. And when he hears flashes from explorers in the north polar and Antarctic regions his imagination is stirred, and he wonders what those areas of the earth really look like; he dreams of television.

Scientists are now talking about hearing light! Radio is leading communication engineers close to the fringes of that spectrum. Tiny Hertzian waves are a scientific rainbow of promise arched across the infinite domain of the research expert.

Marconi was one of the first to be entranced by this "rainbow" in the ether. He pioneered across the wireless trails that lead from the long waves, some measuring 30,000 metres from crest to crest, to the ultra-short waves or mere ripples only a few centimetres in length. Down the wavelength scale the men of radio have plunged, approaching closer and closer to the infra-red ray, the ultra-violet ray, the X-ray and the gamma rays of radium. That's light; radio is encroaching upon its frontiers.

The micro wave is the future of radio!

The short wave (150–10 metres) that hops, skips, and jumps around the earth with strange effects, tantalized scientists for a decade or more.

Why should an aeroplane's 33-metre S O S over the Pacific be heard in New York amid the sky-scrapers but not in California? Why should a message from London find South Africa or China but absolutely miss Brussels and ignore Paris?

Such erratic performances, compared with the more stable long waves, mystified even Marconi and aroused the curiosity of those restless souls who must learn the secret of inconsistency before they can sleep a good sleep. Evidence that the Heaviside Layer or "mirror" reflected the truant short waves back to the earth, causing a skip effect, was partial relief for their inquisitive minds. But solution of that riddle led only to further study.

Radio men set out to chart the short waves just as a mariner charts the routes of the sea. They catalogued every wave and distinguished between those that jump through daylight and those that can be trusted to sneak like a flash through the night's regions of darkness. The analysis disclosed that some of the waves revel in sunlight; others more owl-like hoot their messages only at night. So man had to cope with several variable factors utterly out of his control: the trickery of day and night and the knavery of the billowing "mirror."

With no hope of ever being able to govern these natural mischief-makers, Marconi and others sought ways and means to operate wireless in harmony with them. Unable to harness Nature, they would co-operate, and that they did, although the task was not easy. Few days offer the same atmospheric conditions and the lofty "mirror" is quite unstable. Just a sun-spot on the face of Old Sol often calls for quick scientific manoeuvring if world-wide wireless is not to be overpowered and faded out.

Marconi built reflectors, wire-like aerials to shoot the waves in desired directions. For instance, if London wants to chat with Calcutta when that zone is in darkness, aerials designed to fling the waves in that direction are used to project specific wavelengths. If Canada is the goal and the Atlantic basks in sunlight, still different aerials and another assortment of waves are called into play. Soon Marconi short-wave beams were encircling the earth with telephony and high-speed dots and dashes that rat-a-tat-tat between the hemispheres like the rapid fire of a machine-gun.

As Marconi and his staff studied the results they observed that short waves told tales on space. The wireless experts also became experts in prognosticating magnetic storms that frequently bombard the broadcasts in Nature's brazen attempts to obliterate the flow of dots and dashes. Now, for example, if King George decides he would like to speak to his far-flung colonies, the radio men would probably be consulted for a forecast of atmospheric conditions.

They can inform his Majesty, usually at least two weeks in advance, whether or not the "ether" on the day of his choice would be sprayed with static from some magnetic "blizzard." And with such advice the monarch would probably shift his speech to a clearer date on radio's calendar.

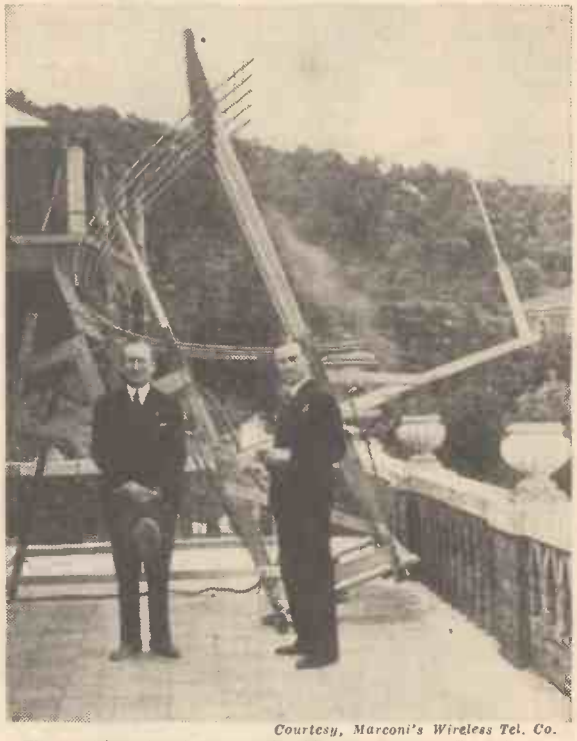
It was natural after all this conquest of short waves that the mind of Marconi buzzed with new ideas. He turned to the ultra-short wave (10 to 1 metre). And when he glimpsed beyond the frontier of 1 metre he was in the realm of micro waves, measured in centimetres! So here were two new things to work with, ultra short waves and micro waves.

Marconi was converging on the province of light. Possibly Nikola Tesla was right after all in his declaration, "Light can be nothing else than a sound wave in the ether; and the shorter the waves the more penetrative they will be." Certainly these miniature radio waves act in many ways like light: to some degree they obey the law of optics. Therefore, scientists were quick to label them "quasi-optical" because they seemed to travel only as far as the eye could see to the horizon. Some one with a dramatic flair called micro waves "dark light."

Stretched out before the eyes of man, as far as the eye could see, lay a vast field for experimentation. There was evidence of inventive opportunities galore. So bewildering with possibilities for expansion was the ultra-short wave that Marconi as well as other research pioneers rushed to develop new and more sensitive instruments to capture them for useful purposes. Tiny detector and amplifier tubes were devised no bigger than an acorn and just about that

(*Please turn to page* 136.)

## MARCONI'S EXPERIMENTS WITH U.-S.-W. TRANSMISSION



*Courtesy, Marconi's Wireless Tel. Co.*

**The great inventor standing beside his experimental 57-centimetre ultra-short-wave aerial erected at the Rocca di Pana, near Rome. With this equipment messages were sent to Cape Figari, Sardinia, a distance of 168 miles.**

# Rumba looking Chaps

R.7

*As a matter of fact, they're called "temple blocks." They make the rattle in West Indian music. If they sound as weird on your radio as they look in this picture, it's high time you changed to an Exide.*


# Exide

## BATTERIES

FOR RADIO

*'Still keep going when the rest have stopped'*

**EXIDE 'HYCAP' BATTERY** (*High Capacity L.T. Battery*)
For modern multi-valve sets—lasts longer on one charge. For small sets use the Exide 'D' Type. Both have the Exide Charge Indicator. Your dealer will tell you which to use. For High Tension use Drydex.

*From reputable dealers and Exide Service Stations. Exide Service Stations give service on* every *make of battery.*
Exide Batteries, Exide Works, Clifton Junction, near Manchester. Also at London, Manchester, Birmingham, Bristol, Glasgow, Dublin and Belfast.

## MARCONI—THE MAN AND HIS WIRELESS—*Continued*

shape. Short duralumin rods were erected as pipe-like aerials from which the "baby" waves could hop into space.

Experimenters went sky-high; to the towers of skyscrapers, up in aeroplanes and to mountain tops, because if these waves did travel only as far as the eye sees then the higher the aerial rod and antenna the greater the range. Marconi went to sea with the Elettra to study ultra-short impulses flashed out from the Italian coast; other experimenters cruised city streets with mobile receivers to learn all they could about the technique of ruling this mystic dominion of science.

They found that the micro wave has little or no affinity for Mother Earth, while the ultra-short wave does, although that was not the early belief. There seem, however, to be fewer sky-wave phenomena below 2 metres. Such signals over a short distance apparently hover close to the ground, and with the horizon as a springboard leap off into space on a straight line. Even the Heaviside "mirror" does not seem to reflect micro waves as it does the waves of longer length. On the other hand, the very fact that radio engineers in London had intercepted 9-metre broadcasts from a 5-watt police patrol car cruising a street in a Mississippi Valley town, showed along with other long-distance pick-ups that ultra-short waves are by no means strictly quasi-optical.

Some are inclined to believe, however, that micro waves, measured in centimetres, do go on and on into the infinite, travelling as straight a line as light. Visionaries base their hope for interplanetary communication on these "freak" waves that dash away from the globe. They argue if these electric waves are almost like light, and light comes from the stars, then what is to stop radio from straying that far from the earth, provided, of course, sufficient power is used?

Now suppose a straight stick is placed on a library globe. It touches only a comparatively small area of the sphere, the ends go off into space. That is believed to be a "picture" of micro waves. Therefore, if man wants to intercept the signals over greater distances he must climb up on lofty pinnacles to pluck them from space because the ethereal "stick" doesn't bend. And if he wishes to relay the messages farther or "bend" them around the earth from city to city he may have to use booster stations to relay them at different angles. For example, two such automatic stations might be needed to "bend" a two- or one-metre television wave from New York to Philadelphia, and that is only ninety miles. Those ultra-short and micro waves are going some place in a hurry and man must call upon his ingenuity if he is to outwit them and confine them to earthly performances.

Both the ultra-short and micro waves are more potent on an unobstructed path. That again follows the law of optics. The height of the aerial and antenna above earthly objects is more important than the height above the ground. Trees, electric wires, buildings and mountains are "death" to the ultra-short impulses. All objects seem to absorb and reflect the tiny waves, splashing them like light. Even a steam radiator in a room near an ultra-short-wave receiver will absorb or "shield" the signals; so will a kitchen stove. The "dead spot" caused by a skyscraper, even by a three-storey structure or a bridge, may well be imagined.

An aeroplane up 4,000 feet and 100 miles away can hear a 5-metre message; also at 3,000 feet; but after the plane drops to 1,000 feet the signals fluctuate rapidly and become more erratic than ever between 400 feet and the ground.

Marconi was convinced that the ultra-short wave is diffracted and refracted as well as reflected. Otherwise, what explains why the signals are audible, even faintly, far below the line of sight? A receiver atop Mount Washington in New Hampshire, 6,290 feet above sea-level, 284 miles from New York, and 37,600 feet below the line of sight, intercepted 6·8-metre and 4·9-metre signals projected into space from a skyscraper. It seems that these waves are diffused just the same as twilight. Technicians like to call it "atmospheric refraction." To explain it they point to the fact that a star appearing on the horizon is actually thirty-five minutes below it. Otherwise, how could 7·3-metre waves from Rochester, New York, be detected in England and on the Pacific coast? How could amateurs talk across the country and the Atlantic on ultra-short waves?

Furthermore, the miniature waves seem to travel in a substantially horizontal direction. The wave-front moves in a plane nearly vertical, and since the upper parts travel faster than the lower, because of atmospheric conditions, the tendency is for the wave to "bend" slightly towards the earth. There is probably an advantage in that the energy is diffused, for it may often provide signals on the "shadow" sides of buildings and hills in much the same way that light passes through a window not facing the sun.

When it was first observed that the ultra-short wave apparently baulked at the curvature of the earth, experimenters of a mathematical turn of mind figured that at last there was plenty of room in space for all sorts of radio stations; and for every television aspirant to establish a station. For example, it was estimated, if a 3-metre signal would cover only thirty miles on earth, then Boston, Albany, New York, Philadelphia, Washington and numerous communities in between, as well as others across the countryside, could use the same channel without interference caused by overlapping. Whether this theory holds is still problematical, for between two New England hill-tops, 100 miles apart, 2½-metre signals have established reliable communication.

Nevertheless, micro waves are heralded as the Promised Land—radio's Utopia—despite the fact that television requires a much wider channel than sound broadcasts, if the image is to appear in detail. Normally the little waves do not fade. They are generally oblivious to static; even a lightning storm does not blockade them. Then they are ideal for television because a picture distorted by fading might be gruesome or it might be ugly if streaked and freckled by static. The "baby" waves are less dependent upon seasonal influences than are the longer waves. Also they are "delicate" to handle, and how to pump high power into them is a puzzle of the first magnitude. So far they have performed their magic with the power of only a few watts. What might they do should 50,000 watts be injected into their arteries? But to get that power flowing across ultra-short-wave channels is a real trick; to control such energy in a tiny wave is no simple task. These things all taunt and haunt the engineers.

Marconi, too, in his sixties, was teased from any possibility of leisure, by these unanswered riddles. Fascinated by the opportunities, his after-the-World-War research was concentrated on the little waves which he beheld in his early experiments, but the devices needed to make them "jump through the hoop" at that time were missing. Into what niche of wireless could he fit this wondrous "dark light"? That was the question, and Marconi was among those determined to find the answer.

"The general belief is that with electro-magnetic waves under one metre in length, usually referred to as quasioptical, communication is possible only when the transmitter and receiver are within visual range of each other," explained Marconi; "and that consequently their usefulness is defined by that condition.[1]

"Long experience, however, has taught me not always to believe in the limitations indicated by purely theoretical considerations or even by calculations. These—as we well know—are often based on insufficient knowledge of all the relevant factors. I believe, in spite of adverse forecasts, in trying new lines of research, however unpromising they may seem at first sight."

These words reveal the resolute Marconi spirit of the '90's still very much alive. Years failed to dim the ardour, the patience required for this man to unwind the invisible threads of science and spin them into a practical service for mankind.

"It was about eighteen months ago," said the inventor, "I decided again to take up the systematic investigation of the properties and characteristics of the very short waves in view of the palpable advantages which they seemed to offer—i.e. the

[1] Lecture, Dec. 2, 1932, at the Royal Institution

(*Continued on next page.*)

### NEXT WEEK

#### CHAPTER XXIV

#### Marconi Looks Into the Future

**Marconi's personality compared with others—His habits—Enchanted by thoughts of boyhood—His comments on power transmission by radio—He crosses the ocean for the 87th time—A tea-party with newspaper men—He talks about ultra-short waves and television—An old friend's impression of the inventor—He inspires an editorial—Visiting a Century of Progress Exposition—Several anecdotes—Marconi inspects Radio City—As seen at a private interview—More honorary degrees—He goes home across the Pacific—"Blind" navigation micro-wave system is demonstrated on Elettra—Dr. Millikan's tribute and what Dr. Compton remembered—Marconi's broadcasts to America—An early associate accounts for Marconi's success—Marconi's view of life and its mysteries—He sees the old order of wireless change—At sixty-three he pursues micro waves to the gateway of television.**

(*Continued from previous page.*)

small dimensions of the radiators, receivers and reflectors necessary for radiating and receiving a considerable amount of electrical energy—and in view also of the fact that they do not suffer interference from natural electrical disturbances. It was, of course, obvious that these investigations would be facilitated if it were possible efficiently to utilize more power at the transmitter and more reliable receivers than those available for the tests in 1919–24."

Marconi summoned his personal assistants—G. A. Mathieu of short-wave beam receiver fame, and G. A. Isted. Valves were developed to function on a half-metre wave and less. New circuits were evolved to meet the extraordinary conditions. An instrument was designed to measure waves as short as a millimetre. And when the mechanism for working the modernized wireless was ready, the practical-minded Marconi and his engineers instituted a thorough investigation under actual operating conditions along the Italian coast. He had used reflectors before, but now radical changes had been made in their design in order to master the tiny waves.

The first test was conducted in 1931 between Santa Margherita and Sestri Levante, near Genoa, a distance of twelve miles over water. The elevation of the two instruments was capable of giving a direct line of vision across twenty-four miles.

Marconi was more anxious than ever to test the distance capabilities of the miniature waves, and with that purpose as the incentive he went to sea on board the *Elettra* with a single reflector unit installed astern of the main deck.[2]

The Santa Margherita signals were still perceivable twenty-eight miles away, well beyond the optical range, and notwithstanding the curvature of the earth. The signals began to lose their strength noticeably at 11 miles from Santa Margherita, that is, before reaching the optical limit, but after passing that position they gradually decreased in intensity until no longer audible. Beyond 22 miles, however, the signals suffered a deep fading. Up to 18 miles, speech was 90 per cent. intelligible, but from 20 miles until the signals could no longer be heard, tone Morse signals only could be clearly identified.

Then the apparatus at Santa Margherita was taken to Rocca di Papa, 12 miles south-east of Rome at a height of 750 metres above sea-level and about 15 miles inland. As the Elettra moved towards the island of Sardinia, Marconi observed and logged reception. The signals vanished at the 110-mile mark.

When the yacht arrived at Golfo Aranci, Sardinia, the ultra-short wave instruments were installed on the tower of a signal station at Cape Figari, 340 metres above sea-level. The signals from Rocca di Papa were heard clearly at times over 168 miles, while the optical distance or theoretical horizon, considering the height of the two places, was approximately 72 miles. The average signal strength was superior before sunset than after.

"It is interesting to add that at Cape Figari the angle of reception was investigated several times by tilting the reflector, and it was found that the waves from the distant station reached the receiving experimental station from a horizontal direction," said Marconi. "I feel that I may say that some of the practical possibilities of a hitherto unexplored range of electrical waves have been investigated, and a new technique developed, which is bound to extend very considerably the already vast field of the applications of electric waves to radio communications.

"The permanent and practical use of micro waves will be, in my opinion, a new and economical means of reliable radio communication, free from electrical disturbances, eminently suitable for use between islands, and to and from islands and the mainland, and also between other places separated by moderate distances. The new system is unaffected by fog, and offers a high degree of secrecy, by virtue, principally, of its sharp directive qualities.

"Its strategic uses in war time are obvious, no less than its practical value to navies and aircraft, in so far as the communications can be confined to any desired direction. The fact, however, that the distance of propagation of these waves appears to be limited suggests other advantages in war time, besides greatly reducing the possibility of mutual interference between distant stations.

"In regard to the limited range of propagation of these micro waves, the last word has not yet been said," warned Marconi. "It has already been shown that they can travel round a portion of the earth's curvature, to distances greater than had been expected, and I cannot help recalling that at the very time when I first succeeded in proving that electric waves could be sent

(*Please turn to page* 139.)

[2] July, 1932.

QUESTIONS AND ANSWERS

By K. D. ROGERS

# COIL LOSSES AND SCREENING

*Someone has asked me a question that I am afraid it is going to take a lot of space to answer. I will do it as simply as I can and as shortly, but it is a biggish subject. Here's the question: "Are iron-cored coils worth while?"*

*As Alexander and Mose might say: "Boy, they certainly are." And I will try to unravel myself.*

To start with, the air-cored coil is a very good bit of electrical "machinery," but with modern set requirements it is rather clumsy, especially as high efficiency valves and so forth have made it necessary to use screens over our coils. That means the coils must be fairly small or else they will take a lot of room, and if they are small they will of necessity be inefficient.

That is a preliminary reason why some sort of coil that can be compact without being inefficient is desirable.

Here is some more. A screening "can" takes away "goodness" from a coil by reducing the inductance. Thus, with a screened coil the number of turns of wire for a given inductance must be increased to make up for the screening losses—and more wire means higher resistance. Which we do not want.

So we have this problem. We want a small compact screened coil, and we want with it low resistance and high inductance. And the things do not go together.

Puzzling over the hardness of radio fate one day, some bright spark thought he could overcome the whole trouble in one go by using a core for the coil which would concentrate the field, thereby keeping the effect of the screen away from it, and would, at the same time, increase the inductance of the coil and so enable it to be small and of few turns of wire for a given inductance. And he chose iron—quite obviously, when all's said and done.

But things did not work out as he expected. The iron gave him increased inductance, and all that, but it introduced a very big loss which offset the gain—the loss caused by eddy-currents in the core, by hysteresis in the iron and by self-capacity of the coil due to the metal core. A nasty bunch of snags.

But radio engineers are not to be put off by trifles, even if they seem to be insurmountable. And once the idea of an iron-cored coil got around a number of bright lads got to work on it. And the result is the Ferrocart coil and the other types of powdered iron-cored coils.

Powdered iron is used because the small particles of iron can be insulated from each other by dipping in wax, and so can be made more or less impervious to eddy currents. You can't start a current in a piece of iron if as soon as it starts it comes to the end of the iron, and that is the effect in non-technical language of the powdered iron cores. Currents try to start in each individual segment, but the individual efforts cannot get together to form a good-sized current which will upset things, and so the eddy current bogy was laid.

Closed cores give a path for the lines of force outside the coil and so keep the effect of the screening can down to its proper job—screening—and prevent it upsetting the inductance of the coil. Self-capacity is lessened by the fact that comparatively few turns of wire are needed for a given inductance, and the wire can be of Litz to keep the ohmic resistance down.

The result of the iron-cored coils is undoubtedly to provide a coil that is more efficient than any air-cored coil of anything like its size or convenience with an inductance that it is impossible to attain with air cores without gigantic coils and huge cans covering them.

Iron-cored coils are certainly worth while, for they are efficient, compact, and can be perfectly screened without loss of inductance to anything like the extent that holds where air cores are concerned.

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*All Editorial communications should be addressed to the Editor, "Popular Wireless," Tallis House, Tallis Street, London, E.C.4.*

*All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.*

*The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception.*

*As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the 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.*

## NOISY SUPERHETS

T. D. D. (Liverpool).—*What causes that hiss so typical of superhets?*

That is the noise generated by the oscillator valve. You cannot at the moment have any valve in an oscillating condition without the generation of a breathing or hissing noise. Some superhets make more noise than others because they go in for more amplification *after* the oscillator valve, while the others go in for a great deal of amplification before the oscillator is reached and for very little in the intermediate stage.

That means that the signal is well amplified before it gets to the mixer and oscillator section, and so the ratio of signal to noise is high. In the other sets the sensitivity of the receiver is obtained through big amplification of the intermediate frequency, which means that the hiss is brought up as well as the signal. It also means that the hiss is high in ratio to the signal when it leaves the mixer valve. If that state of affairs takes place there is no hope of getting rid of the hiss other than by cutting it out with some sort of frequency rejector and losing signal or audio-frequencies that coincide with those round about that of the hiss.

## SEPARATE REACTOR VALVE

G. P. H. (Norwich).—*I have been told that a separate reactor valve is a good idea, especially in a short-wave set. It is said that it is better than using the detector for reaction. Is that so?*

Yes. I advocated the use of the reactor valve many years ago. It is an excellent scheme, for it allows reaction to be applied in a very efficient and controllable manner.

## WHERE SHOULD IT GO?

"PUZZLED" (Bournemouth) *wants to know where to put his pick-up in a four-valve set—one H.F., det. and two L.F.*

Well, "Puzzled," you are only a little more puzzled than I am. You see, you did not tell me the type of pick-up you want to use. And that is the whole crux of the matter.

What you want to do is so to arrange the position of your pick-up that when it is going more or less full blast it will fully load the output valve. If it is a very sensitive pick-up, like the piezo-electric-types, you will be well advised to put it in the grid circuit of the first L.F. valve. It will give too strong an output to warrant it being connected in the grid of the detector, for three stages of L.F. will give too much amplification.

On the other hand, if the pick-up is of a fairly insensitive type like the needle armature models (I am taking extremes in my examples, of course), you will have to put it in the detector circuit in order to get sufficient amplification to load the output valve sufficiently. If you put it in the first L.F. stage you will get far too weak an output from the set.

Let me know the make and type of pick-up, and also the valves you are using and the coupling arrangements between them, and I can advise you more accurately.

## YOUR L.T. BATTERY

ALTHOUGH listeners are warned never to "top up" their accumulators with anything else but distilled water, this advice may in the course of time lead to trouble if taken to the extreme.

During charging, a certain amount of the electrolyte will be thrown out of the accumulator cell in the form of spray. But this will cause only a slight loss. It is, however, a loss which will cause dilution of the electrolyte during the years, and this can only be made good by the introduction of new acid solution. It is as well to keep a check on the specific gravity of the acid by means of a hydrometer.

Incidentally, should you ever have occasion to mix an acid solution for an accumulator, this important rule should be remembered. The acid must always be added to the water, and water must never be poured into the neat sulphuric.

This is because great heat is developed when the two fluids mix, and the bigger the proportion of acid the more spluttering and heat there will be.

## TECHNICALITIES EXPLAINED—No. 68

## BAFFLE BOARDS

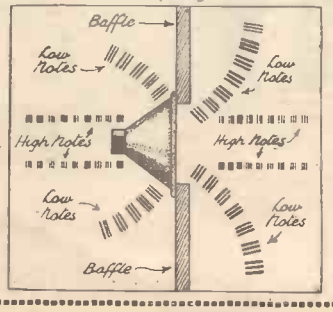
**All sound waves are "pushes" and "pulls" in the air. They are waves of compression and rarefaction like the compression and rarefaction set up when you work a bicycle pump. High notes are composed of a lot of little waves with little distance between them and low notes are composed of long waves.**

**If waves of sound meet one another they often cancel out, distort each other, or, if they happen to be in step, they help each other.**

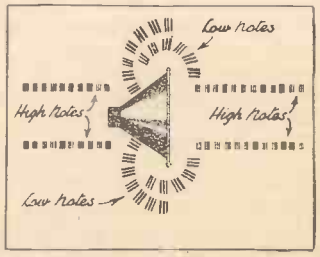
**In the case of a moving-coil loudspeaker the waves are set up from both front and back surfaces. When the front surface pushes the back one pulls, and vice-versa. Now the long, comparatively slow pull or push of low-note generation is slow enough to be transmitted from the front of the speaker, round the side to the back before the return stroke (the push or the pull) is carried out.**

**With a high note or medium note the push and pull are finished and the full note formed before the effect on the air is carried from one side of a speaker to another. With the low note the push may be felt at the back of the speaker (having started from the front) before the pull has been finished at the front. That is nasty, but this is worse. As the front is pushing the air round to the back the back is pulling the air inwards. But by the time the push from the front reaches the back the back may have begun to push (and the front to pull), with the result that the two waves meet and muddle each other up. And that muddle will be enough in very low notes to cancel out the production of low notes altogether (see right hand sketch, below).**

**So the baffle is used. This is a soundproof and sound-reflecting surface which is set up all round the speaker to prevent the air waves from meeting as they come off the front and back of the speaker.**




**Thus there is no cancellation of low notes (see sketch on left). The larger the baffle, i.e. the farther it stretches from the speaker, the lower the notes that can be produced (other things being equal), for the very low notes can stray round a three-foot baffle with ease and still upset each other. It takes a four-foot baffle to guarantee good reproduction of 50-cycle notes and a sixteen-footer to look after 25-cycle notes.**



## MARCONI—THE MAN AND HIS WIRELESS

(*Continued from page* 137.)

and received across the Atlantic Ocean in 1901, distinguished mathematicians were of the opinion that the distance of communications, by means of electric waves, would be limited to a distance of only about 165 miles.

"In any case, the new system is now available for advantageously replacing optical or light signalling in all its long-distance applications, as for example, between signalling stations along coasts, or between forts constructed along a frontier, and in general will be found advantageous in many cases where the erection and maintenance of an ordinary telephone or cable circuit is difficult or too expensive.

"Other applications such as broadcasting and television are already under consideration, and the study of the new fields of application for these so far unutilised electric waves will, I feel sure, soon bring about the design of greatly improved methods and apparatus."

With this complete account of his work to date, Marconi returned to Italy and to the Elettra, "to try new lines of research, however unpromising at first sight."

So successful had been his investigations that the Vatican authorities decided to adopt the new system for telephonic communication on about 60-centimetre waves between the Vatican City and the Papal summer residence at Castel Gandolfo, about fifteen miles from Rome.

The unique installation, the first of its kind in the world, was presented by Marconi to Pope Pius XI in a broadcast heard throughout America as well as Europe.[3]

"Our first word shall be for you, Signor Marchese Marconi," said the Pontiff, "and it will be a word of congratulation for the continuous successes that Divine Providence and divine goodness have reserved for your researches and applications in this field."

The Marchese replied: "This first practical application of micro waves fills my heart, both as an Italian and a scientist, with pride and hope for the future. May my modest work contribute to the achievement of true Christian peace in the world."

Radio engineers throughout the world had by this time accepted the challenge of micro waves. Just as the English Channel had dared Captain Webb to swim it, Marconi to leap it by wireless and Bleriot to fly across, so it offered an ideal opportunity across which to "spin" a micro-ray radiophone line.

The Straits of Dover between Lympne and St. Inglevert, a distance of 56 kilometres, was chosen for experiments, using 18-centimetre waves. The tests began in March, 1931, and after five years of service W. L. McPherson and E. H. Ullrich, engineers of the International Telephone & Telegraph Company, summarised their observations as follows:[4]

(1) The most stable micro-ray conditions coincide with very stable atmospheric conditions as judged by thermometer and barometer.

(2) Given stability of temperature and pressure, the actual values seem to have no importance.

(3) Given stable temperature and pressure, rain, hail, snow, or fog do not affect the link.

(4) No definite relation between the electrical state of the atmosphere (potential gradient) and micro-ray stability has been found. Excellent operation has been obtained during thundery periods, but there is no information as to the general atmospheric stability at the time.

(5) A high wind is almost invariably accompanied by good micro-ray transmission.

(6) Sudden changes in temperature are usually accompanied by micro-ray fading; likewise sudden barometric changes. Rapid fluctuations in temperature occur much more frequently on hot days than on cold days; fading is more pronounced during the summer months than in winter.

(7) The settling of a heavy bank of fog has been accompanied by very severe and rapid fading, followed by stability when the fog bank has ceased to move.

(8) During the summer, extremely violent fades of very short duration—1 to 2 minutes—have been noticed.

(9) During the summer, fading at audio frequency seems to occur both in broad daylight and in darkness.

(10) Ultra-short waves of 6 metres length are much stabler than micro rays over optical paths across the Straits of Dover.

(11) In noisy locations micro rays have the advantage over ultra-short waves of being much less affected by "man-made static."

(12) Micro-ray communication is much more private than ultra-short waves.

It will be recalled that when Marconi first encountered the tiny waves before the turn of the century, "the ether" was all the rage; it helped to account for some of the mystery in wireless. To envisage such a medium assisted the layman, and scientists

(*Continued overleaf.*)

[3] February 11, 1933.
[4] *Electrical Communication*, April, 1936.

## MARCONI—THE MAN AND HIS WIRELESS

(*Continued from previous page.*)

too for that matter, to understand how messages could be sent through the air. But now with the return of ultra-short waves to prominence, scientists because of their advance knowledge of radio were beginning to discard the ether theory. Even Marconi, it was noticed, refrained from using the term "ether." He spoke of Hertzian or electromagnetic waves.

The one-hundredth anniversary of Clerk Maxwell's birth was marked by the scientific world "digging a grave for the theory of a luminiferous ether," but at the same time honouring Maxwell's mathematical genius. That supreme "paradox of Victorian science and yet a triumph of the scientific imagination" was at an end. The ether was gone.

Science, however, will always remember Maxwell for the necessary and convenient fiction his mathematical mind spun to help physicists in the days before they realised "there are no ether waves," as Charles Proteus Steinmetz put it. The waves are electromagnetic wafted in an unfathomed field of force which modern men of science contend extends throughout space.

Marconi had an intuition that the micro waves might be made to penetrate solid bodies just as other wireless waves; he was not satisfied with the experiments to date. He would chase the little waves farther, beyond the horizon.

Into the Tyrrhenian Sea sailed the Elettra to conduct tests with inland Italy.

On August 14th, 1933, Marconi mounted the rostrum of the Royal Academy in Rome with the surprise announcement that both radiophone and telegraphic signals had been exchanged with Santa Margherita 94 miles away. And while the Ellettra was anchored at Porto Santo Stefano, 161 miles from Santa Margherita, faint code signals on the 60-centimetre wave were intercepted on the yacht, although two mountain promontories intervened, indicating that opaque objects do not block the waves. He did not hazard a guess as to what caused the waves to "bend," because he planned other experiments in an effort to determine definitely the laws governing the propagation of the micro waves.

Marconi was at "the gateway to television."

. . . . . .

". . . mankind is at the very beginning of its existence; on the astronomical time scale it has lived only a few brief moments, and has only just begun to notice the cosmos outside itself. It is, perhaps hardly likely to interpret its surroundings aright in the first few moments its eyes are open."—SIR JAMES JEANS.

**S.T.900!**
**OCT. 27th!**

## YOUR EARTH CONNECTION

IN the accompanying illustration may be seen one of the most effective ways of ensuring that an earth connection to a water-pipe shall be of lasting efficiency.

Simply, before winding the bare wire round the cleaned waterpipe, provide a metal plate and a metal or wooden wedge. Place these in position as shown and wind


Perfect contact is achieved by tapping the wedge lightly with a hammer, thus bringing the turns of wire tightly against the pipe.

the required number of turns of wire around them and the pipe as tightly as possible.

Finally, give the metal or wooden wedge a few light taps with a hammer. The result will be that the wire turns are stretched dead tight, thus ensuring a perfect electrical contact.

A wedge type contact of this nature is very useful for fitting to a waterpipe whose nature, or situation, does not permit the use of solder for the purpose of making a soldered joint.

# BETTER RECEPTION

## A Short Story

By

COUTTS BRISBANE

"GRRH!" growled Jim Barton, and shut off the radio with a snap. "That's pretty awful, isn't it? The blamed thing's no good at all."

"Yes, dear," murmured Janet, his wife, mechanically. "It did sound a bit—well, sort of dull, didn't it?"

"Dull! It's a blamed caricature of music!" snapped Jim. "All the pianoissimo parts blurred flat—and that's a first-class orchestra. I did want to hear it, too—but not this awful botch."

He glared despitefully at the ancient radio set which had so travestied old man Beethoven. Music was Jim's passion; he had hoped to satisfy it when he bought the set at bargain price, only to find that it was no bargain at all but the also-ran variety which wouldn't respond to any sort of treatment.

"Lord, I wish I could afford a decent set," he muttered. "Perhaps—after a bit——"

"Yes, dear, one of these days," agreed Mrs. Barton vaguely. "We'll see."

Privately, she considered that Jim was a bit too particular, for the noises that radio gave out satisfied her uncritical ears. Of course, she would have liked him to have a better instrument, but that couldn't be yet awhile, so what was the use of worrying? They had just tided over a spell of unemployment on savings, and now Jim was starting on a good job at the new Scavy Harbour; but though underwater work was well paid there must be no unnecessary expenditure till those savings were replaced. One had to think of the rainy day.

"Maybe in about three or four months," murmured Jim hopefully. "I'll see. I'd best be getting ready to start, I s'pose."

It was some three weeks later that the totally unexpected happened. Mrs. Barton had finished her work for the day when the bell rang. No, the young man wasn't trying to sell a vacuum cleaner or the very latest thing in kitchen cabinets, but was really and truly a lawyer's clerk. Having answered all his questions satisfactorily and even showed the portrait of Uncle Herbert Webb as a young man, in the family portrait album, she received the sum of forty-five pounds, that being her share of Uncle Herbert's estate, less tax.

After that—well, it wasn't so far to the shop before which Jim had lingered longingly more than once. Yes, it was extravagance, if you like, but after all, as Janet Barton told herself while she listened to what was surely a perfect rendering of the B.B.C. Orchestra and afterwards to one in Berlin, it was her money and a windfall, and if she chose to spend part of it that way it was nobody's business but her own.

She didn't write and tell Jim about it, for his last letter had said that he would be back at the end of the month for the week-end. It would be better to give him a surprise, have the new set going when he came in. Even if it happened to be the Children's Hour, he'd hear the difference of reception at once, the moment he entered, though perhaps she'd find something more to his taste coming from the Continent. It'd all depend on the time he came home.

Friday, midday, came the telegram. Janet opened it with some misgivings, for always the few telegrams she had ever received had been tidings of trouble—the sudden death of her sister, the illness of her father—always bad news. But a glance reassured her. It was from Jim to say that he would be back that evening. Still, that might mean that he had lost his job. He'd told her that they were working against time on a contract with a penalty clause for every day beyond a given period. But that again meant that the contractors would hardly be likely to sack a man like Jim who was used to going down in a diving dress. There weren't so many men who could do that sort of thing. It must be something else. Perhaps they wanted him to work on Sunday; that sometimes happened, she knew, on that particular sort of work, when there was any blasting to be done. On Sundays the harbour could be kept clear—or something of that sort. Of course there was nothing to worry about.

She got in the materials for a meat pie, for Jim was fond of it and always said he never got any like her cooking. And everything being all ready, she went to the door to wait.

Yes, there he was, coming! She dashed in and switched on the new radio, having already set it to a French broadcast of orchestral music, the sort of thing he liked so well. Pure and clear it came over, an operatic overture, just as though one had been in the hall away across the Channel. Jim would be hard to please if he didn't like it.

He saw her, waved a hand and quickened his steps. Surely he must hear the music now, and recognise that it didn't come from that old set? Now his arm was round her shoulders, she had drawn him inside, the door was closed. The music flooded about them as he kissed her—and still he took no notice of it. He hadn't said a word as yet, not a word.

He was pale, too, and thinner than he had been, his eyes looked haggard and his lips quivered oddly. Then he spoke, and his voice was strangely flat:

"I didn't write about it, old girl, didn't want to upset you—but I had a bit of accident. It wasn't so bad and I'll be able to carry on—only they thought I'd best have a few days off to get used to it, as it were. I was down under water, but just coming up after laying a charge—blasting a bit of rock, it was—and something went wrong by accident and it went off. I was sort of shocked, but nothing to signify—except for my ears. You've got to learn to talk with your fingers, old girl—for I'm stone deaf for the rest of my life!"

## RADIO RODEO

For his October edition of "Radio Rodeo" Harold Ramsay will present from the Union Cinema, Kingston, a galaxy of broadcasting stars. Listeners will hear them in the Regional programme on October 20th—Harry Richman, with his American wisecracks and songs; Scott and Whaley, the coloured comedians; Jeanne de Casalis in another "Mrs. Feather" episode; Issy Bonn, an outstanding success in a recent "Music Hall" broadcast; Bennett and Williams; Gaby Vallé; the Eight Step Sisters; and Fred Hudson. Three well-known organists will also take part in the programme; Harold Ramsay, H. Robinson Cleaver, and Phil Park, who has again written the continuity and special lyrics. Production will be by Leon Pollock.

# CLUB NEWS

## EASTBOURNE AND DISTRICT RADIO SOCIETY

THE winter session of the Eastbourne and District Radio Society—one of the oldest in the country—opens with a record number of new members. Already some fifteen to twenty have come in. All grades are catered for—beginners and advanced students. Will those interested write the Hon. Sec., S. M. Thorpe, 74, Brodrick Road, Eastbourne, or call at Dowsett & Co., Ltd., 48, Grove Road, Eastbourne.

* * *

## IRISH RADIO TRANSMITTERS' SOCIETY

THE IRTS held one of their D.F. hunts on Sunday, September 26th. The transmitter, which was an R K 2 5 CO. on 3,551 kc., using an input of 15 watts from a generator, operated under the call E I 6 J P and was located at Tallaght, Co. Dublin.

Members in cars and with D.F. receivers started from the city at 2.30 p.m. when the first transmission was made. These transmissions were continued for the first five minutes of every quarter hour; the first car to locate the station was E I 2 J's party; closely followed by E X - E I 4 D's party at 5.30. This was a particularly good piece of work, as the station was situated so that it could not be seen until within twenty yards. All cars reported good signals from the portable; R8 being the report from as far as fifteen miles. All particulars of this society may be obtained from the Hon. Sec., Mr. W. H. Coombs, 23, South William Street, Dublin.

* * *

## BRADFORD S.W. CLUB

AT the annual general meeting of the Bradford Short-Wave Club, held at the club headquarters at Bradford Moor Council Schools on Friday, October 1st, the following officials were elected for 1937-8:

Hon. Sec., Mr. S. Fisher (2 B M O).

Hon. Treas., Mr. V. W. Sowen (2 B Y C).

Committee: Mr. E. M. Varley. Mr. G. Walker (2 A W R). Mr. E. J. Simonard (2 C Q Y).

Mr. Simonard was elected chairman of the committee. Forthcoming events are as follows: October 22nd, "Eddystone" (Demonstration). October 29th, Radio G 6 A Z on "Aerials" (Lecture).

* * *

## BATTERSEA AND DISTRICT RADIO SOCIETY

THE Battersea and District Radio Society announce that they have commenced their winter session and meet on Tuesday and Friday of each week at the Battersea Men's (L.C.C.) Institute, Latchmere Road, S.W.11.

Talks on the everyday problems of the wireless enthusiast will be given each Tuesday and Friday evening will be devoted to practical work and a Morse instruction class for those desirous of acquiring a knowledge of the Code, so useful in short-wave listening nowadays.

Particulars of the club are available any Tuesday or Friday evening from Mr. S. H. Harris (G 5 S H) at the above address.

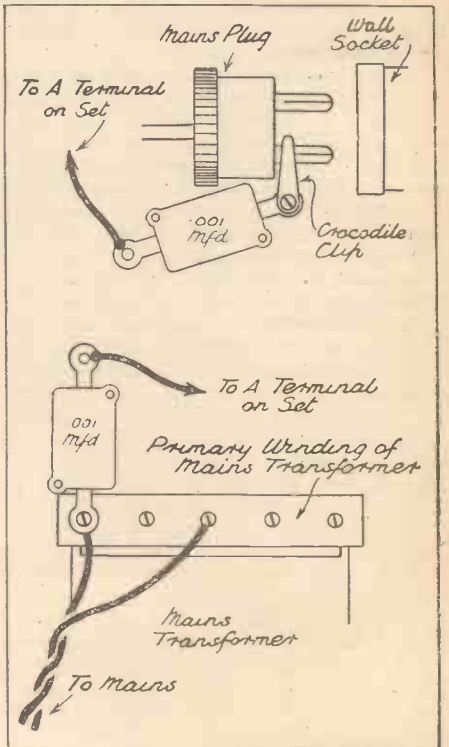
# FITTING A MAINS AERIAL

By A. W. Youngman

FEW constructors fully appreciate the advantage offered by a mains aerial, either as a means of testing or as a permanent alternative to the more orthodox type. In the former case it can be attached to the mains point used in the test, with a soldered or crocodile clip lead; while in the latter instance it may be permanently connected to one side of the mains input. Where no external leads are desired a connection can be made to primary winding of the mains transformer inside the receiver.

Whichever method is adopted, the correct means of connecting is illustrated in the diagrams, where it will be seen that for test bench work (top figure on right), one side of a small fixed condenser having a value of approximately ·001 mfd. is joined to a pin on the mains plug, while the remaining side of this condenser is taken to the aerial terminal on the receiver.

The lower figure will be found more useful for flat-dwellers where the use of an outdoor aerial is not practicable. The actual connections in this case are the same, although in this instance the condenser is joined directly to a terminal on the mains transformer.




Two methods of utilizing the mains wiring in cases where other forms of aerial are not convenient. Mains aerials are not, of course, ideal in districts where mains-borne static is prevalent.

## TECHNICAL JOTTINGS

*(Continued from page 124.)*

perfection and covers a wide musical range; it goes without saying that the reproduction of a good modern record calls for a pick-up with an extensive frequency characteristic.

The B.T.H. "Pezolectric" pick-up has also a generously rising bass characteristic which compensates for low-frequency cut-off below 200 cycles in both records and amplifier circuits. The operating pressure is applied to the crystal by means of a light needle-holding device which produces a voltage in proportion to the applied pressure; in this way amplitude distortion is reduced to a negligible amount, and it is claimed that owing to this and the associated damping there are no unpleasant high-frequency responses.

### A High Output Obtainable

As regards the output of this new pick-up, an average output of 1·6 volts is obtained, the bass response rising to as much as 5 volts. The instrument, therefore, should make a great appeal to those who desire a really powerful pick-up capable of high-quality reproduction.

Owing to the large voltage output of this pick-up it is essential that a potentiometer-type volume control be used and, to ensure uniform control, it should have a graded law giving 20 per cent. of the total resistance at 50 per cent. rotation. The pattern recommended by the B.T.H. people is the Morganite - Stackpole No. MNAR 50420.

I may, perhaps, mention one or two other points with regard to this pick-up: It is important that no contact be made with any H.T. potential and that the pick-up be directly connected to the grid circuit of the receiver or amplifier and not through an intermediate transformer. As the operation of the "Pezolectric" power pick-up is similar to that of a condenser (that is, D.C. current cannot pass through it), a potentiometer or resistance across the pick-up is essential to provide a path for the grid bias of the valve.

### Reducing Bass Response

If it is desired to reduce the bass response a smaller value of potentiometer may be used, but for ordinary requirements this should not be below 100,000 ohms. Used in proper conditions the device gives a relatively linear output, as indicated by the smooth response-curve supplied by the makers. The impedance of the pick-up at 1,000 cycles is approximately 160,000 ohms and the capacity about 0·001 microfarad.

Those of you who are interested can obtain fuller information from the makers.

### Electrolytic Capacity

Readers sometimes think that an electrolytic condenser always has an enormously greater capacity than an ordinary laminated condenser. This is only true if we speak very broadly, but it is necessary to take into account various other factors. For instance, if the electrolytic condenser is designed for a relatively low maximum working voltage, then you can crowd a very large number of microfarads into a relatively small space. As an example I may mention one of the T.C.C. types, which has a maximum working voltage of 12 and which gives 2,000 microfarads in a capacity of 20 cubic inches. On the other hand, where the maximum working voltage is 200 a capacity of 30 microfarads is obtained in a space of 5 cubic inches, or at the rate of 120 microfarads in 20 cubic inches. These figures again are taken only very approximately and they vary with the type of condenser; there are various types of condenser rated at a maximum working voltage of 200 which are approximately the same size, but give different minimum capacities in microfarads.

### The Aqueous Type

The electrolytic condensers also are divided roughly into the so-called "dry" type and the "aqueous" type. The former is in many ways very convenient, but the latter, although it has to be mounted upright, has certain advantages. The aqueous type, for instance, is a reliable precaution against high-voltage peaks and surges. Suppose you apply 460 volts or more to a 440-volt type aqueous electrolytic condenser, this simply results in the passage of current through the condenser, and the voltage is thereby prevented from rising appreciably. Of course, you would not continue to do this because it would cause overheating, but the point is that if the voltage momentarily goes even far past the rated voltage nothing very serious happens, whilst as soon as it reverts to its normal value the condenser behaves quite normally again, since it has never actually been punctured.

This is definitely a practical advantage.

### Acts as a Safety Device

The condenser acts, therefore, as a safety device in the circuit. I should mention that notwithstanding this characteristic of the condenser, care must be taken not to operate it at reversed polarity nor on raw A.C.

### Oil-filled Condensers

Another interesting and relatively new type of condenser is the petroleum-jelly-filled type, which has been specially designed for use at the higher voltages common in cathode-ray television and in modern radio-and low-frequency amplifiers. Wherever high voltages or temperatures are involved, as for example in R.C. amplifiers, for reservoir, decoupling or smoothing, or in tropical climates, these condensers fill an important need. The advantages of oil-filling in a condenser are well known and in huge condensers for power purposes oil filling is practically universal. In these small condensers used for radio purposes, liquid oil-filling has obvious disadvantages, but the use of the petroleum jelly gives the advantages of oil-filling without the risk of leakage or "creeping," since no free liquid is employed.

### "The Lilac Domino"

Gordon McConnel is again to produce "The Lilac Domino." The show will be radiated on October 19 in the Regional programme, and on the following evening on the National wavelength.

Georgine, the Lilac Domino herself, will be played by Maria Elsner, the charming Viennese singer, who made her radio début in "The Countess Maritza."

# NOVEL NEEDLES

## An article which will interest all radiogram enthusiasts

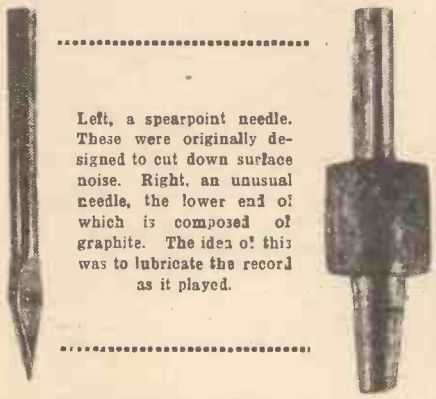
By J. F. STIRLING

THERE is a story on record—and it is probably a perfectly true one—concerning an individual who, towards the close of the last century, purchased one of the earliest disc talking machines, or "gramophons," as they were then called. This pioneer enthusiast was supplied with one needle and with one needle only. He kept that solitary needle in use for no less a period than three long years, sharpening its point carefully on a piece of sandpaper whenever he thought the condition of this long-suffering stylus required such treatment.

One wonders, indeed, what the state of this gentleman's records must have been after three years' playing with his one steel needle!

The needle of a radiogram is, seemingly, a very insignificant article, yet it performs an exceedingly vital task. Consequently, it is not a matter for surprise when, looking into the history of the radiogram and that of its immediate predecessor, the acoustical gramophone, we find that innumerable inventors and enthusiasts have literally allowed their ingenuity to run riot in efforts to produce that still hypothetical article, the perfect needle.

The ideal radiogram needle would be one which would never require changing. It would, also, be one which would not set up the slightest degree of record wear and, also, by the employment of one of these imaginary products, a gradation of sound



Left, a spearpoint needle. These were originally designed to cut down surface noise. Right, an unusual needle, the lower end of which is composed of graphite. The idea of this was to lubricate the record as it played.

volume from a mere *pianissimo* up to the maximum volume obtainable from the instrument would be forthcoming by a predetermined setting of the needle.

The perfect needle possessing all these qualities will, no doubt, never be forthcoming. Yet it is of absorbing interest for the radiogram owner to recall to mind some of the curious needle devices which, at one time or another, have been placed upon the market with the object of remedying one needle fault or another.

Steel needles are undoubtedly the most generally satisfactory for pick-up use under average conditions, and it is, perhaps, in the realm of these metallic needles that the greatest fertility of invention has been displayed. At the same time, however, there have always been gramophone and radiogram enthusiasts who have constantly endeavoured to get away from metallic needles, mainly owing to the slight but steady record wear which most of the latter needles normally set up.

The most popular of the non-metallic needles is undoubtedly the well-known fibre needle, introduced for the first time by a certain Frederick Durize Hall, of Chicago, in 1908. A close runner-up to the fibre needle is the needle of natural thorn which has been marketed under a variety of names.

### Non-Metallic Types

But apart from fibre and thorn needles for radiogram and ordinary gramophone use, there have been at various times a surprising number of other non-metallic needles. The sapphire permanent stylus of the old pre-war Pathé gramophone will be familiar to many readers of this paper as, also, perhaps, will be the rather less-known diamond needle of the Edison disc machines. But few readers, I imagine, will recollect the remarkable three-pointed glass needle which came out some years ago. This was introduced with the object of cutting down surface noise and reducing record wear. Its shank was of metal, and after one of the glass points had worn the needle was twisted in its holder so that a new glass point was presented to the record.

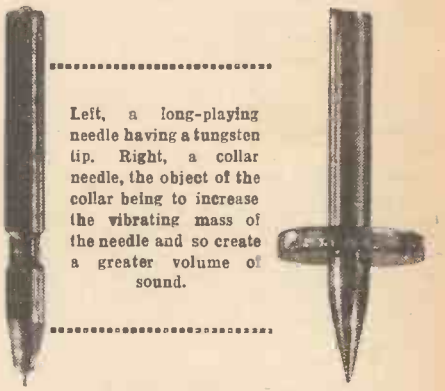
Experimental needles have been made in materials such as sulphur, ebonite, cork, compressed paper, vulcanite, mica, porcelain, carbon, celluloid, and even rubber. None of these, however, ever saw the light of a commercial day, although it must be remarked that there have been quite a number of graphite needles put on the market. Needles of this type comprised a short graphite stylus let into a metal holder, the shank of the latter being inserted into the sound-box or pick-up. The object of the graphite needle was to cut down surface noise and to lubricate the record. Quite a number of these needles were really extraordinarily successful, particularly with the older type of gramophones, but they did not appeal to the modern radiogram owner and, consequently, they are no longer on the market.

### Varieties of Steel Needles

Steel needles of all types, varieties and patterns have flooded the market right through the age of the gramophone and its successor, the radiogram. Do you remember the one-time rage for "magnetised" needles? Such articles were said to be magnetised and, in virtue of their magnetic influence, they were credited with the power of picking up and retaining all particles of metallic matter which they found in the record grooves.

There was at one time a considerable vogue for "collar" needles, steel needles which had a ring or collar of metal forced down over their shafts. The object of the "collar" was to increase the vibrating mass of the needle and thus to create a greater tonal volume of reproduction.

Spearpoint needles were popular at one time. These were supposed to give gradations of tone from soft to loud merely by twisting the needle around in its holder. Originally, however, such needles were devised with the object of cutting down surface noise, it being supposed that the peculiar construction of the needle gave it a sort of springiness which prevented the



Left, a long-playing needle having a tungsten tip. Right, a collar needle, the object of the collar being to increase the vibrating mass of the needle and so create a greater volume of sound.

transmission of the surface-noise vibrations to the pick-up armature or sound-box diaphragm.

What were termed "self-sharpening" needles had a considerable following some years ago. These possessed spoon-shaped ends and as the needle point wore, the curvature of the "spoon" was considered to enable the needle to sharpen itself.

A most remarkable steel needle was the "star" or "multi-point" one. This comprised a little twelve-pointed metal star mounted on a steel shank, the points of the star being utilised to engage with the record. After the record had been played, the star was given a slight turn, whereupon the next of its points was presented to the record. Thus all the twelve points of the star were used up before the needle as a whole required to be changed. An ingenious idea.

Then there was a sort of bell-shaped needle, having a little cup or bell mounted over its point. What this particular needle was supposed to do I have never been able to ascertain. Most likely, however, the "bell" or "cup" of the needle increased its mass and thus enabled it to produce a greater sound.

The "weighted" needle was simply a steel needle provided with two or three "swellings" along its shank. Here, again, the idea was to make the needle heavier and to increase the resulting tonal volume.

Semi-permanent needles which are so deservedly popular among radiogram owners at the present day have a long history behind them. Such needles, of course, consist of a heavy shank in the extremity of which a piece of fine tungsten wire is held. Tungsten is an exceedingly hard metal. Consequently, it wears but slowly, thus rendering such needles capable of playing many records. On this semi-permanent principle, all sorts of hardened needle points have been tried. The metal tungsten, however, has held the day and, seemingly, it will do so for a long time to come, for it is both hard and tough and, in addition, it is not too costly.

# The Radio Bulletin

**Up-to-the-minute news concerning the radio industry.**

RADIOCHRON LTD. are introducing further models of the "Radiochron" combined radio and clock.

Most prominent of these is an improved form of the original model, which differs in that it covers a short-wave range of 16–31 metres and also the long-wave band, and makes use of an improved aerial system giving greater pick-up. Otherwise the model is unchanged and the price remains at 15 guineas.

There is also a special colonial model of this set in which the long-wave band is replaced by another short-wave band, the two S.W. bands covering a range of 13–50 metres. The price is 15 guineas.

Two other sets are being introduced which are new versions of the original "Radiochron." These also have an improved aerial system, resulting in the reception of 20 per cent. more stations than the original model. The prices are 10½ guineas and they cover the medium-wave band only. One set is in a modern type cabinet and the other fits in furnishing schemes of earlier design.

* * *

## "PADDED CELLS" FOR TEST WORK

Specially silenced rooms are used in the Philco factory in connection with test work on receivers. These rooms, or "padded cells" as they might be called, are very carefully constructed and insulated, so as to eliminate any possibility of sound reflection which might seriously interfere with the tests.

There are four rooms in all. In one all radiogram motors are tested for quietness of operation. In another finished sets are checked over from every angle to make sure there is nothing which will prevent satisfaction for the owner after the receiver is sold.

The remaining two rooms are employed for speaker tests and for investigating the acoustical properties and general performance of new designs.

* * *

## OSRAM CAR BULBS

Those readers who have cars which do not conform with the new Road Vehicles Lighting regulations will be interested to hear that the G.E.C. are able to supply special bulbs and fittings for adapting the older types of cars so as to meet these regulations.

For the headlamps two Lucas-Graves bulbs are needed together with a dimming switch. These bulbs have two filaments, the main filament providing a full driving beam and the auxiliary filament a flat-topped or deflected beam.

The wiring alterations are comparatively simple. Full details are given in a pamphlet recently issued by the General Electric Co., Ltd., and copies can be obtained from Magnet House, Kingsway, London, W.C.2.

* * *

## BRIMAR VALVES

A new catalogue of the well-known Brimar valves made by Standard Telephones and Cables, Ltd. has come to hand. In it is a wide selection of valves of types to suit various requirements. For the first time a range of the popular American UX and International Octal type valves are offered. These are identical in characteristics, dimensions and performance with existing American types and bear the same type numbers as their equivalents.

The catalogue contains nearly 60 pages of useful information concerning the firm's range.

## McCARTHY CHASSIS

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## ROYAL COMMAND PERFORMANCE TO BE BROADCAST

THE whole of the Royal Command Variety Performance—the first to be given in the presence of Their Majesties King George VI and Queen Elizabeth—will be broadcast in the National programme from the London Palladium on November 15th.

The broadcast will be the outstanding event of the year's Variety programmes, and has been made possible by arrangement with the Variety Artists' Benevolent Association, with whom negotiations have just been concluded. The performance will be "on the air" from 8.15 p.m. to 10.45 p.m. The News will be broadcast during the interval.

* * *

## FOR NORTHERN LISTENERS

The Northern Region evening programme on October 19th will be notable for the beginning of a short series of special features entitled "News of a Hundred Years Ago." It is hoped in this radio flash-back to convey a vivid impression of the march of events in the North of England during those vital months preceding the Coronation of Queen Victoria, when the face of England was being changed by new currents of thought and by amazing industrial developments.

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