RADIO BYGONES

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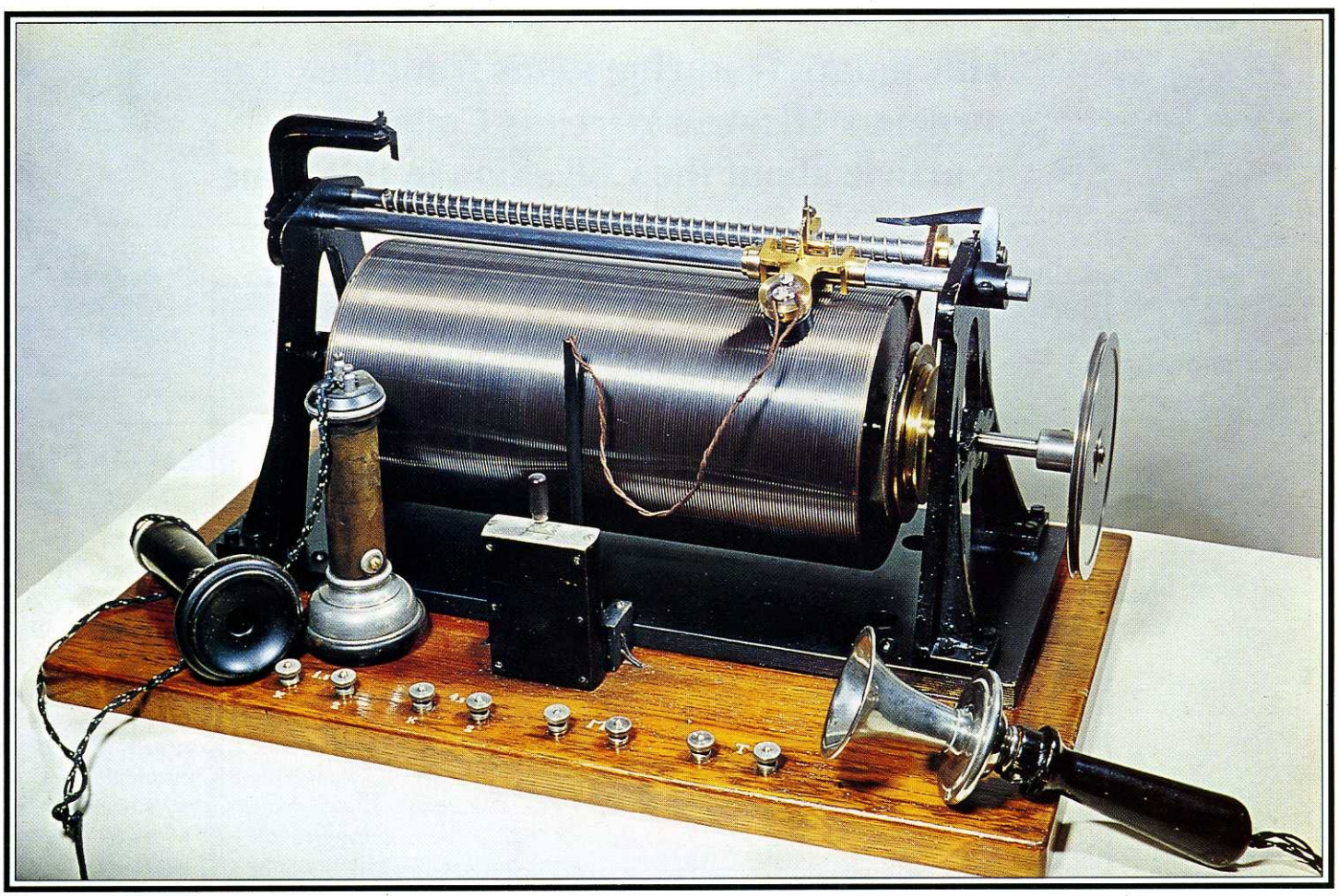
No. 2 – October/November 1989

A History of Magnetic Recording

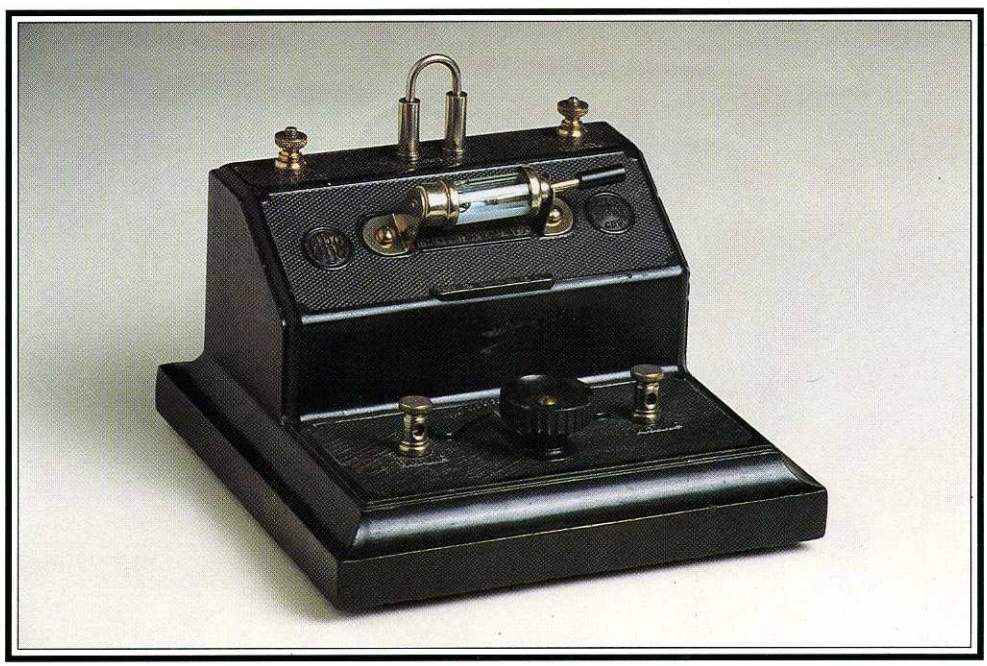


The Vintage Years of Amateur Radio – Part 1 □

First Ladies of Pirate Radio □ The Mighty HRO

MUSEUM PIECES

This month featuring items from the Journeaux Historic Wireless Collection. See the article about the Collection in this issue



Domestic crystal sets from the 1920s era. At the top of the page are the Type 0/1050 Miniature Crystal Set of 1923, made by the British Ericsson Company of Beeston, Notts (left), and the JAY-GEE Crystal or Valve Set of 1924 (right). Above is the Brownie Wireless Company's No. 2 Model Crystal Receiver of 1926

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WELCOME to the second issue of *Radio Bygones*. Some of you will already have heard that, following the publication of our first issue, Chas Miller decided that he wished to revert to producing *The Radiophile* as a separate publication. Hence the disappearance of the words 'Incorporating The Radiophile' from our title logo, and of the regular *Radiophile* features from this issue.

Chas has promised that he will still contribute articles to *Radio Bygones* from time to time, but the change does mean that the balance between domestic radio and the remainder of vintage radio will be different in the future, with much less space devoted to the domestic receiver side of things. Whether you view this as good news or bad news will obviously depend very much on where your particular interests lie, but I hope that you will continue to find each issue of *RB* interesting and informative.

In 'Feedback', our readers' letters page, you will find a summary of the most common comments about our first issue, together with our responses. Some of the things you complained of are easily put right, and we do so with pleasure. For others, there is no simple answer that will please everyone, or indeed the matter is totally out of our hands as in the case of postal rates to Eire. I hope that you will continue to let us know your views, so that we can do our best to shape the future development of *Radio Bygones* in the way that will please as many of you as possible.

You have somewhat less than two months to wait for the 'Christmas' issue of *Radio Bygones*, which is coming out on December 12 in the hope of escaping the postal rush.

Thinking of the festive season, if you have friends who are interested in vintage radio but aren't already readers of *RB*, why not give them a Christmas present of a year's subscription. We'll start them off with a copy of our Christmas issue, together with a card bearing simple seasonal greetings and your name and address. You'll find further details on page 23 of this issue.

Geoff Arnold

In This Issue

News & Events

Can You Help?

One of our readers is involved in efforts to mount an authentic display within Dover Castle, of photographs or other items regarding the use of radio in or around Dover during World War II. Anyone having such material please contact:

Mr J. V. Glass, Hill View, 70 Canterbury Road, Lydden, Dover, Kent CT15 7ES.

Acknowledgments

Our apologies to *Electronics World + Wireless World* for failing to acknowledge *Wireless World* as the source of the circuit diagrams of the two Premier Radio kit receivers published on pages 8 and 9 of Issue No. 1 of *Radio Bygones*.

Vintage TV

Recently through the letter-box came Issue 3 (September) of *405 Alive*, the newsletter of the 405 Line Group, packed with interesting articles on topics such as BBC Test Card music, cleaning and restoration techniques, vintage DX-TV, and much more.

For a year's subscription to *405 Alive* (4 issues), send £5.00 plus four A4-sized stamped addressed envelopes (with 28p stamps) to:

A. N. Emmerson, 71 Falcutt Way, Northampton NN2 8PH.

QSO?

Though it is not a matter connected with vintage radio in any way, we have been asked by Dyfed-Powys Police to publish the following appeal for help.

On 5 July 1989, the bodies of Peter and Gwenda Dixon were discovered having been brutally murdered on the Pembrokeshire Coastal Path. Peter was a keen radio amateur, callsign G0HFQ, and sometime CB enthusiast.

The Police are anxious to talk to any person who had contact with, or heard, Peter Dixon whilst he was operating in Pembrokeshire as GW0HFQ/M, on 2 metres FM, 20m or 40m SSB, or 10m FM/SSB, between 19 and 29 June, 1989.

It is believed that Peter Dixon had a contact with another mobile station operating in the area on 10m FM on the morning of Wednesday, June 28

At about 2pm on Sunday 25 June 1989, two men in a boat fishing on the Hellwick Bank off Worms Head on the Gower Coast overheard a conversation on the boat's CB radio. The set was tuned to Channel 33 and a man was transmitting, who, from the personal details he gave over the radio could well have been Mr Peter Dixon. This person speaking on Channel 33 said he was middle aged, from the Oxford area and had been holidaying in Pembrokeshire for the last 16 years or so. These details and the fact that he was using a complicated callsign such as a radio amateur would use indicated he was an experienced amateur radio enthusiast like Mr Dixon, as opposed to being a CB radio user.

The conversation he was conducting was with a second unknown man believed to have been called Tom and who was also in a fishing boat but off the Pembrokeshire coast. This second man had a broad Pembrokeshire accent and during the conversation agreed to meet the man believed to be Mr Dixon somewhere at a later date. It is not known whether or not this meeting did actually take place, as the second man appeared slightly uninterested in any future rendezvous.

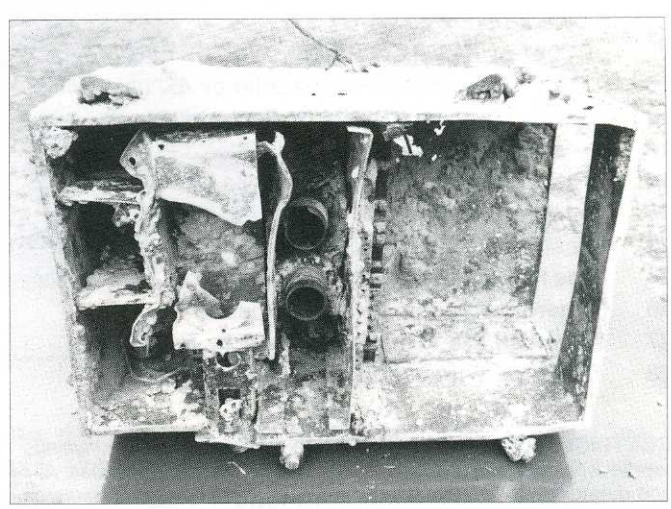
The Police are very interested in speaking to the second man, as he may be able to furnish them with further information as to the movements of Mr and Mrs Dixon in the days immediately prior to their murders on 29 June 1989. They ask therefore that he contact them as soon as possible at Haverfordwest Police Station, telephone 0437 763355.

Anyone else having any information should contact the Murder Incident Room at Haverfordwest Police Station, telephone number as above, or their local Police Station.

Rescued from the Deep

Covered in barnacles and seaweed and barely recognisable as a radio, this wartime gear was recently found in the Solent by a scuba diver, and is now reposing in the Wireless Museum at Arreton Manor, Newport, Isle of Wight. It has been identified as a TR9 transmitter-receiver, used by the RAF in the early years of WWII, and powered by a 2 volt accumulator and a 120 volt HT battery – definitely QRP!

The TR9 covered the band 4.3 – 6.6MHz, with a claimed minimum range of 35 miles air to ground and 5 miles air to air. In conjunction with its microphone amplifier A.1134, it also provided intercom facilities for the crew. A cry from the heart in the official servicing instructions for the TR9 reads: 'Ask the crew to refrain from swinging helmets and plugs idly about, whilst walking about the aerodrome, etc.'



QTI – The Tape Magazine for Blind Radio Amateurs

QTI, a title which stands for 'Quotations of Technical Interest', is produced by QTI Talking Newspaper Association, a voluntary organisation which is dedicated to helping visually handicapped radio amateurs and shortwave listeners to enjoy radio and electronics magazines.

Each issue of *QTI* tape magazine is a compilation of technical articles selected from current radio magazines (including *Radio Bygones*) and recorded on tape by a team of readers from all parts of the United Kingdom. The magazine comprises two C90 cassettes and is sent out to more than a hundred members about every three weeks. Most of them are in the UK; there are some in Europe: Norway, West Germany, Southern Ireland; and in India, Canada and California. Also a copy of each issue is sent to Australia, where it is copied and distributed to listeners in Australasia.

The service is available to all handicapped radio amateurs and shortwave listeners for a voluntary subscription of just £3.50. Under the Post Office arrangements for the Blind, postage is free. In other cases postage has to be paid.

An enterprise of this kind is always in need of funds to cover maintenance, replacements and the purchase of up-to-date recorders and fast-copiers in order to provide a first class service. Material and financial support has been given by the electronics industry, amateur radio dealers and the radio press. However, donations, large or small, are gratefully accepted. A covenanted donation is worth one third as much again, because QTI-TNA, as a registered charity, can reclaim the income tax which has already been paid on the amount of the donation. There is also a 'Sponsor a Member' scheme which is designed to help those members who are on small incomes by paying their subscriptions. Volunteer helpers are also needed.

If you are able to help this very worthwhile enterprise in any way, please get in touch with:
Harry Longley, QTI Talking Newspaper Association,
7 Anderson Close, Lancaster LA1 3JE, telephone 0524 33207.

An Orkney Wireless Museum

On 13 April 1987, James MacDonald GM8BFG joined the list of Silent Keys, leaving to the Wireless and Antique fraternity a museum of a rare kind, which he had built up over many years of devoted enthusiasm.

About 350 items reflect not only the development of wireless from the crystal set through the war years up to the dawn of the transistor era, but the local history of a community apart from the main stream as radio amateurs and vintage wireless collectors know it. In a well written 44-page book describing the collection, there is also a history of the men who built wireless sets for the Orkney Islanders in the early days when most sets were home-made, and of the special role of the Island in war-time as a Naval and RAF base.

Of special interest is the 'Wartime Comms at Scapa Flow' section which includes as centre-piece a Signals switching unit from the Fighter Sector Ops. Room. The VHF T1131/R1132 and HF T1087, R1155 of the RAF, 18 and 19 Army sets, with the 17 set used in the thirty-odd anti-aircraft and coast defence sites in the area, the naval B28, all with their ancillary items, plus a GPO section which includes radio link gear, some hand-made from Eddystone components, make a comprehensive picture of the war-time role of radio, made more interesting by log-books and documents.

An American DF set and a Type B 3 MkII (B2) suitcase set add interest, while the civil section includes many of the sets made locally as well as commercial sets and components.

Some amateur radio history includes that of GM3CCK, Jack Twatt, who with his brother James built many sets including the first TV set, a Baird design, receiving a picture on the medium waves in 1931. Others of the dozen radio amateurs in the area, and craftsmen enthusiasts including a tin-smith and a watch-maker, have made contributions to building and maintaining not only domestic wireless, but hospital and hotel and public-address systems.

The Museum is being continued in its tradition by James' son, Peter, who is a printer by trade. He now copes with correspondence, books and 'woodworming' as well as cataloguing the collection, while Grandma, at 80, continues the care, cleaning and dusting, as well as reception of visitors which has been her role for many years.

Any visitor to the Orkneys should set aside a day for the enjoyment of this little treasure house in Church Road, in the southern island, St Margaret's Hope.

John I. Brown G3EUR

Swapmeet

The 8th 'Aerial' Christmas Vintage Wireless Stall Sale and Swapmeet is to be held at Clarence House near Bristol on Sunday, 3 December 1989. All interested in 'vintage wireless' are most welcome.

A special feature will be a working display of vintage television sets and of course, the usual Christmas fayre and refreshments!

Entrance is strictly by advance ticket – booking forms are available (SAE please) from:
Mrs D. Roe,
7 Ashdown Road, Portishead,
Bristol BS20 8DP.

If you offer a service or are staging an event of interest to vintage radio enthusiasts, send full details to Radio Bygones, 8A Corfe View Road, Corfe Mullen, Wimborne, Dorset BH21 3LZ, and we'll give it a mention.

Items for inclusion in our Christmas issue, due out on 12 December 1989, must reach us by November 23.

The Vintage Years of Amateur Wireless

Part 1

by Stan Crabtree

Before the turn of the Century, the intricacies of wireless telegraphy were confined to the meetings and lectures given by and for scientists and academics. Mention in the press was brief and generally sensational in the reporting of Marconi's achievements. Professional journals such as *The Electrician* carried technical articles but these were clouded with formulae and not for the layman. There was therefore no reason for the man in the street to think he too could take part in this new means of communication.

Possibly the first publication on wireless telegraphy, in terms the ordinary man could understand, was an article in the very first edition of *The Model Engineer and Amateur Electrician* which appeared in January 1898. Under the editorship of Percival Marshall AIMechE it was published from 6 Farringdon Street EC initially on a monthly basis at 3/- (15p) per annum, post free. Aimed at craftsmen in the mechanical and electrical trades and also middle-class professionals with time on their hands it was to provide a means of promoting experiments and the exchange of knowledge for many years ahead.

The inaugural edition carried an article by Leslie Miller AIEE under the title 'The New Wireless Telegraphy – Some Interesting Experiments for Amateurs'. In it the principles were concisely explained as well as a history of Hertzian waves. A general outline of the apparatus in use was given together with suggestions as to how they could be constructed. The induction coil was of course already in general use but the article described how this item could be connected up to other components to produce damped, wireless waves. The coherer, used as the receiving element, required fresh thought but was considered within the scope of the model makers and technicians to whom the journal was directed. The writer mentioned that with a 6 inch induction coil as a transmitter he was able 'to ring a cheap electric bell three floors away in the same building'. This needed the use of a sensitive relay in series with the coherer to actuate the bell circuit.

The writer felt there was little need to worry about violating patents. He mentioned that some of the items had been used by Lodge and Popov and since the nineteen claims of Marconi's patent were submitted, proof had subsequently come to light that every one of his ideas had been previously anticipated in some part of the world. This was not written in a spiteful vein as the article also acknowledged Marconi's 'good work for which he deserves to benefit'.

Another journal soon to devote space to cover the exploits of amateur wireless was the *English Mechanic and World of Science*; a weekly paper again obtained by private subscription for 11/- (55p) per year. This had a different approach to the *Model Engineer* where the editor generally responded to readers' queries himself. In the *EM & WS* a correspondent's query was printed under a number, and any person who felt he had the knowledge to expound on this query was given space to reply in a later issue. As the queries increased, certain experts appeared on specific subjects and eventually it became usual for writers to address their questions to these personalities.

An early example of this was the sought-after knowledge of Mr S. R. Bottone. Virtually all questions on wireless telegraphy were directed to him and a reply would follow in subsequent editions. Bottone had the knack of describing technical matters in a clear and simple way. His book *Wireless Telegraphy and Hertzian Waves* published at 3/- (15p) was soon to become one of the most useful aids to amateurs, keen to grasp the practical aspects of wireless.

Basic Tuning

In December 1898, Mr Bottone gave explicit instructions in one reply that must have put many aspiring amateurs on the right path. He inadvertently explained basic tuning by advising a constructor to try different lengths of wire attached to the coherer pick up. This is remarkable when it is realised that at this time Marconi had not yet achieved his twelve mile contact between the South Foreland lighthouse and the East Goodwin lightship.

Writing to the *Model Engineer* in June 1899 'BSM' of Oxford wanted to fix up a W/T system between the upper rooms of two houses, 100 yards apart. He also wanted to know whether the brass balls of the spark gap should be hollow or solid.

The editor replied that a sensitive relay of 250 ohms together with a bell or Morse printing inker would be needed. Two copper wires would be required, one to earth through the gas or water pipes and another 'about 6 feet long and pointing to the sky like a miniature lightning conductor'. He ended by saying trial alone could determine the distance but suggested a half-inch gap between the balls to start. He offered a rough sketch.

The editor appeared to be getting rather tired of random letters, many of them asking the same questions. In a reply to 'RH' of Jarrow he referred him to *Wireless Telegraphy* by Richard Kerr available from the *Model Engineer* book department at 1/2d (6p) post free. Of the few 'layman' publications on the subject available at the time, this book became perhaps the most widely read

'WAC' of Bath asked in the October edition: 'How could I send a message to a particular receiver if there were more than one within the distance?' He also asked for details of coils and whether intervening buildings would hinder the message.

The editor ignored the first part. This is understandable as at this time, Marconi himself had only just mastered such a system by the use of RF transformers or 'jiggers' as they became known. Answering the rest of the question, the editor stated the size of spark and number of Leclanché cells depended upon the distance required. For a distance of 100 yards it was suggested a two-inch spark coil would be suitable but the gap should be no bigger than a quarter of an inch. To increase the range the length of the sky wire should be extended. Finally, the editor replied no, the buildings in the path of the wave would not affect the signal.

The gentry were also apparently represented in the growing number of wireless experimenters. 'AP' of Sedbergh, Yorks reported that he had a W/T system working across the billiard room using a coil giving a quarter-inch spark. Presumably to summon the gardeners he now wanted to know how he could extend his range to take in the greenhouse some 220 yards distant. It is apparent that at this stage the aim of a communication link was simply to provide a signal that would actuate a bell or buzzer circuit. However, people were more aware of the Morse code than they are today and enthusiasts realised they would need to learn this means of communication if they were to get more from their hobby.

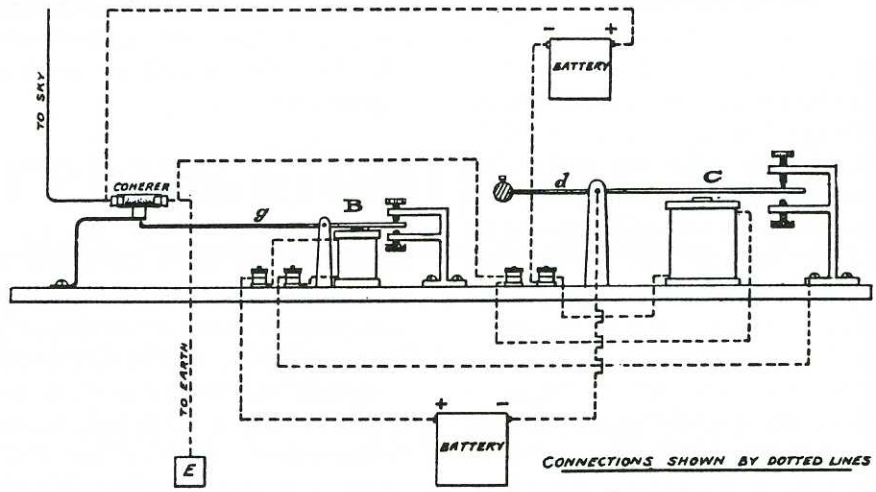


FIG. 1.—GENERAL ARRANGEMENT OF RECEIVING APPARATUS.

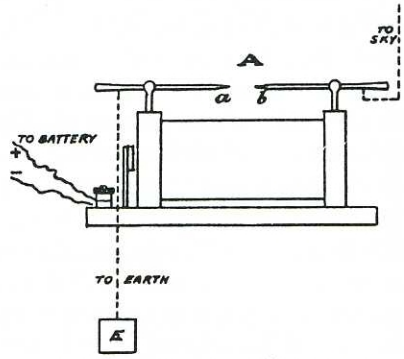


FIG. 2.—TRANSMITTING APPARATUS.

Diagrams of the transmitting and receiving equipment given in the Model Engineer *article 'Wireless Telegraphy for Amateurs' appearing in March 1900.*

In Figure 1, 'B' is the decoherer and 'C' the relay. Wireless waves picked up by the sky wire set up a small current which made the filings 'cohere'. This provided a conduction path and allowed a separate current from the battery to flow through the coil of the magnet 'C'. The bar 'd' was drawn down until it reached the screw setting. This allowed a current to flow through the magnet of 'B' which pulled rod 'g' up to tap the coherer tube. This ensured the filings were separated (non-conducting) again. When the next spark occurred at the distant transmitter the same series of events took place again.

In Figure 2, 'A' is the induction coil and 'a' and 'b' form a gap for the spark to cross. Signalling was achieved by interrupting the current supply from the battery

Towards DX

In December 1899, 'WGD' of Birmingham really had aspirations. He wanted to know the coil size for a range of five miles in order to establish communication between two houses, visible to each other on opposite slopes of a valley. What height poles would he need? He also mentioned that he had 'tuned up' both systems within the space of one room – would this hold good for the longer distance?

In his reply the editor thought a two-inch spark coil would be suitable and suggested a sky rod of 50 feet. 'WGD' would also need a delicate relay wound with 2 oz of No 36 silk-covered copper wire.

His answer to the tuning query was correct but for the wrong reason. He said. 'No, because as the distance increases so the wave decreases in intensity as it spreads itself over a larger space'. However, it must have sounded feasible in 1899.

The majority of experimentalists at this time were engineers and craftsmen who until now had spent their time building model steam engines and boats or constructing clocks. It is interesting to note how their techniques were carried over to their wireless experiments. For instance, one article on building a coherer emphasises the need for a solid wood, varnished base and probably by force of habit goes on to say: 'To make the varnish, dissolve a quarter of a pound of good shellac in 8 oz of methylated spirits...'

In the March, 1900 edition of *Model Engineer* the editor appears to have consolidated his (and his readers') knowledge of the time in an informative article entitled: 'Wireless Telegraphy for the Amateur'. He concisely covered the main areas with useful sketches of the main apparatus and in particular spent some time on the construction of a realistic coherer; always the most temperamental of components at this time. He ended with a paragraph recommending restraint and an observation that, taken loosely, must have applied to all of us over the years: 'Readers should not try to work over long distances with small coils as the result is nearly always a failure. This is not only very disheartening but means the loss of a lot of valuable time'.

To the British public, the year 1900 was taken up with news of the Boer War which had broken out in the previous November. Marconi had finally obtained his long sought after contract with the

British Admiralty and was busy fitting out warships with his equipment. The *Kaiser Wilhelm der Grosse*, the first liner to be fitted with wireless, sailed in February from Bremen to New York. On the home front, two stations had been set up for the London Metropolitan Fire Brigade at Mitcham Lane and the top of Streatham Hill. Marconi was gratified to have the patent on his method of tuning accepted in April (Patent No 7777).

As the interest in experimenting grew, advertisements for components appeared in both the *English Mechanic* and *Model Engineer*. In November, 1898, H .W. Cox of 10-11 Cursitor Street EC offered W/T and X-ray apparatus. This company were also named in the first group to be issued with an experimental licence in 1904. They were allowed a radiating range of 50 miles from their then premises in Roseberry Avenue EC. The earlier mentioned Mr Bottone had now started manufacturing apparatus as S. Bottone and Sons at Wallington, Surrey. In September, 1900 he offered coherers at 5/-, relays 3/-, bells at 2/6d and 'multiplex' coherers at 1 guinea. Apart from the Marconi Company, this firm must also have been the first producers of a complete wireless system of transmitter and receiver which was available at 3 guineas. Bottone offered free advice to customers; non purchasers were charged 2/6d. Lists of apparatus available cost a penny-halfpenny.

In January 1901 'FCL' (Lowestoft) writing in the *Model Engineer* asked for an explanation of how a coherer worked and whether he should make or buy one. He also wanted to know how to finish off a sky wire.

In his reply the editor said that the choice to make or buy really depended upon one's personal ability and knowledge of the subject. He suggested the top of the sky wire should end in a roll of galvanized wire netting of 9 inches diameter and 3 feet wide. (It is not made clear whether the wire should be unrolled or not).

Dr J. A. Fleming (later Sir Ambrose) announced during a lecture to the Liverpool Chamber of Commerce in February 1901 that Marconi had achieved a communication range of 200 miles between his station at Poldhu (near Land's End) and St Catherine's Point on the Isle of Wight. Signals were exchanged in both directions and it had been possible to send and receive two messages at once. This was given wide press coverage and undoubtedly rekindled the interest of amateur experimenters.

Take 1 lb of DCC...

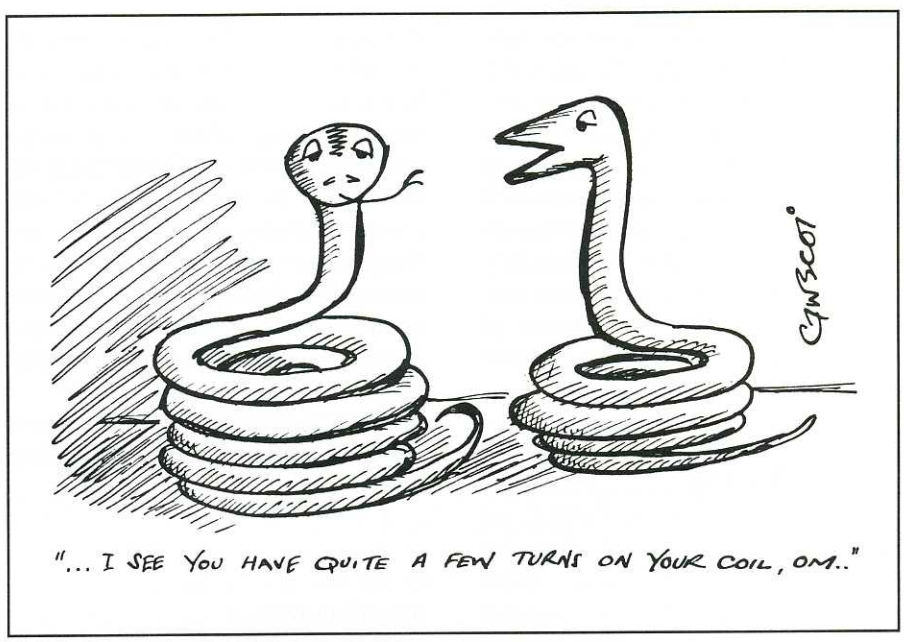
For some reason, at this time, inductance was never mentioned in constructional articles. The value of a coil's properties were given by the weight and size of the wire used. Mr A. Gandolfi, of Genoa, highlighted a problem due to this method. Writing in the correspondence columns of the *Model Engineer*, he found 1 lb of No 14 double covered cotton wire too little for his coil, and even 1-1/2 lb of No 14 insufficient to wind 3 layers on a 7/8in core for a length of 7 inches. The editor answered that it was always better to buy more than was needed as one careful worker (winder of coils) may be inclined to wind on more wire than another.

In October 1901, the *English Mechanic & Science World* reproduced a long, authoritative article from the US *Scientific American* magazine entitled: 'How to construct an efficient wireless telegraphy system at a small cost'. This really spelt out just what was possible at this time and must surely have attracted much interest in the magazine's readers.

A news item was carried in the December 1901 edition of the *Model Engineer* regarding the attainment of E Ruhmen, in Germany. This gentleman had apparently discovered that an ordinary telephone receiver could be used to receive wireless waves, a coherer not being necessary. He had achieved a distance of 2km (1.25 miles) using an aerial 25 metres (82 feet) high. The earpiece had initially responded to the leading edge of the class 'B' (spark) wave but by adding capacity, Morse characters had been clearly defined. It is interesting to ponder whether Guglielmo Marconi knew of this breakthrough before he departed for Newfoundland for the memorable transatlantic test. For he, together with George Kemp, used a single telephone earpiece connected across the coherer of their apparatus at Signal Hill to recognise the Morse character 'S', picked up by the kite aerial.

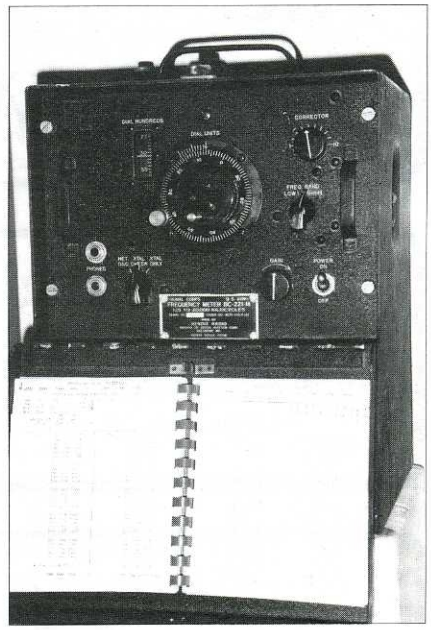
News of Marconi's remarkable achievement gave birth to a fresh wave of enthusiasm for amateur wireless, and also some queries as to the theory of the operation. 'Treadle' of Tunbridge Wells (where else!) used the columns of the *Model Engineer* to ask a very pertinent question. Since there was a 'hump' or mountain of the earth's convexity about 125 miles high and 2000 miles in depth could someone tell him whether the electric magnetic waves went 'over' it or 'through' it? In any case, why were high poles or kites necessary to hold up an aerial? Even a pole 500ft high would not do much towards making wireless waves alight over a mass 125 miles high. I leave you with that searching question until the next part of this record of the early years of wireless.

RB



BC221

by Richard Q Marris G2BZQ



BC221 – what is that? The date of a war in ancient Greece? – could be! However, some readers will recognise BC221 as the type number of a really excellent crystal calibrator/heterodyne frequency meter, for use with transmitting and receiving equipment.

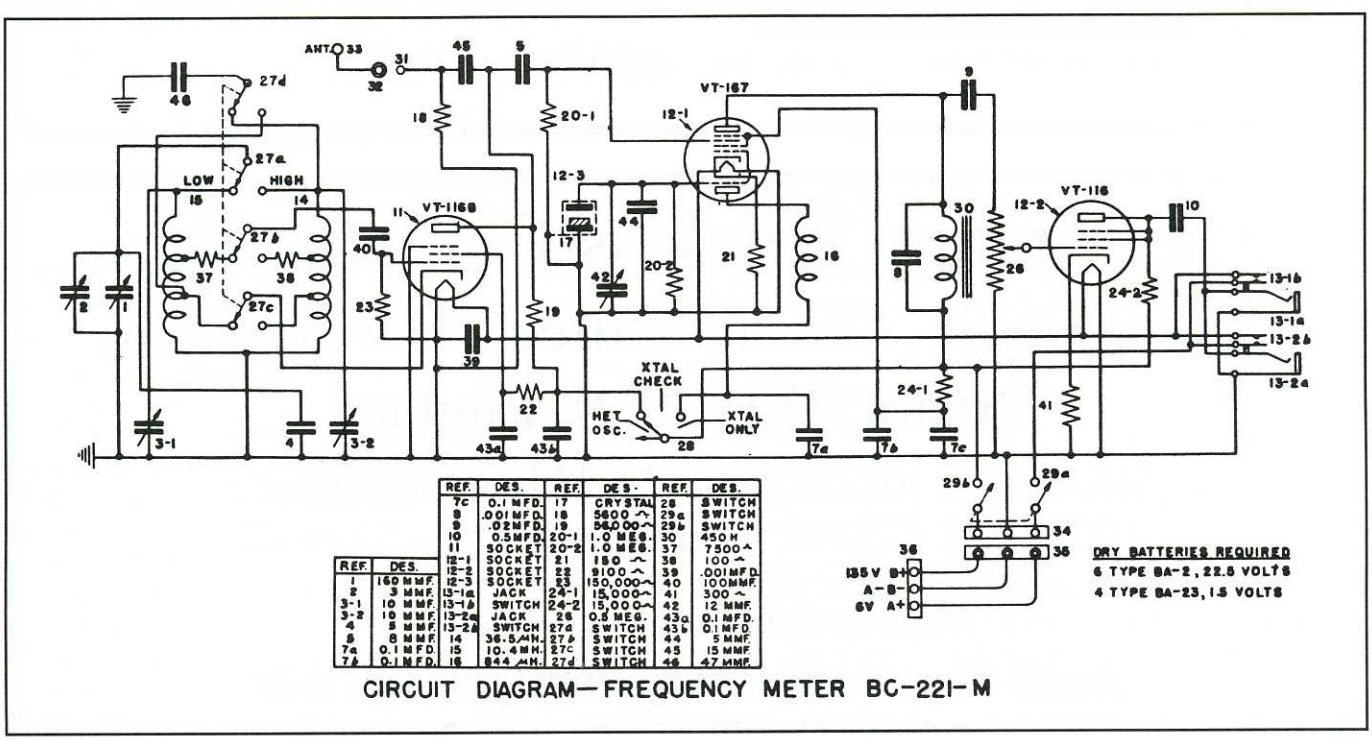
The BC221 was produced during World War II by the Bendix Corporation (and possibly others) for the US Signal Corps. It is still being used, and still being released onto the surplus market from time to time. In readers' advertisement columns you will find them advertised at anything between £15 and £100. A good BC221 is a gem. A fair price, in good condition, is maybe £25, in view of the fact that it appears to be in plentiful supply, probably because many do not realise what it is. Such an instrument is necessary in any amateur station, and is advisable for listeners. Even now, the BC221 takes a lot of beating.

Vast quantities of the BC221 were used by all the US armed services during WWII, and many found their way to the UK for use by our armed services. Way back, I remember using them in Catalina PBY flying boats and elsewhere. These were all painted in a black crackle finish. I also recollect, with some amazement at the time, seeing an American GI carrying a BC221, painted a sort of khaki/green colour, with a shoulder strap. He was following another GI with a large back-pack transmitter/receiver, followed by yet another chap carrying ancillary items. In addition they had tin hats, rifles, water bottles and grenades, etc. The local natives were hostile at the time.

An excellent BC221M, serial number 4414, is still in use in my shack. Its actual date of manufacture is not known, but there is an indelible notation which says: 'Last moisture and fungus proofed in September 1944', now over 45 years ago. There is also a label saying that the calibration was checked by G & E Bradley Ltd in August 1963, just a few years before I bought it. It has been in use in my workshop for over 20 years absolutely trouble free, and it still works like a dream.

The circuit shows a variable frequency oscillator, a crystal reference/mixer, and an audio amplifier feeding two pairs of headphones. It is an all valve affair. There is an aerial terminal (ANT) on top of the case, to which a wire or rod can be attached. In its steel case, the BC221 measures 13in high, 10in wide and 9.5in deep, with a carrying handle at the top. With its complement of batteries it must have weighed in at around 30lb.

There is a 'front door' which lets down to reveal the controls including an excellent vernier dial and comprehensive calibration book with charts. Below this is a plate, held by six screws, enclosing a spares compartment. After using many BC221s under active service conditions, it can be categorically stated that the



REF.	DES.
1	160 MMF.
2	3 MMF.
3-1	10 MMF.
3-2	10 MMF.
4	5 MMF.
5	8 MMF.
7a	0.1 MFD.
7b	0.1 MFD.

REF.	DES.
7c	0.1 MFD.
8	.001 MFD.
9	.02 MFD.
10	0.5 MFD.
11	SOCKET
12-1	SOCKET
12-2	SOCKET
12-3	SOCKET
13-1a	JACK
13-1b	SWITCH
13-2a	JACK
13-2b	SWITCH
14	36.5 MH.
15	10.4 MH.
16	844 MH.

REF.	DES.
17	CRYSTAL
18	5600 ~
19	56,000 ~
20-1	1.0 MEG.
20-2	1.0 MEG.
21	150 ~
22	9100 ~
23	150,000 ~
24-1	15,000 ~
24-2	15,000 ~
26	0.5 MEG.
27a	SWITCH
27b	SWITCH
27c	SWITCH
27d	SWITCH

REF.	DES.
28	SWITCH
29a	SWITCH
29b	SWITCH
30	450 H
37	7500 ~
38	100 ~
39	.001 MFD.
40	100 MMF.
41	300 ~
42	12 MMF.
43a	0.1 MFD.
43b	0.1 MFD.
44	5 MMF.
45	15 MMF.
46	47 MMF.

CIRCUIT DIAGRAM— FREQUENCY METER BC-221-M

spares compartment never contained any spares! Presumably it should have held a spare set of valves and crystal. However, the compartment did have its uses, such as hiding away a small flask containing Navy issue rum, or some brandy.

Now that the batteries used are no longer available, it is more convenient to make a simple inbuilt AC mains power unit to fit the battery compartment, using readily available components from advertisers, the surplus market or the junk box. Access to the battery compartment is via a 'let down' flap at the bottom rear of the instrument. A copy of the circuit is rivetted to the flap. On the PBY, B17 and B24 , the BC221 was usually run off the aircraft power circuits. Battery packs were used 'in the field'.

The LM Series of Heterodyne Wavemeters

Very similar in circuit details and performance to the BC221, the LM Series of wavemeters was designed for the United States Navy. They have the advantage over the BC221 of being smaller and having internal modulation, so that they may be used as a signal generator as well as a wavemeter.

The LM7, pictured here, covers 195kHz to 20MHz in two bands, and can operate from 12 or 24 volt LT supplies and HT from 180 to 400 volts by adjusting internal links. The LM7 features a gold-plated main tuning capacitor!

The LM10 is similar but has its LF coverage extended down to 125kHz.

Rod Burman

Uses

The BC221 is a versatile instrument which can be used for several different purposes:

(a) To tune a CW receiver to a desired spot frequency, or check the frequency of an incoming signal on that receiver. It will also provide an unmodulated carrier on a particular desired frequency on other receivers.

(b) To tune a transmitter to a desired spot frequency, or to check the frequency of that transmitter.

(c) To provide a captive signal of known frequency when experimenting with receivers and loop or other antennas.

Full operating instructions appear in the calibration book.

Frequency Coverage

The BC221 covers 125 to 2000kc/s and 2 to 20Mc/s in two bands labelled LOW and HIGH. In practice, it will provide harmonics which can be used (with care!) to check calibrations up to the 28MHz (10m) band.

The BC221 calibration book of charts contains 73 pages, 69 of which each contain about 50 calibration points. Each page has a 'Crystal check point' whereby the CORRECTOR control can be adjusted to obtain zero beat with the function switch set to XTAL CHECK. The other switch positions are XTAL ONLY and HET OSC.

The heterodyne oscillator has an excellent vernier dial with the following features: Slow moving dials to read HUNDREDS; Fast moving dial to read TENS and UNITS; Vernier to read TENTHS.

As an example, let's look at the page covering 14 000 – 14 200kc/s in the calibration book of my instrument. The XTAL check point is stated as 1316.8° on the dial, to accurately calibrate the heterodyne oscillator with 52 separate dial readings from 3416.8° (14 000kc/s) to 3519.3° (14 200kc/s). The next page covers from 14 200 – 14 400kc/s, still using check point 3416.8°.

In practice, I have checked the BC221 with crystal controlled transmitters using close tolerance crystals on most HF bands; a 100kHz crystal calibrator; and on standard frequency transmissions such as WWV on HF and the BBC 200kHz (now 198kHz) long wave transmitter. In all cases it has been found to be remarkably accurate over the whole frequency range.

Power Supplies

As the batteries used in the BC221 are no longer available, it is suggested that a small power unit be made up, onto a shallow chassis, to fit into the battery compartment. The target voltages are HT (B+) 135V (maximum 150V) at say 40mA, and preferably stabilised. For the valve heater supply (A+) use 6.3V AC at 3A. Circuits are available in many textbooks.

As an alternative, a complete external AC power supply unit might be purchased. At the time of writing, A H Supplies of Sheffield are offering an ex-MOD type SPU-150 stabilised power unit giving 150V (adjustable) plus 6.3V AC at 3A, for £15.50. This has not been seen but sounds ideal, though possibly a little bulky.

Old hands will need no reminding of the fact, but for those who have practical experience only with low voltage transistor circuits it is important to remember that an electric shock from an HT or mains voltage line is at best unpleasant, and at worst FATAL.

Buyers' Guide

If you propose to purchase a BC221 it is essential to look at it carefully before parting with your money. Make absolutely that the serial number on the calibration book is identical to that on the instrument. Each BC221 was individually calibrated. Also, have a look inside and make certain that it is 'clean', unmodified and in good condition.

The BC221 is rather large, it is rather heavy, it is rather old, and it is very good! It was designed to operate in wartime conditions, complete with enemy action, from the Arctic to the tropics, and always seemed to be a survivor.

It has been around for maybe 50 years or so, and there seems to be no reason why it should not be around for another 50. It is built like a battleship – it was used in battleships! ***RB***

The First Ladies of Pirate Radio

by A. Lester-Rands

Do you remember those pre-war continental advertising radio stations, Radio Normandy, Radio Luxembourg and others, that transmitted sponsored programmes of popular music? The advertising 'jingles' to remind us whose programme it was, like *We are the Ovaltinies*, etc. – a nostalgic reminder can be heard on today's TV advertisement by the same maker. Or the cultured voice expounding the virtues of Mr A's Liver Salts, or Mr B's Pills. Radio Luxembourg still operates on 208 metres (1440kHz).

In the mid and late 1930s, none of the laws of this country concerned with 'advertising on the wireless' prevented the transmission of commercially sponsored programmes from these stations, or us, the British, from listening to them. Much to the annoyance of the 'BEEB'.

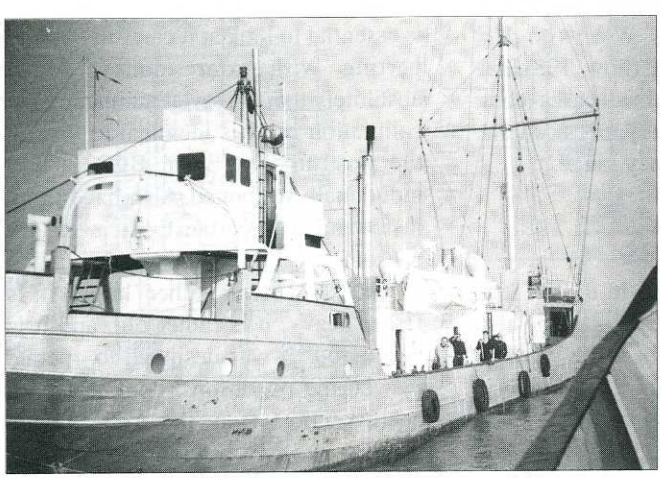
However, stations that operated on medium waves frequently suffered from fading at certain times. Advertising and programmes calculated to capture a pretty large audience were often lost in the upper regions of the atmosphere. But then came the war and the advertising stations closed down.

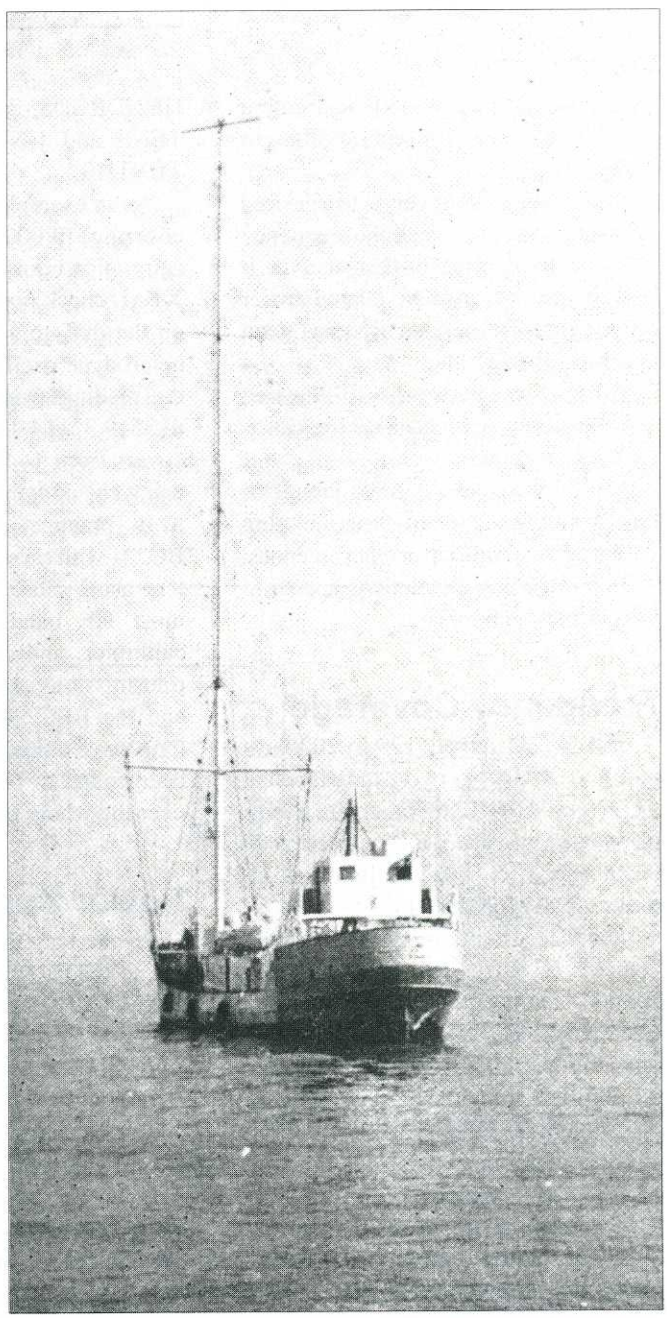
Post-war

Following World War II, someone came up with a proposal for pirate radio ships. This seemed like a good idea. Out at sea beyond the territorial limit of the country concerned and yet near enough to ensure good reception well inland and with a minimum of fading. There was nothing it seemed which could prevent the transmission of pop music, for which there was now a great demand by the younger generation, plus commercial product advertising which paid enough to cover the running costs and make a profit.

First of the Few

The first off-shore 'pop pirate' was Radio Syd, the entire station and its aerial being on a ship anchored off the Swedish coast. This was set up in 1958 and was soon followed by two





Two photographs of Mi Amigo *– Radio Caroline South – off the east coast of England in 1964. Above: The supply tender about to come alongside. Right: A more distant view, taken through the mist as we departed for home, which emphasises the height of the transmitting aerial*

more to provide a similar service for an even larger part of the population of Sweden. However, by 1962 they were closed down but there were others ready to climb on this money-making wireless bandwagon.

Next came an English/Dutch consortium which brought about the formation of 'CNBC' (Commercial Neutral Broadcasting). Activity began from a ship anchored off the east coast of England. Programmes were transmitted in both English and Dutch but the latter became so popular in Holland that the English service was dropped and the ship relaunched as Radio Veronica.

Radio Veronica still exists today, but is now a respectable and duly licensed broadcasting station in Holland itself; it is no longer 'off-shore'.

The Carolines

The Radio Carolines were perhaps the most popular. Caroline North was located in the Irish Sea and Caroline South was anchored in the North Sea about five miles east of Frinton. It was on the latter that I spent a whole day towards the end of 1964 and was invited to act as disc jockey for my own half-hour music programme, probably the only fully licensed radio amateur ever to operate from an off-shore pirate radio station! The registered name of the ship was *Mi Amigo*, and she was originally the vessel operated off Sweden as Radio Syd. It was purchased and set up by an Irish gentleman, one Ronan O'Rahilly.

The only way to get to Caroline South was by its supply tender vessel from Harwich, which also took the disc-jockeys and visitors back and forth. Incidentally, this involved going through full Customs formalities and having a passport, since Caroline South was officially classed as a 'foreign country'. A similar arrangement no doubt applied to Caroline North.

Well Equipped

Except when a North Sea force 8 gale was blowing, Caroline South (the *Mi Amigo*) was a comfortable ship. Technical facilities included a small control room and studio for the DJs, a large disc record library and magnetic tape equipment used mainly for playing the pre-recorded advertisements and jingles.

There were two 10 kilowatt transmitters, one in use and one for standby. The entire equipment, including ship's lighting and heating, etc., was run from one of two large generators.

The aerial was in effect a grounded vertical 140 feet high and tuned to resonance at the transmitter wavelength of 199 metres. Combined with an almost infinite 'ground' of sea water, this formed quite an efficient aerial system, and between them the two Caroline stations covered almost the whole of the UK.

The fact that the two Caroline stations alone had succeeded in capturing an audience of millions, proved the demand for non-stop music programmes as well as advertising. In other words, the need for 'commercial' radio, possibly on a 'local station' basis and with proper authorisation for operation on UK soil as we have today.

Other Pirates

Apart from the two Carolines, a station was set up on an old gun fort just off the end of the Thames estuary. Another Radio Caroline did make as appearance more recently and of course there have been a number of 'back room' stations operating in large towns, but their rise and fall may be a story for another time.

Acknowledgements

Thanks are due to Pat Hawker G3VA, formerly of the IBA Engineering Information Service, for additional information and details of the following books:

Paul Harris, *When Pirates Ruled the Waves* (Impulse Publications Ltd. 1968). Includes a summary of the technical facilities of the early ship stations.

Paul Harris, *Broadcasting From the High Seas – the history of offshore radio in Europe* (Paul Harris Publishing, Edinburgh 1977).

Bob Noakes, *Last of the Pirates – a saga of everyday life on board Radio Caroline* (Paul Harris Publishing, Edinburgh 1984).

Stuart Henry and Mike von Joel, *Pirate Radio Then and Now* (Blandford Press, Poole). **RB**

Gerald Marcuse (G)2NM

A Footnote to Broadcasting History?

by Pat Hawker

On page 371 of *The Golden Age of Wireless* (Volume II of Asa Briggs' history of broadcasting in the UK) there is a footnote on the beginnings of short-wave (HF) broadcasting. It reads:

'The first short-wave broadcasting service had begun in the United States in 1924, and Eindhoven in Holland, which began a regular three-day-a-week service in 1927, had started experimental broadcasts a year earlier. On 1 September 1927 Gerald Marcuse, the well-known English amateur, was allowed to transmit material for two hours a day on wavelengths of 23 and 33 metres.'

This footnote formally, if briefly, recognises that Gerry Marcuse, (G)2NM, in his home in Caterham, Surrey, begat the Empire Service. He beat the first BBC experiments by several weeks. Then, stirred by the welcome given to his efforts and by constant prodding from *Wireless World*, the BBC hurriedly arranged with the Marconi Company for a series of their own transmissions on 24 metres from the 10kW experimental station (G)5SW located at the Marconi factory in Chelmsford. They were apparently less than happy when the few listeners with short-wave sets reported that they were receiving better signals from the home-built 1.5kW transmitter with its Zepp aerial raised on 100ft poles at Gerry's home 700ft above sea level at Caterham. When, in 1929, the Postmaster General withdrew his authorisation for the 2NM broadcasts, the BBC experimental transmissions soon ceased for technical and financial reasons. The BBC's Empire Service did not begin formally until 1932.

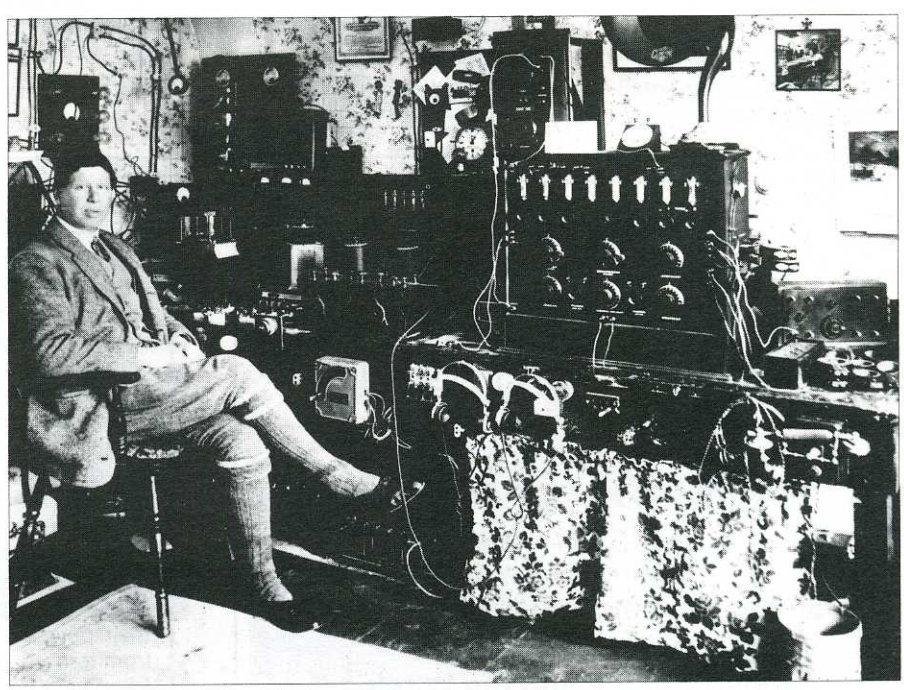
How did it come about that for more than a year, a private individual, at a cost to himself of over £6000 (a very large sum in the 1920s) was able to broadcast programmes that were so successful that they were frequently rebroadcast on medium waves to local audiences in Australia, New Zealand, India, Singapore and elsewhere?

First Interest

Marcuse had become interested in radio telegraphy by 1913 when, at the age of 26, he was living in Purley, Surrey after travelling the world as a young mechanical engineer. After war service he again took up his interest while at Bristol, using a spark transmitter on about 1000 metres and contacting other experimenters over distances up to about 20 miles. Soon he moved to Caterham where in the early 1920s he took part in early transatlantic tests but also transmitting on 1000 metres until this was withdrawn because of interference to Croydon Airport radio, moving down to around 440 metres until this was claimed for the exclusive use of the early British Broadcasting Company.

From 1923 onwards he became one of the leading British amateurs pioneering long-distance working on HF (initially about 90 metres, then 45, 30 and 23 metres). In that period, the short waves were written off by most professionals, including the Post Office which dismissed HF in favour of such giant stations as the one they were building at Rugby (GBR 16kHz). The experimental amateurs could virtually pick their own frequencies anywhere below 200 metres (above 1.5MHz) – it was not until the Washington Conference of 1927 that frequency bands and international prefixes were formally allotted to both amateur and professional services.

Gerry made the first-ever HF contacts from the UK with many countries, one of about half-a-dozen who successfully opened up the short waves. In 1925 he played a prominent role in relaying



Gerry Marcuse (G)2NM with his equipment at the time of the transatlantic tests of 1922/23. His 200 watt transmitter on about 180 metres was heard in North America on five of the ten nights

messages to the Royal Geographical Society from the Rice expedition in the Upper Amazon, the first land expedition to take with them a short-wave transmitter. He was also able to keep contact with the American Fred Schnell of the American Radio Relay League (ARRL, the national society for radio amateurs in the USA) on board the US cruiser *Seattle* during a historic six-months cruise in the Pacific Ocean that persuaded the US Navy that the future of long-distance communication from ships was to be found in relatively low-power HF equipment. This in turn led the British Admiralty to seek his assistance in tests with Stonecutters Radio, Hong Kong, which again showed that it was possible to communicate regularly with the Far East without enormous aerials and very long waves.

When his signals were picked up in Japan, the Post Office, anxious to establish a telegraphic service with that country, asked him for technical details of the power and wavelengths he was using. In their letter, a senior Post Office engineer wrote: 'If the limitations of your licence have been exceeded in the tests, steps will be taken, if possible, to amend the licence to regularise such tests.' His rapport with the Post Office was such that they were willing to authorise his proposal to broadcast regularly to Empire listeners.

Fan Mail

He had, in fact, already begun to do so in a tentative way. This began, according to Gerry, when an experimenter in Bermuda began to rebroadcast to local listeners some of his Sunday morning amateur transmissions. It led to some curious fan mail. One lady wrote: 'I am enchanted with your voice which I hear every Sunday morning. I have three lovely daughters and a flourishing business. If you would like to come over you can have the pick of the daughters and the business.' Gerry may have been tempted but he remained in London where the family import-export business, which dealt in a large range of commodities, was flourishing. Gerry never found it difficult to make enough money in the City to finance his interests in radio and later to give him international recognition in yachting circles. For his broadcasts, however, he was helped by industry. Captain Mullard had his generator, which gave him 4000 volts for the transmitter, rewound without charge when this blew up, and also supplied him with large power valves – the size of young footballs – free of charge. The Marconi Company let him have a high-quality Reisz microphone.

For listeners there was the thrill of hearing a voice from the 'Mother Country'. But his broadcast transmissions were programmes, not just amateur chat. With his friends he organised concerts and song recitals, inviting many well-known musicians and singers to his home 'Coombe Dingle' in Queens Park, Caterham and to that of a nearby friend, Percy Valentine, in whose home a 'studio' and control room were set up. He even had a Post Office distribution link between the two houses in the form of two telephone lines for which he paid £3 15s. (£3.75).

Valentine's uncle was a conductor of the Lloyds Insurance Orchestra and occasionally they had a full orchestra packed into the little studio. On one occasion he organised an 'All-Australian' concert with internationally known talent. There were 'outside broadcasts' – local church services and the song of thrushes and blackbirds in the garden. Officially, he was not supposed to rebroadcast BBC medium-wave broadcasts, but he often did so, and got away with it. The high-spot was his regular transmission of the mid-day striking of Big Ben – the first time these familiar sounds had ever been heard by listeners in the far-flung British Empire of the 1920s.

London artistes were brought to Caterham in Gerry's car. Gramophone records and relays of 2LO were used in the absence of their own 'live' broadcasts. On Armistice Day, 11 November 1927, the BBC attempted its first major HF broadcast when the Prince of Wales (later Edward VIII/Duke of Windsor) spoke over 5SW, but the same day 2NM scored a further success in relaying the Albert Hall Armistice Concert which was well received in Bombay.

As an amateur rather than a broadcaster, 2NM was responsible for the first chess match played over radio; a transatlantic match between Oxford University and Harvard.

Technically, 2NM was virtually 'state-of-the-art'. He had one of the first HF superhet receivers at a time when virtually all other British amateurs were using 'straight' two-valve or three-valve receivers. With his friend Cecil Goyder, who when 16 years old had made the first two-way contact with New Zealand using the Mill Hill School transmitter 2SZ in October 1924, he built one of the first high-powered, crystal-controlled transmitters. He ascribed much of his success in reaching so many Empire countries to his use of 32.5 metres, believing that this was superior for this purpose to the more erratic 23 metres of 5SW.

Disbelief

During his 1925 telephony tests with the USS *Seattle*, often about 6am, an early morning visitor, first knocking on the door and then throwing stones at his window, proved to be an American reporter. His paper had expressed disbelief that anyone in London could really talk directly to a ship in the Pacific: 'They don't believe the report and have asked me to verify it.' He had five written questions and Gerry invited him to put them to the ship. They replied correctly to all five. The reporter returned to London delighted.

About 1928, the Bermudan amateur whose relays had launched Gerry into HF broadcasting turned up in London where he soon became involved with a well-known singer. But she had a husband who threatened that if he did not go back to Bermuda he would shoot him. The amateur, together with his ladyfriend who was suffering from bronchitis (with her throat wrapped in cotton-wool) pleaded with Gerry to lend him the money for the fare back. He did so but never heard from him again.

Gerry continued his broadcasts for almost two years until in 1929 the Post Office told him to close down. They wanted his frequency for the BBC. It had cost him thousands of pounds out of his own pocket but he had proved his point that there **was** a demand for short-wave broadcasting from those who regarded Britain as their 'Mother Country'.

This was only one episode of his remarkable life. As a young man he spent some six years in Tsarist Russia installing British-made diesel engines; he traversed the camel routes of the Middle East; knew the Mexico of pre-World War I. He was honorary secretary of the Radio Transmitters Society of

continued on page 15

Yesterday's Circuits - No. 1

by Gordon J. King, IEng, G4VFV

INTRODUCTION

It is the plan in this ongoing series of articles for each issue to explore one of yesterday's circuits. It is hoped that the presentation will enable the motivated reader to try out any of the circuits for him or her self. The basic operation of each circuit will be explained, and a good many of the circuits will be those which I have designed or constructed from published material, and which I have actually used during a period of almost six decades of being a radio enthusiast both as a professional and as an amateur.

However, before looking at the first circuit just a few words by way of an introduction and to give you some sort of time scale. I seem to remember that I was first inspired at the very opening of the thirties, aided by my grandmother (a super lady) who helped me search through recently delivered coal in her under-pavement cellar for a small piece of coal with a silvery vein running through it. This, my grandmother explained to me, made a usable 'crystal' for a crystal set. Then, aided by books from the City Library, a springy wire to make light contact with the silvery piece of coal (cat's whisker), a big reel of double cotton-covered 26 swg copper wire and a pair of 2000Ω headphones, I built my very first crystal set. This yielded remarkable reception of the long-wave London transmitter some 50 miles distance from my Oxford home with a 100ft aerial mounted high in my grandmother's garden!

As time unfolded my crystal sets became more sophisticated. I distinctly recall trying two or more crystal detectors, tapped coils, tuning capacitors (condensers as they were then termed), and at one time I think I even 'invented' the point-contact transistor but was totally unaware of this. It was when I was experimenting with two cat's whiskers 'tickling' a single crystal and when a grid-bias battery was connected to the circuit in some way. In those days my parents sported a Beethoven 'portable' radio whose model number now escapes me. Anyway, it was a massive device tailored into a suitcase with the loudspeaker and frame aerial in the lid and the set with HT and grid-bias batteries and the accumulator in the bottom part.

I discovered that if I tuned this, say, to the LW BBC programme I could tell when my crystal set was tuned to the same wavelength by the strength of the crackling noises coming from the Beethoven's loudspeaker as I scratched the cat's whisker on the crystal. The plan was to tune the crystal set until the crackling noise was strongest (an early wavemeter?), the crystal set then being tuned to the same frequency as the Beethoven.

One day while experimenting with the dual cat's whisker and battery circuit I discovered that with very critical positioning of the two cat's whiskers on the crystal I could change the crackle to a whistle, not unlike the 'reaction' effect of another receiver nearby, as I adjusted the tuning capacitor of the crystal set. I have since concluded, of course, that the circuit went into a state of positive feedback (oscillation) and for that to have happened there must have been 'gain' which must have emanated from the crystal, two cat's whiskers and the battery set-up.

Before I finished with crystal sets and graduated to thermionic valves, I do remember giving a talk to my class at school on 'how to make a simple crystal set' around about 1933, when I was eleven years old. From then on I started adding valves at the front and rear of the crystal set to provide RF and AF amplification; but before then I did manage to get a crystal set going loud enough to be heard without having to put the 'phones on. Instead, I placed them in a large pudding basin, thereby discovering acoustic 'amplification'. Happy days!

I shall certainly look at crystal sets later in this series. However, to start off with let's look at a very simple yet interesting audio circuit (audio being one of my pet subjects, as readers may well recall!) which I spent many weeks experimenting with.

A Simple Volume Expansion Circuit

Before the days of wide dynamic range FM programmes, gramophone records and now more recently compact discs and DAT, the range between the softest and the loudest sounds transmitted or recorded was quite limited. In those days one was thought to be doing well with some 20 to 25dB of dynamic range. Nowadays, of course, we are talking in terms of 70dB or more.

Even before the term 'hi-fi' was coined and I think even before we started talking much about 'high quality' amplifiers and sound reproduction, there were folk around who had started to strive towards better fidelity. One line of thought at the time was that if the required enhanced dynamic range was not available at source (radio or disc), then perhaps it could be artificially created at the point of reproduction.

One of the earliest schemes around to add a few extra decibels between the softest and loudest sound was merely to connect a torch bulb across the loudspeaker. It worked like this: when cold, small metal filament lamps have a relatively low resistance, the resistance increasing as the lamp warms up and brightens with increasing drive.

Hence with the bulb in shunt with the speaker, more current is diverted through the bulb from the speaker when the drive is

low (low sound intensity), so that the output from the speaker is then even less than it would be without the bulb. As the drive rises the bulb glows and its resistance rises, so less current is diverted from the speaker and the sound intensity goes up, the net result being a slight widening of the dynamic range.

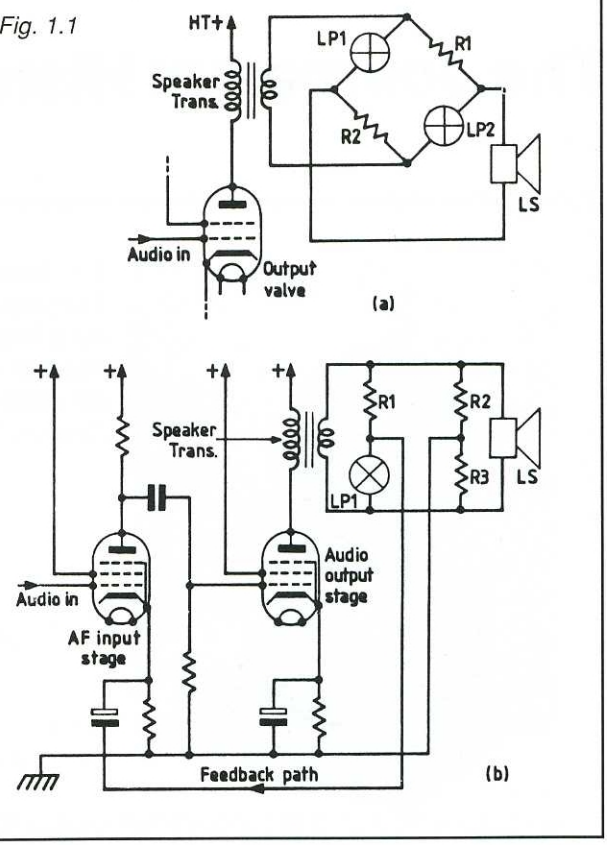
In practice the scheme is pretty dodgy, and I found it would not help at all unless the output valve was a pentode devoid of voltage feedback. Even then the available power of the output stage was seriously diminished by the loading of the bulb. However, some bulbs worked better than others, and one reference found that running around 40mA the attack time of a torch bulb was around 30 milliseconds (ms) and the recovery time about 150ms. Anyway, this does serve to illustrate the basic idea.

A more logical approach is revealed at (a) in **Fig. 1.1**. Here a bridge circuit (see *Radio Bygones* Issue No. 1, page 22, 'Resistance and Capacitance Bridges'), which has in adjacent arms two resistors and two small metal filament bulbs, is connected in shunt with the loudspeaker. When the bridge is balanced, no current would flow from the speaker transformer secondary winding to the loudspeaker. Resistors R1 and R2 are selected to provide a little out-of-bridge current flow (not quite balanced) when lamps LP1 and LP2 are cold (low audio output). However, as the sound intensity rises and the lamps glow more brightly, the bridge becomes further and further unbalanced resulting in an increasing speaker current. Hence the ratio between the softest and loudest sound is increased, giving volume expansion!

A further development of the circuit is shown at (b) in Fig. 1.1. There is still the simple bridge circuit across the speaker comprising R1, R2, LP1 and R3, but this time the values are selected so that as the lamp (LP1) becomes brighter owing to a louder sound, the signal flowing out of the bridge to the cathode of the audio input stage reduces and hence the negative feedback also reduces. This means that loud sounds are made even louder (reduced feedback). On soft sounds the feedback is increased, thereby reducing the gain of the audio amplifier, which in turn makes the soft sounds even softer. A well detailed scheme like this can add up to 10 or 12dB to the dynamic range.

These circuits are certainly interesting to try from the academic aspect, but they bristle with shortcomings related to the varying load and/or feedback, and thus emphasise harmonic distortion and power loss. However, I must admit to spending many happy hours in experimenting with them way back in time!

Fig. 1.1



Further Reading

F. Langford-Smith, *Radio Designer's Handbook*, first published 1934, fourth edition 1953, 'Expanders incorporating lamps'.

V. C Henriquez, *Philips Technical Review*, July 1938, 'Compression and expansion in transmission sound'.

T. S. Korn, *Electronics*, July 1948, 'Dynamic sound reproduction'.

In the next issue, how some of the early bandspread tuning systems were engineered

GERALD MARCUSE

continued from page 13

which Peter Eckersley of Two Emma Toc (2MT) Writtle fame was President until the 1924 'fusion' with the Transmitter and Relay Section of the Radio Society of Great Britain (RSGB). For two years Gerry was President of the RSGB. He remained an active amateur until his death at the age of 74 in 1961. During World War II he was a Group Leader of the Voluntary Interceptors of the Radio Security Service listening to the networks of the German Military Intelligence (Abwehr) service. He was an international figure in yachting circles.

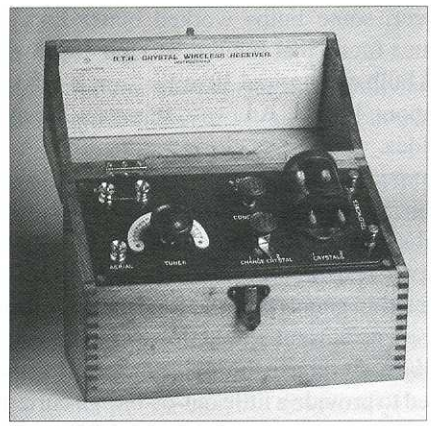
I remember seeing him at RSGB meetings in the late 1940s and 1950s: a cheerful, alert, friendly man in a beret which he wore constantly presumably to hide the baldness that in the 1920s he had concealed in the wig. A man who was much more than a footnote to broadcasting history.

Much of the previously unpublished information in this article has been derived from transcripts of the reminiscences recorded by Gerald Marcuse in conversation with H. A. M. Clark G6OT and Frank King G2FK and others between November 1960 and early 1961, shortly before his death on 10 April 1961.

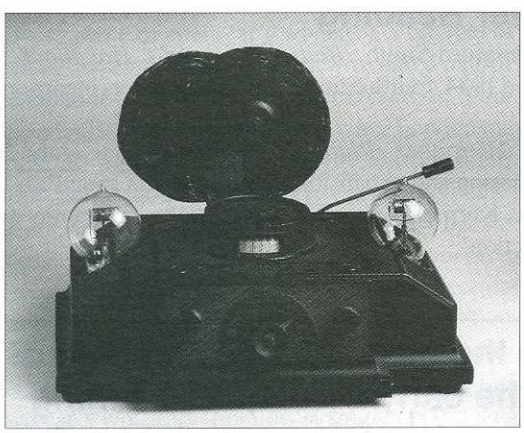
He spoke his own epitaph: 'My life since 1919 has been radio, and the biggest kick I get out of my old age is talking to my old friends up and down the country – I repeat that the finest thrill of my life is amateur radio and talking to all the old friends up and down the world.' ***RB***

The Journeaux Historic Wireless Collection

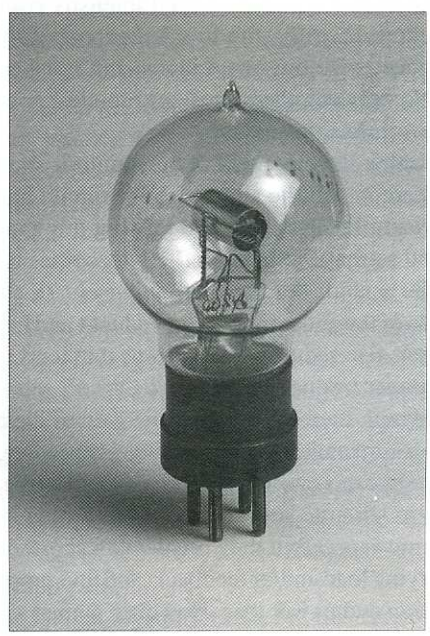
The Brownie Wireless Company's No. 2 Model Crystal Receiver, with plug-in coil attachment for Daventry 5XX (1926)



BTH Crystal Wireless Receiver Type C Form A (1923)



The Brownie Wireless Co's 2-valve set (1926)

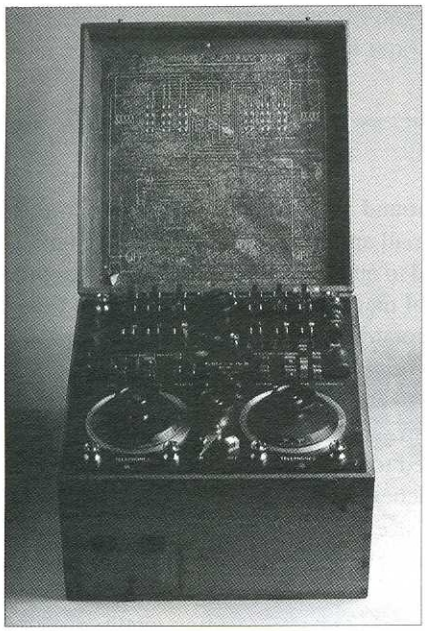


An 'R' valve by Osram GEC

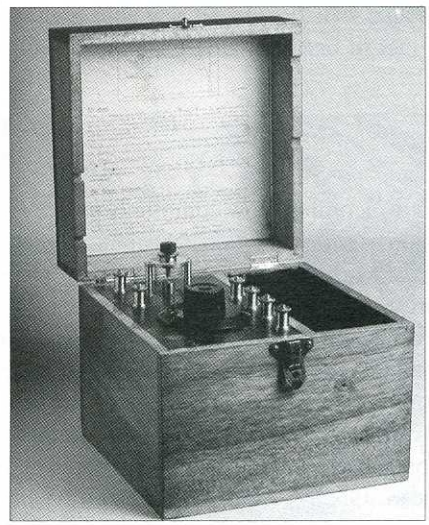
H. H. (Bill) Journeaux, a descendant of a well-known family in the Channel Island of Jersey, has spent a life-time in radio and television in industry and the armed forces. Among his earliest memories of working days is pedalling a shop-bike over many miles around Bournemouth, with its basket full of 2 volt filament accumulators being returned to their owners after recharging. Only during the second year of his apprenticeship did he graduate to looking after the actual charging process!

In the late 1960s, whilst Bill was working as a TV engineer, a customer approached him to ask if he could do anything to renovate and repair some of a collection of vintage radio and TV sets, which no-one else seemed prepared to tackle. This he did with great success, and when that customer died in 1970 he bequeathed to Bill a large number of early wireless receivers, all in very poor condition, with the hope that they would eventually be restored to full working order.

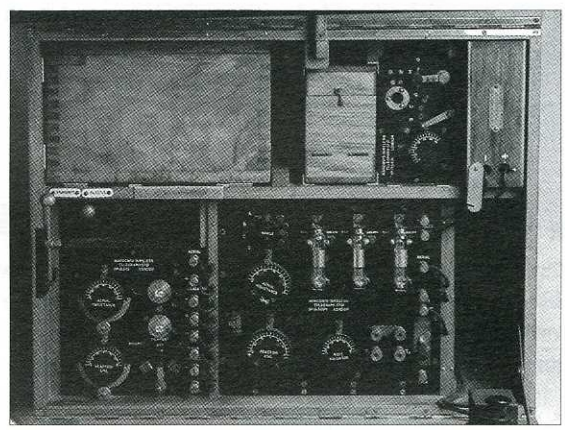
During the next few years, the story of the bequest and subsequent restoration was reported in the local press, and on radio and television. This resulted in further donations of vintage wireless equipment, including a large library of early wireless books, magazines, service sheets and catalogues. At this point it was decided to incorporate all the items into a comprehensive collection, to include all aspects of wireless history from 1900 to 1950. This has since grown into one of the largest private wireless collections in the country and now numbers over 1500 radios including 160 crystals sets and 50 World War I radios,



Army Tuner Long Wave Mk III, made in the WT Factory Soho (1918)



Radio Instruments Limited Crystal Set Type XLA (1923)



Marconi 50 watt CW Pack Set. Five of these sets were produced for the British Army between December 1918 and October 1919, at a cost of £283 each. Believed to be the only example remaining in existence

Army Tuner Short Wave Mk III

and over 200 405-line standard TV receivers, plus related items together with a reference library of 2500 wireless books and 3500 wireless magazines from the 1920s to the present day.

Following an accident, Bill took early retirement and now devotes all his time to developing his collection. He travels over much of southern England and occasionally further afield to view items which have been offered for sale or as a donation. He does not sell pieces from the collection, but is happy to offer duplicate items in exchange for wanted sets on a straightforward swap basis.

One of Bill's particular interests is 405-line TV receivers, which he likes to restore to full working order. All the 405-line transmitters have of course long closed down, and he uses a VHF modulator together with video recordings of programmes on the 405-line standard to provide a signal for tests and for demonstrations at exhibitions and displays.

At present, items from the Journeaux Historic Wireless Collection are on exhibition only at radio or historic shows in the Dorset area, such as the Wimborne Hamfest and the Great Dorset Steam Fair, but it is hoped that eventually the whole collection will be on permanent display to the public. Until then, most items are available on free loan for exhibition or research purposes.

Bill Journeaux is always pleased to help vintage radio and TV enthusiasts with information from his large library. He can be contacted on Parkstone (0202) 748072.

RB

A History of Magnetic Recording
Audio & Video

by F. C. Judd

Magnetic recording, now commonly used by all broadcast and television stations, has also become a domestic feature in homes the world over. It is widely used in computer systems for both professional and personal applications. It is not generally realised, however, that the recording of audio frequency signals by a magnetic process was first accomplished just about 90 years ago!

However, 10 years earlier, in 1888, a method of recording that could be described as 'magnetic' was proposed by an American, Oberlin Smith, who also revealed details of his system in an article published in the same year. Smith suggested the use of cotton thread loaded with steel filings on which to store the recordings as well as an electromagnetic 'record-playback' head, similar to that used today. The system was never constructed and made to operate owing to technical difficulties that could not be overcome.

First Working Recorder

At the 1900 World Exhibition in Paris, great excitement was caused by an apparatus called the Telegraphon, for which the inventor Valdemar Poulsen, a Danish physicist, was awarded the Grand Prize. As shown in the photograph on the front cover of this issue of *Radio Bygones*, his apparatus consisted of a brass cylinder around which a thin steel wire was wound spirally with a small space between each turn. Signals to be recorded were fed to an electromagnetic 'head' that produced varying degrees of magnetism along the length of the wire as the cylinder was rotated. The remanent magnetism in the wire could at any time be re-transformed into electrical currents by rotating the cylinder and arranging for the 'head' to traverse the wire from the start. The electrical signals reproduced in the head were then fed to a telephone receiver. The cylinder, approximately 16 inches long and 5 inches in diameter, contained 380 turns of thin steel wire. The effective speed at which the wire ran past the head was 80 inches per second (ips). Although its primary function was to record telegraph signals, it was also used to record speech. The reproduction quality was poor, in fact the system did not compete with the early American Dictaphone recorder which employed wax cylinders. (Attributed to Edison).

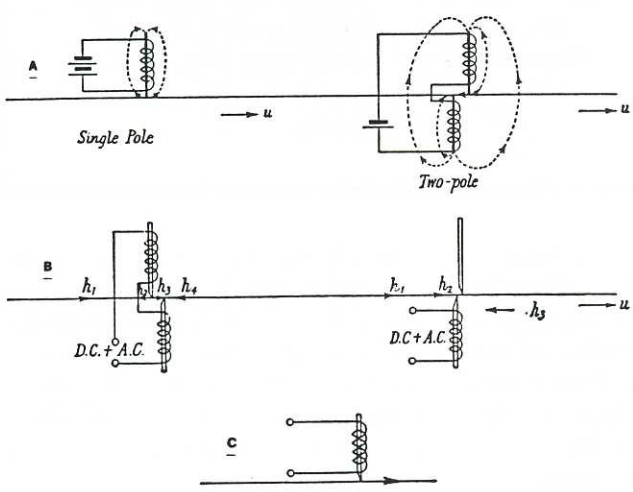


Fig. 1 - Recording and playback head system used with the Blattnerphon (Stille) recorder. (A) Single or double head for pre-magnetising the steel tape. (B) Single or double recording head. (C) The replay head. The pre-magnetising and recording 'bias' voltages were DC

The Stille Recording Apparatus

Details concerned with the early development of magnetic recording given in British publications have, in some instances, been found to be incorrect. The following information comes from German sources.

In 1924 a German engineer named Stille (pronounced Stiller) produced a magnetic recording apparatus that employed narrow but flat steel tape instead of wire. His method depended on two magnetic properties of steel tape, remanence and coercivity. The tape had to retain the magnetisation imposed upon it but at the same time resist any demagnetising effect due to the fields between neighbouring portions. The essential requirements were: movement of the tape at a constant speed of 90 metres per minute (60 ips), and as illustrated in **Fig. 1**, a special head (A) to magnetise the tape at a constant level, a recording head (B) to impart varying magnetism from speech currents to the tape, and a reproducing head (C) to pick up and re-convert the varying magnetism to the original speech currents.

The Stille machine was very large and to obtain a total running time of 30 minutes, because of the high tape speed, the reels for carrying the tape were in the region of 24 inches in diameter. Incidentally, the tape speeds of modern-day audio tape recorders stem from that original 60 ips, being first reduced to 30 ips and 15 ips, used for studio recorders, and finally to 7-1/2, 3-3/4 and 1-7/8 ips for domestic recorders. One drawback with the Stille system was the high noise during replay, although the general reproductive quality was superior to that from gramophone disc records of the time. Another

drawback was that if the steel tape broke, as it often did, it could only be rejoined by welding, which resulted in a loud 'crack' when the join passed the head on replay.

The Blattnerphon

The Stille system was not particularly successful, at least not until the development of valved amplifiers. It was then taken up by the Berliner Fernsprechund Telegraphonwerk AG, (Ferdinand Schuchand) in an attempt to produce a far better performance in terms of recording and reproduction quality

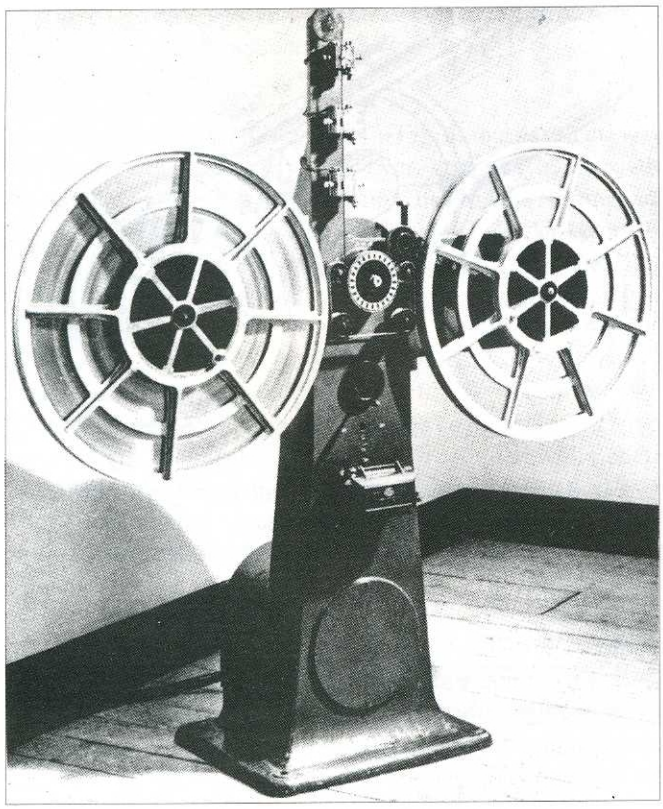


Fig. 2 - The Blattnerphon-Stille recorder (Circa 1930)
Photograph courtesy BASF, Germany

than had previously been obtained. The outcome was the Blattnerphon-Stille recorder shown in **Fig. 2**. One of the intentions of this company was to use the machine in connection with 'cinema films with sound'.

In 1930 a Blattnerphon-Stille recorder, now known as the Blattnerphone, was acquired by the BBC mainly for experimental purposes, but with an improved electrical performance was in fact employed in connection with a BBC Empire Broadcast in 1932. Otherwise its uses as a means of recording programmes to be broadcast at some later date proved to be rather limited. However, co-operation between the BBC and the Marconi's Wireless Telegraph Company Ltd in 1934, resulted in the development of the Marconi-Stille machine shown in **Fig. 3**. This could record both speech and music with a reproduction quality much more suitable for broadcasting. Several of these machines remained in use by the BBC until about 1940.

Meantime, steel wire recorders had been further developed and were used for certain applications during World War II, and although recorders and kits of parts for building them were available immediately post-war, they were soon superseded by magnetic tape recorders.

The Magnetic Tape Recorder

In 1928 a German engineer, Fritz Pfleumer from Dresden, demonstrated a magnetic recording machine of his own design that employed thin paper tape 6mm wide, and from which the standard 1/4 inch plastic tape was developed. The paper tape was coated with fine 'iron dust'. This idea had in fact been

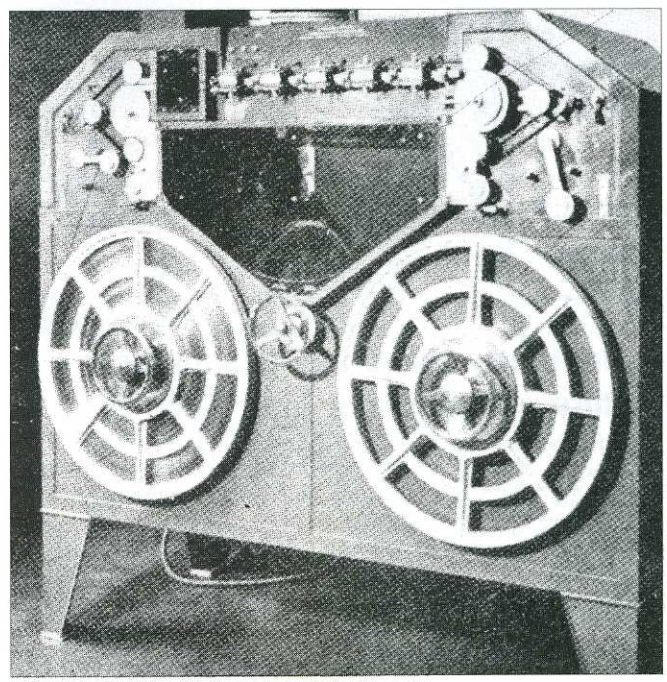


Fig. 3 - The Marconi-Stille recorder (Circa 1934)
Photograph courtesy GEC - Marconi Ltd

Fig. 4 - The Magnetophon tape recorder (Circa 1936)
Photograph courtesy Telefunken, Germany

announced in a technical journal in 1917 but was never developed. Pfleumer pointed out that if his magnetic tape broke, it could be joined by splicing as opposed to welding, and that a join would not produce an unwanted noise.

In 1932 the Allgemeine Elektrizitatgesellschaft (AEG) decided to take up the idea and investigate the possibility of

improving sound quality and reducing background noise (early magnetic tapes had a limited audio frequency response). It was realised that the 'iron dust' magnetic coating needed to be in the form of a very fine powder, so AEG went to the Badische Anilin Soda-fabrik (BASF) in Ludwigshafen, Southern Germany.

The German BASF company responded with the idea of using cellulose acetate tape, and tests carried out in the laboratory proved this material to be most satisfactory. In the meantime, AEG had designed a suitable tape recorder, originally called

Fig. 5 - A different approach to the post-war domestic tape recorder market. A 1964 advertisement for the Gramdeck

the Ferrotron but later renamed the Magnetophon. By 1935 BASF were able to manufacture a tape coated with a magnetisable iron oxide which proved to be far superior to the iron powder previously used.

The Magnetophon Recorder

The first Magnetophon recorder was shown at the Berlin Radio Fair in 1935. Originally designed as a dictating machine, it was not suitable for recording music as the frequency response was too narrow. By 1936 a new version of the Magnetophon, as shown in **Fig. 4**, was being produced. Using the BASF iron oxide tape, it was capable of recording and replaying music with a wider frequency range and a much lower level of tape noise at a tape speed of 30 ips. The writer has a copy of an original tape recording made with the new Magnetophon in 1936, of music by the London Philharmonic Orchestra playing in Berlin.

By the time World War II had begun, tape-recorded speeches by Hitler and others of the Nazi hierarchy were being transmitted from German broadcasting stations at times when the speakers might well have been engaged elsewhere. Only when the Allied Forces occupied Germany in 1945 did the development in magnetic recording and its uses become known. British and American intelligence also uncovered the fact that Magnetophon

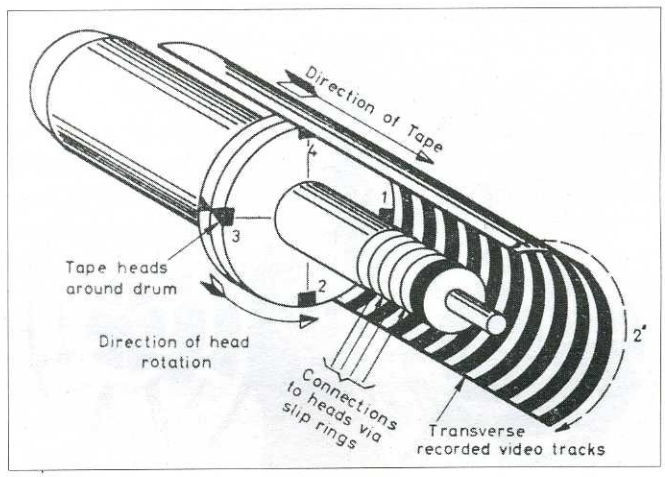


Fig. 6 - Video recording helical scan tape head system (Circa early 1960s)

Diagram courtesy Shibaura Electric Co, Japan

recorders, installed by the Germans, had been in operation at Radio Luxembourg since 1941.

The manufacture of Magnetophon recorders was eventually taken over by the German Telefunken Company, well known for wireless equipment both before and after 1939.

Video Recording

Directly after the war, the frequency ranges attainable with magnetic tape became greater as the quality of tape and the design of recorders were improved. So, attention was turned to the possibility of video recording, though this necessitated a frequency range in terms of 'megahertz'. The first attempts to record 405-line television pictures off-camera, or off-air, utilised recorders with very narrow-gap record/replay heads and a very high tape running speed. A machine called the Vision Electronic Recording Apparatus, VERA for short, was designed and built in the UK in 1958. The tape speed was 200 ips. It was used by the BBC for a while and then abandoned in favour of the American Ampex machines. These employed a tape head that rotated at 15 000 rpm and 'scanned' across two-inch-wide tape thus producing an effective tape speed of 1260 ips, although the tape itself ran at only 15 ips. The upper frequency response was in the region of 5MHz, suitable for 405-line television off-camera.

Video Comes to the Home

Video recorders for home use were slow to come and it was not until the early 1960s that the Shibaura Electric Co of Japan

Fig. 7 - The Wesgrove VKR500 domestic video recorder deck, constructed from a kit

produced a helical scan system, as in **Fig. 6,** that paved the way for home video recorders. However, attempts by two UK manufacturers are worthy of mention. In 1963 the Nottingham Electric Valve Co produced a home video recorder complete with camera which they announced would be available for less than £150! The writer did see the prototype, working as claimed, but for some reason it never got onto the market. Another attempt by Wesgrove Electrics Ltd of Worcester a year or two later was their VKR500 kit for 'home constructing' a complete video recorder that could be connected to a TV set for off-air recording or to a camera. A kit complete with camera was made available to the writer for evaluation. The deck (see **Fig. 7**) was assembled and wired according to instructions, and with a 10 inch spool of standard 1/4 inch wide tape running at

Fig. 8 - Picture via video camera, recorded on Wesgrove VKR500 video tape machine. Photographed from TV screen playback (1965)

120 ips, passable recordings were made from off-air 405-line TV transmissions and from camera, complete with sound. The photograph (**Fig. 8**) taken off screen, is from a recording made with the camera although picture linearity leaves much to be desired. The kit retailed at £97 10s. excluding the camera.

Since around 1960, development has continued to reach the near perfection of recording and reproduction possible with magnetic recording equipment available today, but undoubtedly even this will eventually become history. ***RB***

Restoring a Bush DAC90A

by G. F. Baker

One of the best small radios of the 50's era was the DAC90A. In its day it was, perhaps, a little plain and cheap looking in appearance, but at £15 5s., or another £1 for the cream cabinet model, it was a very good buy.

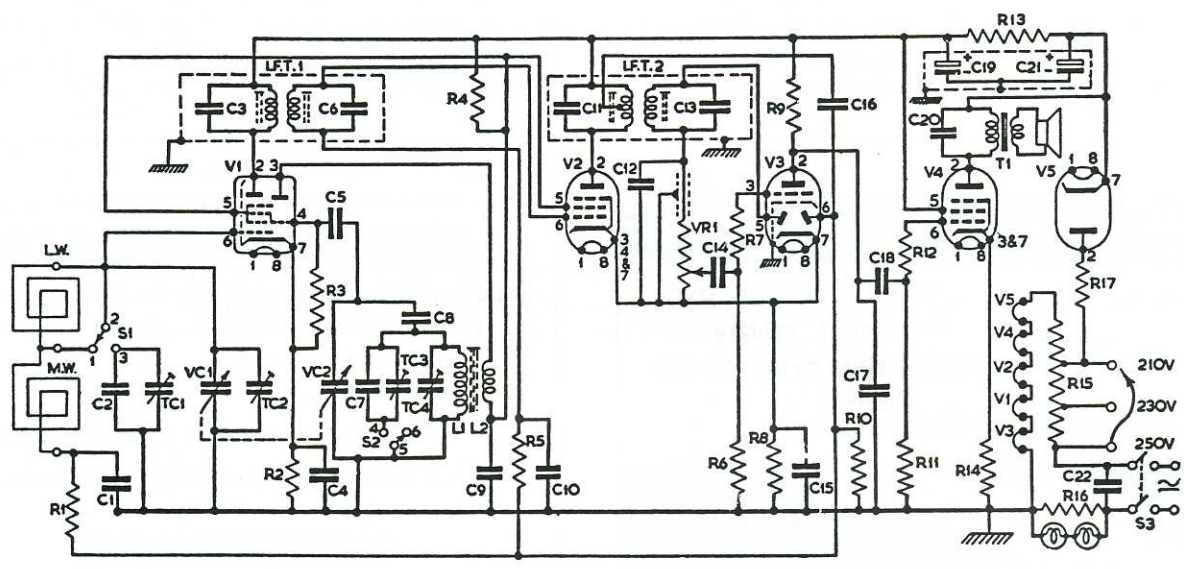
I used to enjoy selling this set to a customer when I was in the retail trade as I knew that it would give satisfaction. Of course, today, its bakelite cabinet and good performance is prized by collectors who require something that not only looks good but will perform very well too.

It is a set that carries its age well, being made 'like a tank' in the first place. It uses a frame aerial mounted at the side of the chassis and does not require anything further to give a good account of itself.

This is a set that can be picked up in a Sale Room or Car Boot Sale and usually requires only a little work to put it in good order. One should aim to pay between £5 and £10 for one 'as found' (check that the cabinet and dial glass are not cracked), or between £30 and £50 for one in first class order.

Restoration

Remove the chassis, secured by two bolts at the rear. Remove the front knobs, whose grub screws are accessible via holes in the base of the cabinet. Unscrew the wave change knob from the rear.



Reproduced from Radio and Television Servicing, *by kind permission*

Capacitors

C1	0.05µF	C10	0.05µF	C19	16µF
C2	130pF	C11	110pF	C20	0.01µF
C3	110pF	C12	100pF	C21	32µF
C4	0.05µF	C13	110pF	C22	0.1µF
C5	50pF	C14	0.01µF	TC1-TC4	4-40pF
C6	110pF	C15	0.05µF	VC1/VC2	
C7	515pF	C16	50pF	2x528pF ganged	
C8	605pF	C17	0.003µF		
C9	0.05µF	C18	0.01µF		

Resistors

R1	1MΩ	R10	1MΩ
R2	220Ω	R11	470kΩ
R3	47kΩ	R12	47kΩ
R4	12kΩ	R13	10kΩ
R5	2.2MΩ	R14	150Ω
R6	2.2MΩ	R15	950+150+150Ω
R7	100kΩ	R16	250Ω
R8	330Ω	R17	150Ω
R9	150kΩ	VR1	500kΩ

This gives reasonable access, but the loudspeaker leads may have to be unsoldered.

The first step in the restoration process is to replace the demodulation capacitor (C22, 0.1µF) connected across the mains input, between the volume control switch and the chassis. This will save a loud bang and a puff of smoke at a later date!

Give the wave change switch and volume control a burst of switch cleaner. Check the valves for continuity, and fit new dial lamps (3.5 volt 0.15 amp). It will also be worth replacing the two coupling capacitors C14 and C18 (both 0.01µF). After this one should be ready for a trial.

Very little else seems to go wrong with these sturdy old sets. There are, however, one or two points to watch for. A fairly loud background hum will mean that you need a new UL41 output valve, assuming that the electrolytic capacitors C19 and C21 have been checked.

Vibration from the loudspeaker area will mean that the cone has become detached from its frame; check around the cone edge and also behind the cone near where the speech coil goes into the magnet. These problems can be cured with some UHU glue or a replacement 'speaker can be fitted.

Cleaning

If the set is to be used in the home it will pay to give it a really good clean, as otherwise it is likely to emit the smells of age and of its former home, when warmed up. To do this, remove everything from the cabinet, including the 'speaker and dial. Immerse the cabinet in hot water and washing up liquid and scrub inside and out, not forgetting to give the knobs the same treatment. When thoroughly dry, polish with a normal spray polish.

Clean the chassis with methylated spirit on a swab, using cotton buds for the awkward areas. Take care not to clean away the type numbers on the valves. If these are missing they are as follows, from left to right: UCH42, UF41, UBC41, UL41, UY41. Clean the dial with New Windolene; **do not use methylated spirit** as this will remove the dial printing.

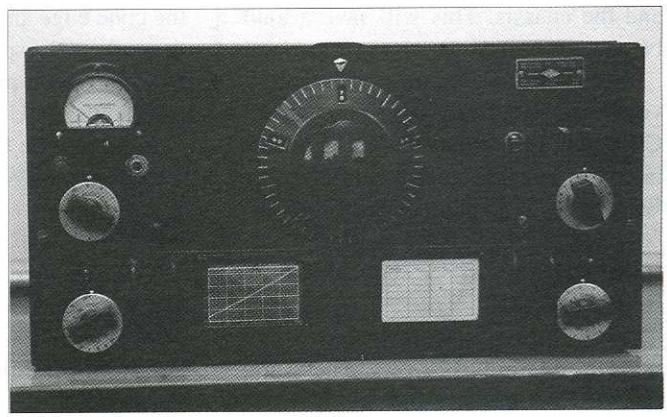
Reassemble and test – your DAC90A should now be ready for its honoured place in the living room!

RB

The Mighty HRO

by Peter A. Hopwood G3UKH

The best magazine article devoted to the HRO series of receivers I have ever seen, was in 1965. That article started with the author explaining that little had been written in recent years about the HRO. These words could certainly be reiterated in 1989, apart that is from a brief history in the book *A Guide to Amateur Radio*, and the odd mention in the 'Technical Topics' section of the RSGB's journal *Radio Communication*. Due therefore to recent interest in so-called vintage receivers, I have decided to pen some notes on the National HRO, as far as possible keeping off information that can be read in any good HRO handbook or manual.



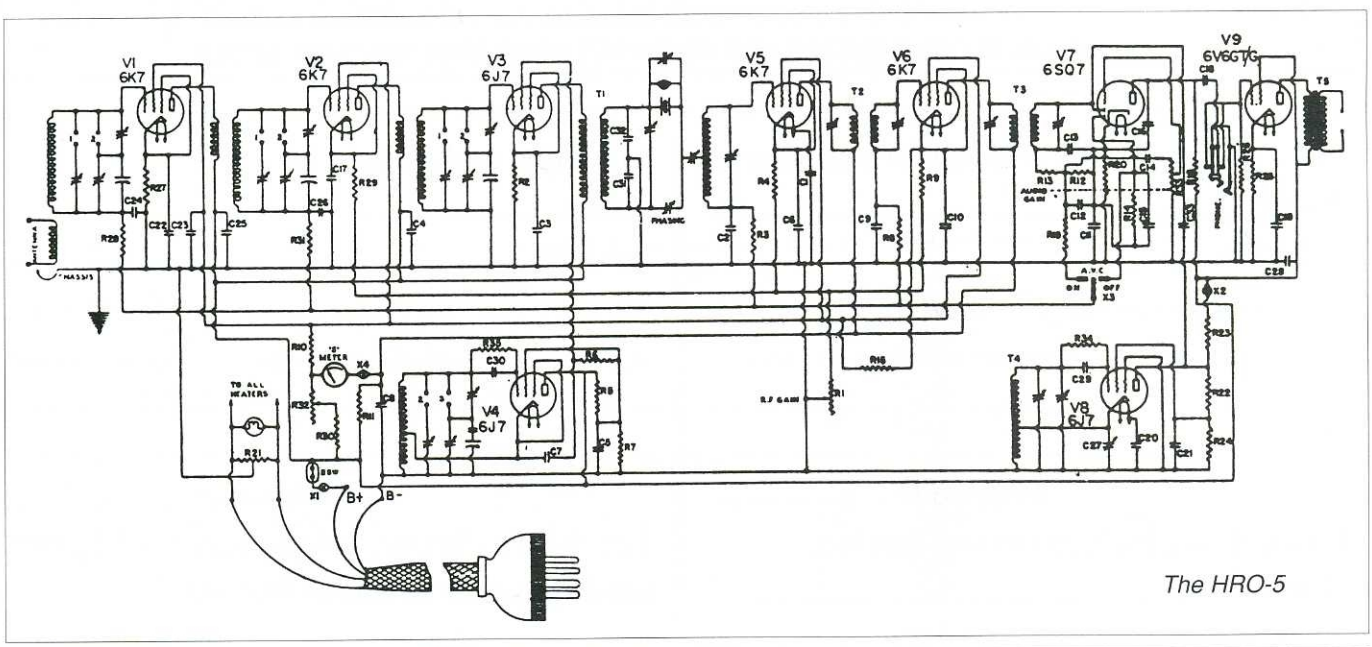
The National HRO

Origins

The first HRO prototype was made in 1934 by the National Company of Malden, a suburb of Boston, Massachusetts in the USA. It was designed by James Millen, who remarkably was a mechanical rather than an electrical engineer. The beautifully designed main tuning capacitor, gear-box and dial give testimony to this. The production model appeared in 1936, differing in several features, including the addition of bandspread. For its time it was a remarkable receiver, featuring such novel ideas as a crystal filter, plug-in coils, an effective dial scale length of 12 feet, the bandspread feature, and of course its being a superhet, instead of the ubiquitous TRF type of those days. The plug-in coils could be quickly changed from general coverage to bandspread, by the removal of four set-screws to different positions. Early sets had 2.5 volt valve heaters. The pre-war receivers were known as HRO Seniors and were considered by amateurs as 'the Rolls Royce of receivers', and indeed the set was very expensive. In 1941, prior to America's entry into World War II, an HRO Senior with a full set of coils, loudspeaker, power supply and coil storage unit cost around $587, which was equivalent to £147 at that time. To put this in perspective, a Ford car in 1938 cost £100. By today's standards the set would have cost £2640. There were however cheaper versions available. The HRO-Junior had neither S-meter nor bandspread, and of course you only had to buy the coils that you needed. The sets were nevertheless very expensive, and there were relatively few in the UK prior to the war.

War Clouds

The advent of WWII changed all that. In the early years, the services lacked any receiver of the quality of the HRO. As a stop-gap, amateur receivers were bought from the National Company, as indeed they were also from RCA, Hallicrafters and Hammarlund. Later military versions of the HRO were supplied via Lend-Lease to the UK, and the full production of other manufacturers of various models, such as the RCA AR88, were sent here. The



The HRO-5

military versions of the HRO, type M and MX mainly were the basic receiver less the amateur features (bandspread and an illuminated signal-strength meter calibrated in S-units) and with the plug-in crystal filter replaced by a more secure wired-in version. The HRO-Junior was widely used by the US Navy in various forms known as the RCE, RAS and RBJ. Some had higher frequency IF stages, so as to fit in with other equipment found on ships. The final change to the original HRO-Senior design came in late 1944 when National at long last changed the glass UX-based valves to metal octal types, the set being the HRO-5. Most American companies had been using metal valves since the early 1940s, and one can only assume that National resisted this change as the old UX valves (6D6, 6C6) were perfectly matched to the front-end circuitry of the receivers. In my humble opinion, the old Senior model was a better set than the HRO-5, and the crystal for example had a higher *Q*. I have heard it said that the 6D6 valve was designed for the HRO rather than the other way around.

During the war, the Germans produced a version of the HRO which followed the original design quite closely, albeit with the use of different valves. The Japanese also used a receiver with an HRO type dial, although I do not think it featured plug-in coils.

After the war, bandspread coils were reintroduced, and the circuit now featured a noise limiter and a square-faced S-meter, which I consider spoilt the lines of the set. The HRO-7 in a redesigned case appeared in 1947, the circuit being similar to the HRO-5, but having in addition a tone control and voltage stabilisation. About 1950, the HRO-Fifty appeared with built-in power supply unit, slide-rule dial in addition to the old HRO dial (known as the PW dial), external local oscillator adjustment and such niceties as a panel lamp dimmer. The set was however lacking in gain and in 1954 an extra IF stage was added and miniature valves put in the front end – 6BA6s and 6BE6. Collins also produced a series of mechanical filters for use in the Fifty as plug-in units. The final valved version was the HRO-60, basically being an HRO-Fifty with double conversion IF. This set was replaced after four years, in 1964, by the fully transistorised HRO-500, its only claim to the name HRO being the PW dial, now coupled up to a frequency synthesiser.

Due largely to import restrictions and of course the cost, the main HROs available then and now in the UK are the wartime sets, starting with the HRO-Senior in full amateur rig and ending with the later HRO-MXs and 5Ts. A few were built in the UK under licence, but I have never seen one except in the D-Day Museum in Southsea, Hants. In the 1950s and 60s they were used by many thousands of amateurs, although they were prone to cause TVI to nearby VHF TV receivers, due to the harmonic output from the local oscillator when using the 14 – 30Mc/s coil.

Modifications

Over the years the sets have suffered from excessive modifications at the hands of two generations of amateurs. The layout of the receiver and roomy front panel have lent themselves easily to various modifications. Perhaps the best and most easily excused modifications are those which tended to follow National's own uprating of the original Senior model to the 5 and then Fifty models. There are however still some unmodified types around. I find that the amazing thing about these receivers is that they will perform remarkably well with little or no modification. I have well over 100 confirmed countries worked on SSB using a virtually unmodified pre-war HRO-Senior. To cope with the SSB, the injection capacitor from the CW oscillator has been increased to around 22pF, and a voltage stabiliser added. This was simply a VR150/30 on a bracket bolted to the underside of the chassis, feeding the local and CW oscillators. Above 14MHz (20m) a little help is needed in the way of a good pre-selector, but at 20m or lower this can introduce cross-modulation and other unwanted responses. The 21MHz (15m) amateur band was of course not available until after the war, and so it is necessary to build your own 15m bandspread coil. This is easily achieved using an old long-wave coil, and spending a few hours putting in the new tuned circuits for 15m.

The HRO is a nice set to operate, and the slight inconvenience of plug-in coils is outweighed by the set virtually being a one-band set at any one time, although a full set of coils allows coverage from 50kHz to 30MHz, less the segment

Capacitors

C1	0.1µF
C2	0.01µF
C3	0.1µF
C4	0.1µF
C5	0.1µF
C6	0.1µF
C7	0.01µF
C8	0.25µF
C9	0.01µF
C10	0.1µF
C11	10µF 50V
C12	100pF 1kV
C13	250pF 1kV
C14	0.1µF
C15	0.01µF
C16	500pF 1kV
C17	0.1µF
C18	0.1µF
C19	10µF 50V
C20	0.1µF
C21	0.1µF
C22	0.1µF
C23	0.1µF
C24	0.01µF
C25	0.1µF
C26	0.01µF
C27	var
C28	0.01µF
C29	0.001µF
C30	100pF 1kV
C31	100pF 1kV
C32	100pF 1kV
C33	2pF
C34	40pF 1kV
C35	1200pF
C36	850pF
C37	2600pF
C38	1600pF
C39	880pF
C40	450pF 1kV
C41	350pF 1kV
C42	100pF 1kV
C43	50pF 1kV

Working voltage 400 - 600V unless otherwise stated

Resistors

R1	10Ω 2W var
R2	5kΩ
R3	500kΩ
R4	300Ω
R5	50kΩ
R6	100kΩ
R7	100kΩ
R8	500kΩ
R9	1k to 5kΩ
R10	15kΩ 2W
R11	250Ω to 2.5kΩ
R12	500kΩ
R13	50kΩ
R14	250kΩ
R15	30kΩ 2W
R16	20kΩ
R17	100kΩ 2W
R18	100kΩ 2W
R19	500kΩ
R20	800Ω
R21	64Ω 3W
R22	100kΩ
R23	250kΩ
R24	100kΩ
R25	500Ω 2W
R26	500kΩ
R27	300Ω
R28	500kΩ
R29	300Ω
R30	2kΩ
R31	500kΩ
R32	1kΩ 1W var
R33	500kΩ 1W var
R34	50kΩ
R35	20kΩ

Wattage rating 0.5W unless otherwise stated

430 – 480kHz, centred around the IF. All the coils are situated directly below the main tuning capacitor and there is no wave-change switch. The front end is thus extremely efficient and heat drift is reduced to a minimum.

Maintenance

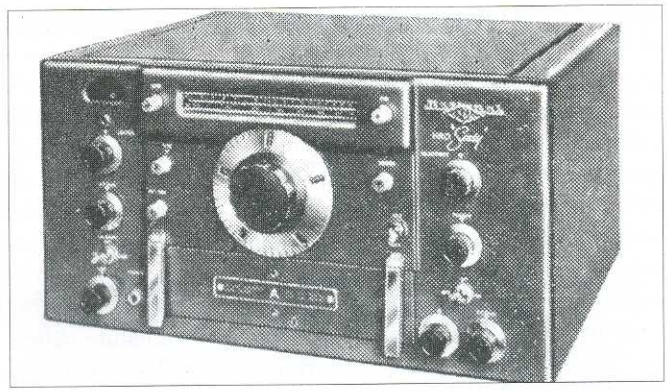
The full worth of an HRO can only be achieved with careful alignment. Once correctly aligned it can be an extremely accurate and stable frequency-measuring instrument, if one goes to the trouble of calibrating the dial. In some sets which have had a great deal of use, the resettability can be in error by up to half a dial division. This is caused by wear in the main tuning capacitor rotor end bearings; the split wheel and worm causing the rotor to move fractionally right or left depending on the direction of rotation of the dial. It is easily cured by adjustment of the left-hand end bearing, in the following manner. Undo the locknut and tighten up the screw until the capacitor plates just start to move. Slacken off a touch and re-fasten the locknut. In any restoration work most of the paper capacitors will need replacing, and don't forget to grease the tuning gear. The front panel can be easily removed and for a small cost can be repainted in your own home, using an aerosol crackle-finish spray.

It is of course essential that the contacts on the coils and inside the set are clean. A little silver polish will do the trick. Using modern photocopying machines all the frequency charts from the coil fronts can be reprinted to look like new for about 30p. Spare valves are still easily obtained.

The sets produced in 1944/5 were mainly treated with a fungus resistant varnish, which means that they seldom rust. The older sets are often also in good condition, due to the excellent grey chassis paint applied by National.

How much should you expect to pay for an HRO? Buy two scrap sets (one for spares) and do a rebuild job and you could have a nice set for around £50. For a set in excellent condition, £70 – £80 is not too low a figure. In the early 1960s these sets were available for about £18 as government surplus! I do believe that some are still in use in various government establishments, but the chances of buying one are of course remote. The later models – HRO-Fifty and HRO-60 are few and far between.

I was not born until seven years after the HROs were first made, and I have been associated with them only since the early 1960s. I would be interested in hearing from anyone who grew up with them, so to speak. ***RB***



The National HRO-Sixty, from a 1953 advertisement

COMPETITION

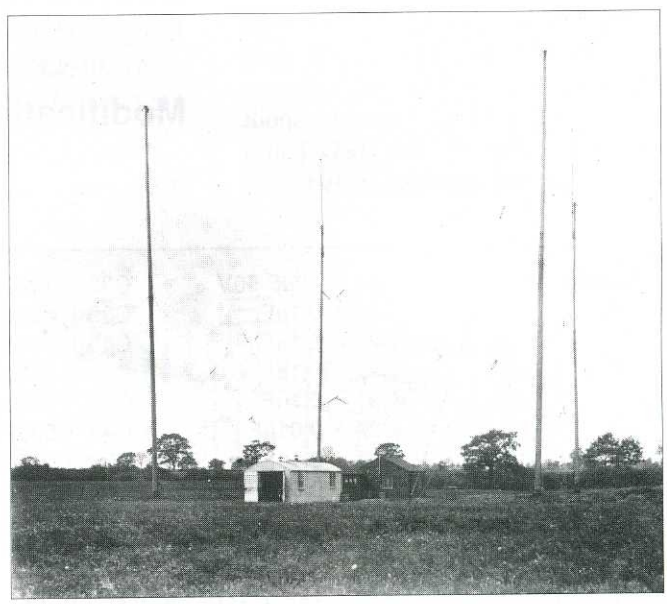
Where is it? - No. 2

Each issue in *Radio Bygones*, we'll feature for your puzzlement and delight a photograph of a radio installation of days gone by, drawn from the archives of GEC-Marconi Ltd. And we'll be asking the question, where and when was it taken?

I'm afraid that our first one was rather too tough. We got only two entries, and they were both completely off the beam!The photograph, taken in 1902, was of the station located at Babylon, Long Island, in the USA. At that time there were two stations in the United States and two in Canada available for communication with ships fitted with Marconi wireless apparatus, in addition to ten in the British Isles and two in Germany.

Our second puzzle picture is rather easier, and I look forward to floods of entries! A slightly different question this time. The year that the photograph was taken is not known exactly (unless someone out there can tell us) so we'd like you to say when the station was first opened, and for what purpose.

Send your entry, on a postcard or the back of a sealed-down envelope please, addressed to Radio Bygones, 8A Corfe View Road, Corfe Mullen, Wimborne, Dorset BH21 3LZ. The first correct answer drawn from the editorial biscuit tin on Friday, November 24 will win for its sender the prize of a year's subscription to *Radio Bygones*! The answer, and another 'Where is it?', will appear in our next issue, due out on December 12.



Photograph by kind permission of GEC-Marconi Ltd.

Don't forget, the closing date for receipt of your entries is Friday, 24 November 1989. The Editor's decision is final.

Wireless Takes to the Road

Part 2

by Tim Wander

Today we tend to take radio for granted; it's simply a noise in the background or one more black box full of ICs and transistors. We also take the motor car in the same vein, it gets us from A to B, more or less in a straight line – and of course the small dashboard radio eases the journey. While digging through some old papers I came across a report, dated Wednesday, 25 October 1922, concerning the first introduction of wireless into a motor car for entertainment purposes.

In the autumn of 1922, 'British Broadcasting' was in the hands of a group of brilliant eccentrics with 2MT in Writtle, 2LO in London was just making its small voice heard, and the British Broadcasting Corporation had yet to be born. The radio entertainment industry was undreamt of, domestic receivers were fresh out of the laboratory and hardly suited to the rigours of mobile usage. However, back in 1902 the Marconi Company had put the first wireless set on board a vehicle, a somewhat modified 'Thornycroft steam omnibus' [1], and again, in 1922, as British broadcasting was born, the Marconi Company was part of the experiment.

[1] 'Wireless Takes to the Road', Part 1, *Radio Bygones* Issue No. 1.

PURSUED BY A VOICE

WIRELESS IN A MOTOR-CAR
SUCCESSFUL TEST

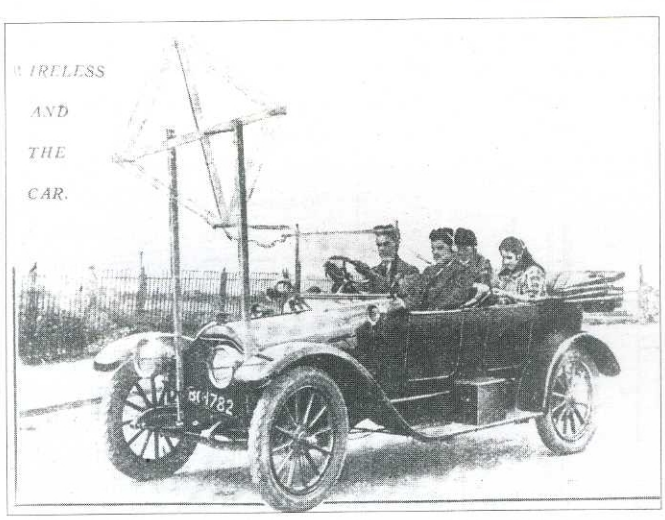
FROM OUR SPECIAL CORRESPONDENT

Chelmsford, Essex, Tuesday.

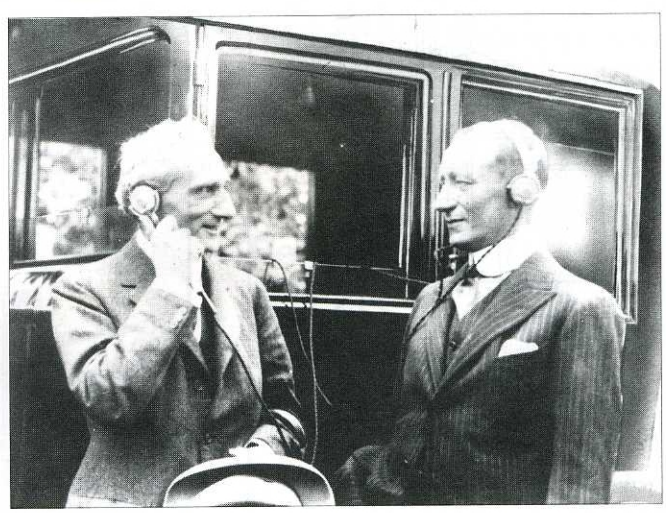
'An experiment in wireless telephony was carried out today by the Marconi's Wireless Telephony Company, in conjunction with the Daimler Company, when constant communication was kept up with a motor-car travelling at high speed from London to Chelmsford. The distance is about 30 miles. On the return journey from Chelmsford to London we listened to an evening concert sent out by the Marconi station at Writtle, near Chelmsford. It was so loud that it filled the moving car with music.

We started in the car from Marconi House, Strand, shortly after four o'clock, with instruments to "listen-in" for Marconi House. Our luxurious Daimler limousine was stopped outside Liverpool Street Station in the thick of the afternoon traffic by a point-duty policeman. The car was fitted with a receiving set, and on top was a frame aerial. Just as the policeman dropped his hand we heard a voice rising clear above the din of the London traffic: "Hullo, hullo! Marconi House speaking. Excuse my voice, as I have a cold." We were soon well on the move, but could not leave the voice behind. It followed us for more than an hour down Bow Road, right through the East End and out into the open country. Sometimes the voice grew dim as we passed under viaducts and bridges; sometimes it grew husky owing to the interference of the overhead tramway wires, but it was there all the time. It was not until we had almost reached Chelmsford that the voice faded away.

The night concert was even more fascinating than the pursuing voice. As we sped through the quiet countryside we were followed by music and a sweet voice – a very eerie experience when travelling through the night on a deserted road. On the way back from Chelmsford the car had a puncture. While the mechanic was changing the wheel the occupants of the car sat in comfort and listened to two wireless gramophone selections, a pretty French song and a valse (waltz). '



Mobile wireless reception, 1920s style



Marconi and Alexander Flood Page listen in

Photographs by kind permission of GEC – Marconi Ltd

The First Wireless Signal

by Ken Smith

Crack, Crackle, Crackle... the first ever deliberate wireless signal flashed across the laboratory floor just over 100 years ago. Did you see a vast number of celebrations on TV (a medium **very** dependent on the events I am discussing), or perhaps you heard a talk on Radio 4? There **must** have been a mention in a piece on Radio 3? If so, I failed to hear it.

Strange isn't it, much gets broadcast about this president or that state, this political event or the other, but the very facts that gave birth to wireless get not a mention. I asked an audience of 50 to 60 sixth formers the other week if they had heard anything at all (even in a school lesson!) of this epoch making event – but all looked blank at the question.

Heinrich Hertz had been asked by Helmholtz, his senior supervisor (as we would call him now) at Berlin University, to look into the rather unbelievable claim made some time earlier by the Scotsman James Clerk Maxwell, that electromagnetic waves some metres in wavelength should exist which, once produced, would travel at 186 000 miles per second. Further, James had written that in theory the waves would have electric force lines vibrating in one plane and accompanying magnetic field lines always vibrating at right angles to them. The waves should start from very, very fast changes in electric force strength that some generator or transmitter might be made to produce. The final *pièce de résistance* was the statement that 'these waves are the same as light – only with vastly longer wavelength...'

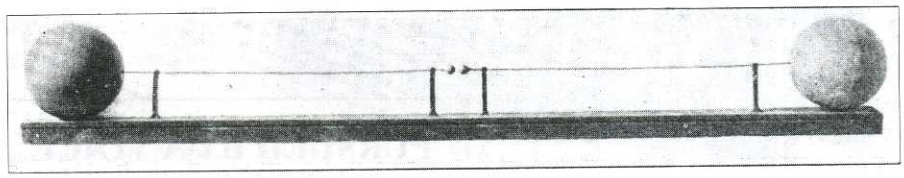


Fig. 1 - Hertz's 'Dipole' Oscillator

The Germans decided on efforts to refute these rather preposterous claims by Maxwell, using experiments to do so. But how to try to generate the waves, and how to ensure the detection of any that might arise so convincingly that failure to find them and measure their velocity would disprove Maxwell's theory?

Hertz put aside the attempt at this very difficult problem until 1888. By this time he had become established in a more senior post at Karlsruhe. Over the next three or so years from then (which means we are at the centenary celebrations time now), Hertz not only set up a brilliant set of experiments, but these experiments worked in Maxwell's favour, and resoundingly proved that electromagnetic waves existed and could be generated and sent electrically just as the theory predicted.

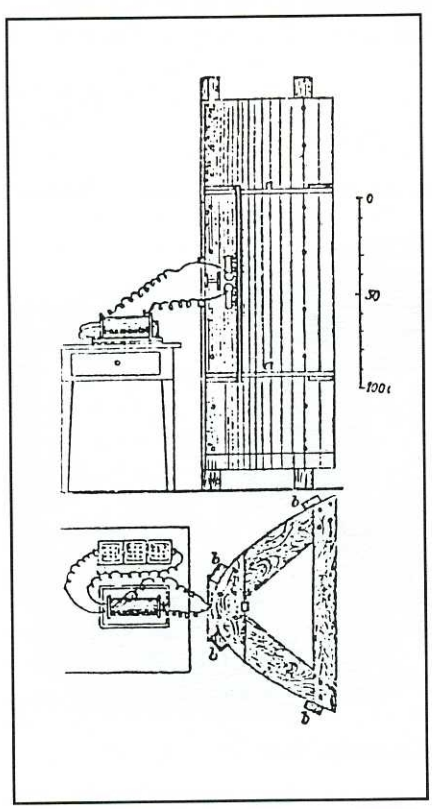
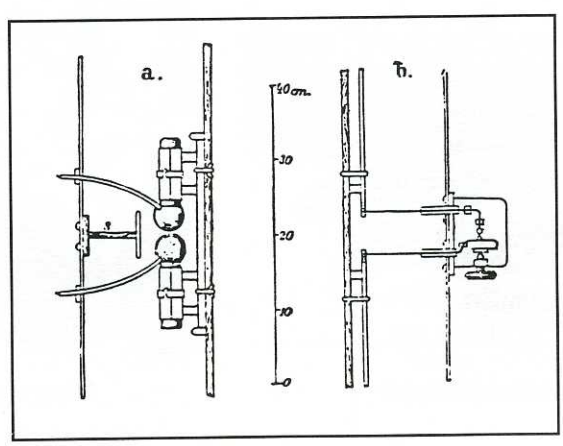


Fig. 2 - Hertz's drawing of the transmitting system for his 'Short Wave' experiments. Details of the sending and receiving dipoles are shown below at (a) and (b) respectively



How Did He Do It?

Hertz set up an apparatus to store a fairly large quantity of energy in a pair of conductors, then he 'emptied' this stored electrical energy through a straight conductor between them, causing a surging of current backwards and forwards some 80 000 000 times a second. The apparatus which he used, which still exists today, is shown in **Fig. 1**. The charge at high energy was stored on the two spheres, the 'switch' was a spark gap in the middle that broke down when the voltage was high enough, causing the enormous surge of current required. The high voltage charges stored on the spheres came from Hertz's use of one of those marvellous pieces of Victorian research apparatus – a Rhumkorff Induction Coil.

The rapid oscillation of the charges after the spark gap broke down, set up waves in space with a length a little over twice as long as the extent of the apparatus. The spheres and the conductor between them formed what we now call a dipole. In fact any wireless aerial one half wavelength long should be (and by some people is) termed a Hertz Dipole.

As the apparatus used by Heinrich was about one and a half metres long, the waves had a length somewhat over three metres from crest to crest. The problem was how to detect their presence? Hertz was a physicist, and understood perfectly well that the

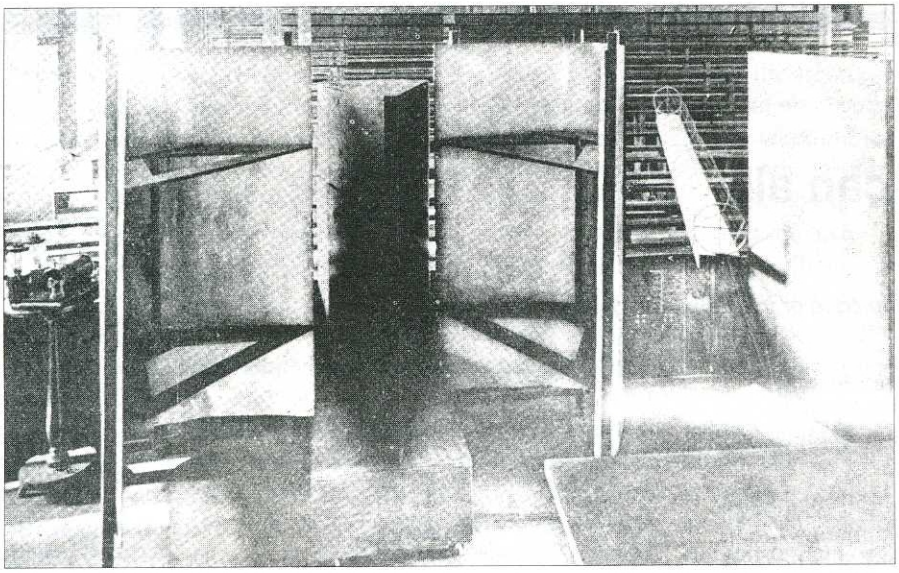


Fig. 3 - Hertz's dish aerials, as exhibited in Germany in the 1930s

apparatus must resonate rather like tuning forks in sound experiments. So he reasoned that if a loop of wire was cut to length and bent round so that it resonated at the 80 000 000 vibrations per second he had generated, it should respond to and pick up a portion of the radiant wave energy and with luck, a sufficient voltage should build up at the tiny spark gap across the ends of the ring, thus making the received 'signal' visible.

This indeed succeeded. Not only did Hertz detect the radiation, but he went on to show that the waves reflected, refracted and interfered, causing standing waves. This second series of experiments involved making a much shorter dipole, which in turn enable Hertz to generate very short wavelengths. These had a vibration rate of 450 000 000 times per second, or a wavelength of 66cm. In other words, Hertz was already well on his way towards the microwave region.

With such short waves, parabolic 'dish' aerials were possible, and Hertz set up two of these for the 'microwave link' he used to show the waves had all the properties of light. Reproduced here as **Fig. 2** is Hertz's own diagram of these reflectors, with details of the sending and receiving dipoles. The aerials as they were exhibited in Germany in the 'thirties are shown in **Fig. 3**.

Thus, Hertz was able to measure the wavelength and knowing the frequency of vibration, he worked out the velocity of the waves. This was within a few per cent of the value predicted by Clerk Maxwell, and earlier measured for light itself by the Frenchman Fizeau, who did it by sending a light beam some kilometres out and back between mountain tops.

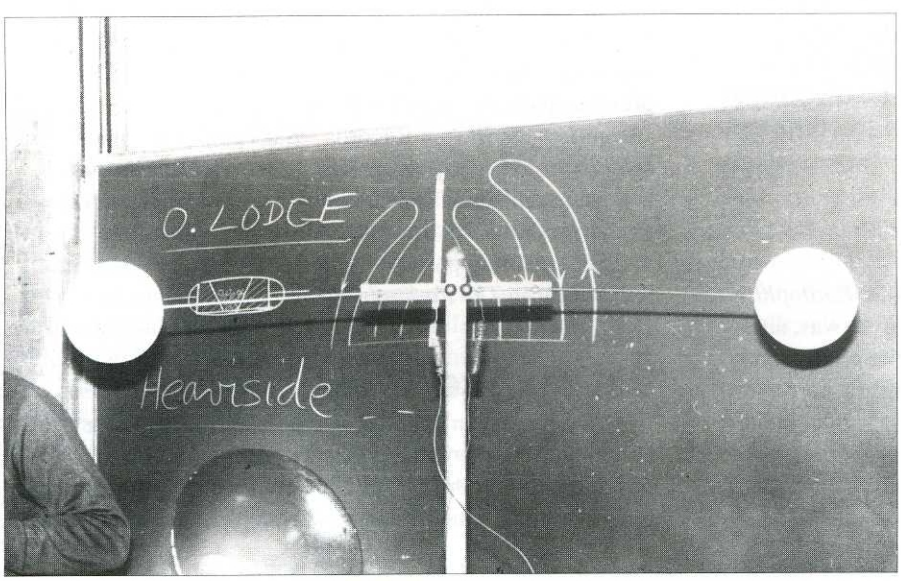
The power of the wave Hertz sent 100 years ago was surprisingly high [1]. Calculations show he was generating 16 kilowatts peak power. He was quite aware of this, as he gave his power as 20 horsepower in one of the papers he published. These extraordinarily high powers were the key to the success, as the received potential across the receiver loop points was sufficient to produce the visible spark needed.

The publication of these results electrified (sic!) the scientific world of the day, and very soon gave rise to the work of Marconi, Popoff in Russia and others, so that wireless telegraphy became one of the engineering marvels of the 20th Century. F. C. Judd has recently re-enacted these experiments with a reproduction of the 'long wave' apparatus, describing it in sufficient detail for any keen experimenter to reproduce [2] [3].

The author has also reproduced the gist of these experiments, together with the reproduction of a pair of 0.8 scale parabolic dishes to Hertz's drawings. The 0.8 scale 'long wave' transmitter is shown in **Fig. 4**. I can verify that all this apparatus works well, and the dishes send beams of electromagnetic waves some distance which are detectable at the receiving dipole terminals. The equipment has been on tour to twenty-three lecture venues all over the country, so that some 10 000 young people saw the re-enactments and participated in them, often showing a tremendous enthusiasm. The Radio Society of Great Britain should take note of this approach in its YEAR (Youth into Electronics via Amateur Radio) campaign concerned with worries about youth not taking any interest in wireless.

But still the unanswered question remains; why didn't every radio society, every newspaper and magazine, and all TV and radio channels carry some commemoration of this most interesting event?

Fig. 4 - The author's reproduction Hertz Dipole oscillator



References

[1] K. L. Smith, 'A Radiant Century', *Electronics & Wireless World* , November 1988.

[2] F. C. Judd, 'Heinrich Rudolf Hertz', *Practical Wireless*, December 1988.

[3] F. C. Judd, 'Reproduction Hertz Apparatus', *Private Communication.*

F. C. Judd, 'A Wireless Centennial, H. R. Hertz', *Private Communication.*

RB

Feedback...

The page where you can air your views

Letters should be original, and not copied to or from other magazines

GB Substitute

The first issue of *Radio Bygones*, received this morning, was read with interest. However, I was jarred to see an obvious error on page 31.

Six resistors of 10kΩ across 9 volts will draw 150 microamps, not 15, and the battery will not last long on continuous drain. It would be much easier to solder sockets from old valve holders to the top caps of dry cells (which have a long shelf life) and make a grid-bias battery in the way they used to be, and this would be cheaper over a period of one year.

I would not recommend use of 100kΩ resistors, since such a high impedance may cause common coupling between stages in some sets, and in a QPP output stage which takes some grid current on peaks, there would be added distortion. I do go on, don't I? 'Tis the Purist in me!

John I. Brown
South Ockendon

I'm still trying to work out how the mathematical boo-boo slipped through. I've treated the editorial calculator to a new battery, just in case, though it's behaving itself now! –Ed.

Stopping the Leak

Regarding the R1155 and those dreaded decoupling capacitors, aptly described by Chas Miller as low-value resistors in *RB* No. 1, I have found that these can sometimes be resuscitated by the following process.

Disconnect all leads and unscrew the capacitor can from the chassis; thoroughly cleanse the leads of all tired and flaking rubber insulation and other gunge, then place PVC or waxed cotton sleeving over each lead, pushing it as far down inside the can as possible. Test each of the three 0.1μF capacitors inside the can for insulation resistance and capacitance; the chances are that they will now measure 10 to 20 megohms or more, and 0.1μF ±20 per cent respectively. Provided the capacitors pass these tests, the can may be reinstalled inside the receiver, wired up and tested with power applied.

I wouldn't dare to guarantee that this method will work every time, and I don't claim any originality for it; however, it does obviate the necessity of having to replace the original decouplers with modern tubular polyester types which work fine, but just don't look right. I have noticed that some of these 3-way decouplers were originally wired with PVC covered cables on later issues of the 1155, and these seem to have a very high insulation resistance, based on samples tested.

Incidentally, does anyone know how many 1155s were made? Judging from one of mine, there seem to have been at least 80 000.

Neil Clyne
Uxbridge

Radio Bygones – your comments...

A very big thank you to all those readers who took the trouble to let us know their thoughts on *Radio Bygones*. I hope you'll continue to maintain that feedback in the months to come. As several of the points raised will be of general interest, I thought it might be useful to comment on them here.

Changes

As was only to be expected, some existing *Radiophile* readers had liked that magazine just the way it was, and wished it had stayed like that. For them, the problem has been solved by Chas Miller's decision to revert to publishing *The Radiophile* as a separate magazine. Others had welcomed the changes such as the introduction of colour and the broadening of coverage; some of them have decided to subscribe to both magazines in the future.

Back Numbers

One thing which we should have made clear in Issue No 1 of *RB* was how to get hold of previous issues of *The Radiophile*. Obviously, some readers will want the previous parts of 'The Pye Story' and Part 1 of the 'Amplifier for 78 rpm Records'. Back issues of *The Radiophile* are available, price £1.90 each including post and packing, from The Radiophile, 'Larkhill', Newport Road, Woodseaves, Stafford ST20 0NP.

The remaining parts of 'Amplifier for 78 rpm Records' will appear in *The Radiophile*.

Did You Ever Go...

Some readers in Eire have complained that we are charging them more than UK subscribers when 'the postage rates are the same'. This comment is, in fact, one that is received quite frequently by companies who run

mail order services in this country

It does not seem to be widely known in Eire that the basis of postal rates in the UK was changed about three years ago, when the Post Office decreed that the Irish Republic was no longer considered to be a UK destination, and European postage rates would apply.

The only concession is that letters of up to 20 grams in weight to Eire, in common with all other EEC countries, can be posted for 20p (the same as the UK Inland 1st Class rate). I think that this may be why the misunderstanding persists.

An issue of *Radio Bygones* weighs around 125 grams in its envelope, and costs 28p to send by 2nd Class Letter Post to a UK address, but 46p by surface mail to any other country, in Europe or elsewhere in the world. The difference between those two rates, taken over six issues, almost exactly equals the £1.00 difference in our UK and Overseas annual subscription rates.

Readers' Ads

Some readers have bemoaned the fact that we do not have a Free Readers' Advertisement column as many enthusiast and hobbyist magazines do, and feel that the Classified ad rate is uneconomic for their purpose.

The reason for taking this decision at the time of launching *Radio Bygones* is quite simple, though it was not an easy one. In special interest magazines generally there is a tendency for a few unscrupulous people to abuse Free Readers' Ads columns, by not revealing that they are really traders deriving most or all of their living from buying and selling the advertised items. Readers who respond to those adverts, expecting to deal with a private individual, frequently complain to the magazine concerned about this deception. Not that we've got anything against traders, let me hasten to add. They provide a service, and they've as much right to make a living as anyone else. It's just that people have a right to know who they're dealing with.

In response to this demand from readers, we are introducing a Free Readers' Advertisement feature from our next issue. You will find full details on page 11 of this issue. Please let us know if you find the service being abused.

Technical Terms

Capacitors or condensers? Kilohertz or kilocycles? The question of whether to use old or modern technical terms in newly-written 'vintage' material is one that provokes much discussion in publishing offices. We all have our own likes and dislikes, our own prejudices, and often the official standard-setters seem to be similarly torn. In television broadcasting systems, for example, it was decreed just a few years ago that the signals are radiated from antennas but received on aerials!

Perhaps I may reveal a few of my own prejudices. I prefer Metric measurements to Imperial (proponents of duodecimal systems, etc., please **don't** write; I've heard all the arguments and still remain unconvinced!), because from my own experience I think there is less scope for mistakes in Metric. However, I use both systems interchangeably and with the aid of a few easily-remembered 'anchor points' can convert most measurements in my head with reasonable accuracy. I know, though, that those of more advanced years find it difficult to come to terms with metres and kilograms, but at the same time anyone under the age of 26 or so may well know a foot only as the thing you have on the end of each leg.

I prefer kilohertz (kHz) to kilocycles per second (kc/s) etc., because it's shorter. Yes, I know, kilocycle is the same length, but what's a kilocycle? A cycle with a thousand wheels perhaps, or maybe a cycle-park in Amsterdam or Shanghai?

I **hate** rectangular boxes for resistors, inductors or logic gates, only introduced because of the inability of early mechanical drafting machines to cope with zigzag resistors, loopy coils, etc. The old symbols are much easier to understand, and to draw, too, if you're sketching freehand.

But if I'm reading for information, with my proof-reading function 'switched off' (not easy, after over 20 years at that game), I may not even notice which symbols or words were used in a particular technical manual, book or article. My brain just accepts and interprets all the alternatives. May I quote to you from a book which I came across recently, talking on this very topic.

'The term *capacitor* has lately been adopted as the correct one to designate devices which are used in electrical circuits to purposely introduce the element of capacitance. While the term capacitor is a very good one, the term *condenser* used commonly to denote the same thing, is perhaps used much more in radio and electrical work. The term condenser is a very poor one, for it has no relation to the action of the device in a circuit. The so-called 'condenser' does not 'condense' anything, except possibly the negative electrons crowded into the negative plate. Its capacity for storing electrical charge or electrons is called the *capacitance*. The term *capacity* is commonly used in practice instead of capacitance. The student should become familiar with all of these terms, for while it is desirable to use the correct one always, one must sometimes do as the Romans do when in Rome. Both sets of terms are found in radio and electrical literature. It is very difficult and almost impossible in some cases, to change a term which has been in common use for years, so it is doubtful if the terms *capacitor* and *capacitance* will ever entirely supplant the more popular terms *condenser* and *capacity*.'

Where and when did this gem of wisdom appear? In an excellent book entitled *Radio Physics Course*, describing itself with some justification as 'A book no radio student, set builder, experimenter or serviceman can afford to be without', and published in 1932! Although, with the passage of time, the final few words may be somewhat less true today than they were then, they still hold.

Geoff Arnold

Bits & Pieces

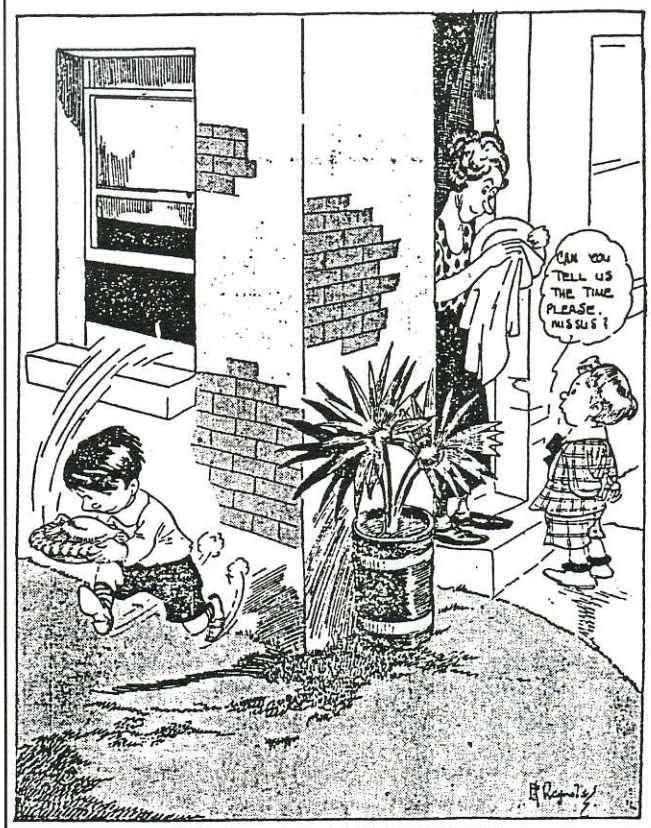
Coil Corrosion

Many old sets used double silk covered wire in wave-wound IF coils, and later used rayon, but did not impregnate the coils in wax. When rubber-covered flex was used in the sets the results were disastrous. I recall the first Radio Instruments Limited (RI) table superhet, which received good reviews, but within a year the sulphur released from the rubber leads blackened the coils and with atmospheric moisture the *Q* of the coils dropped to a low value, so the selectivity and sensitivity reduced the sets to local station use only. The sets were in guarantee, and RI had to pay dealers to fit new coils at ruinous cost in cash and reputation. It was found that the coils could be restored by first drying out in an oven at about 250°F (121°C) and then immersing them in a pan of molten paraffin wax. Following this experience, most set-makers took care to impregnate their coils.

In restoring an old set, it pays to look inside the IF cans, replace any rubber wiring, and if the selectivity is below spec. then suspect low-*Q* coils if they have textile-covered bare copper wires. Single-layer coils seldom go low-*Q*, and Litz wires usually survive since the strands are enamelled, but sometimes a few of the strands will be found broken due to movement or corrosion by soldering flux, so inspect under a lens. Of course, if one has a *Q* meter, checking is easier, but the sharpness of trimmer adjustment is a fair guide to coil *Q*. In the case of the RI set mentioned above, twiddling the IF trimmers made very little difference to gain.

John I Brown

The Brighter Side of Listening In



Wireless Terms Explained.—TWO-WAY WORKING.

THE LISTENER IN, NOVEMBER 30, 1927—Page 17

Radio Signals

'CQ CQ CQ' - a signal which has winged its way through the ether since the days of Marconi, signifying a call to all stations. In the earliest days of wireless communication at sea, CQ was even adapted as a call for help, by the addition of the letter 'D' (meaning distress). However, to send CQD in Morse code (dah-di-dah-dit, dah-dah-di-dah, dah-di-dit) is not the easiest thing in an emergency situation, nor would it stand out to grab your attention through a welter of other signals or atmospheric static crashes. In 1912, the *Titanic* sent both CQD and a newer signal SOS (popularly translated to mean 'Save Our Souls') after hitting a North Atlantic iceberg.

When transmitted in Morse, SOS is made as one signal (di-di-di-dah-dah-dah-di-di-dit), rather than as three separate letters, and is easy to send in an emergency situation, even perhaps by someone who is not a trained telegraphist. It also stands out well at the receiving end among the other signals on a busy distress and calling frequency.

In telephony, the international signal signifying a station in distress is 'Mayday'. This has no connection with ancient British rites, chasing maidens round the maypole, etc., but is an adaptation of the French 'M'Aidez', meaning 'help me'.

Where the general call CQ came from originally is not so clear-cut, and has been the subject of speculation and correspondence in many radio magazines from time to time over the years. The most common explanation is that it comes from 'seek you', but the argument for it has never seemed entirely convincing.

A couple of years ago, the American radio magazine *Monitoring Times* carried a brief item about a letter received from one James Van Dalsem of Albany, New York, which put forward an alternative suggestion. According to Jim, CQ was apparently first used by Marconi himself who devised a list of Morse shorthand which substantially reduced the amount of transmission time required to send common terms and phrases by a hand key. He suggests that Marconi, an Italian, might have derived CQ from the Latin 'cuique' meaning 'whomever'.

My knowledge of Latin is not renowned, having been chucked out of the Arts stream at school for achieving an overall 3 per cent in my first year in that particular subject! However, I do feel that this explanation seems as good as any, and more plausible than most. Or does anyone know better?

Geoff Arnold

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The Europhone 2-valve receiver, made in Birmingham in 1928

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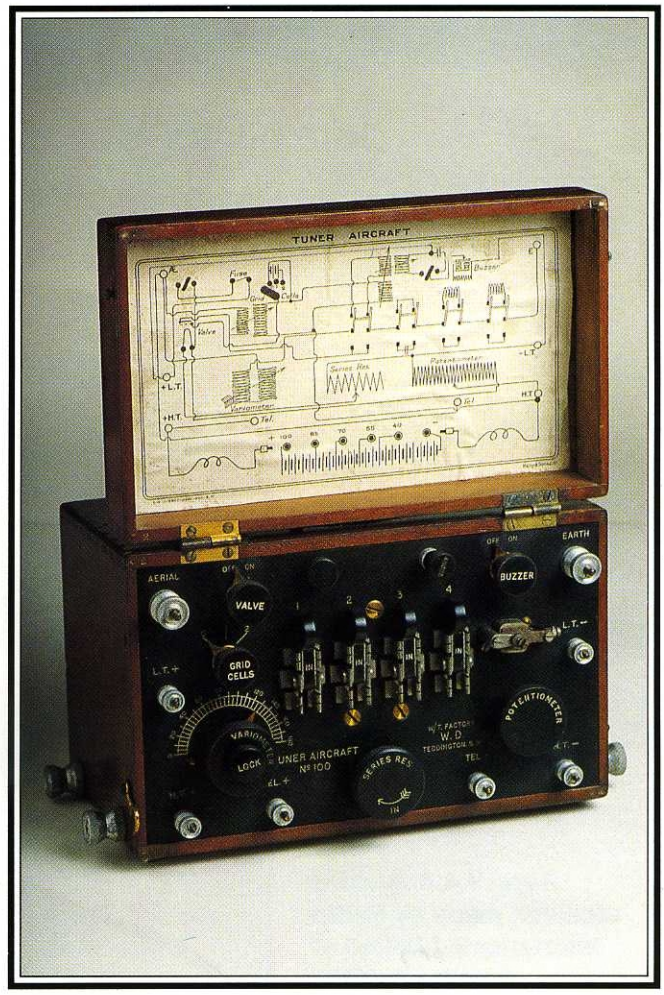
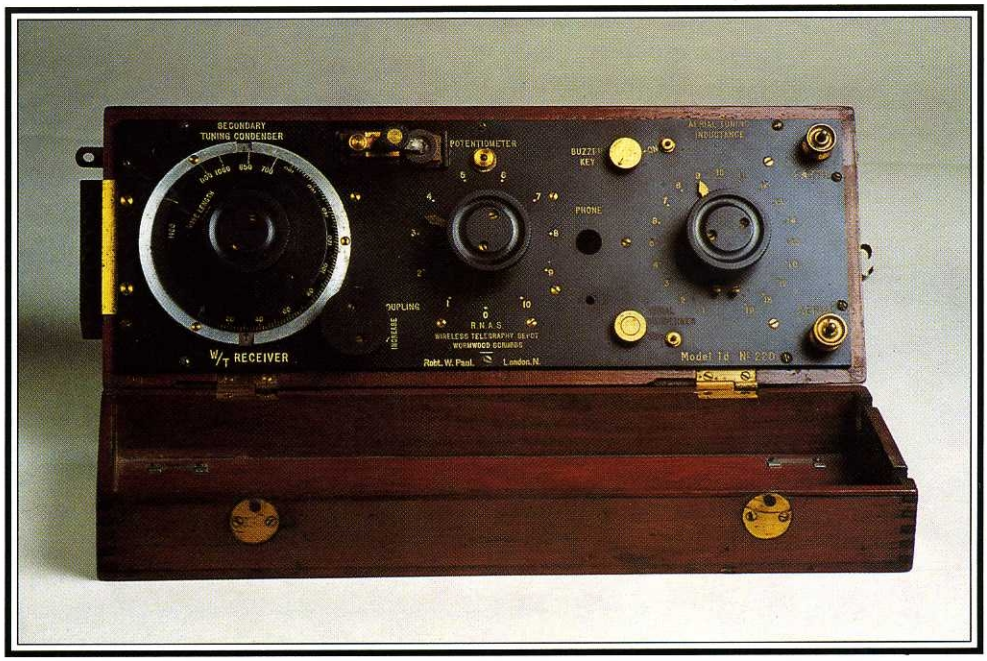


The 1-valve 'Tuner Aircraft No. 100', made at the War Department W/T Factory, Teddington, in 1917



A Crystal W/T Receiver Model Td, manufactured at the Wormwood Scrubs Depot in 1918 for the Royal Naval Air Service

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This month featuring items from the Journeaux Historic Wireless Collection

Type V.4.A. 4-valve receiver, made by Radio Instruments Limited of London in 1923