

BULLETIN OF THE BRITISH

# VINTAGE WIRELESS

SOCIETY



*A broadcast from London's 2LO studio in 1922 - ten years before the move from Savoy Hill to Broadcasting House. In August, the BBC celebrates 70 years of broadcasting and sixty years at Broadcasting House, with a social show and a new book. See "In Passing" on page 28 of this issue.*

**BULLETIN OF THE BRITISH  
VINTAGE WIRELESS SOCIETY**

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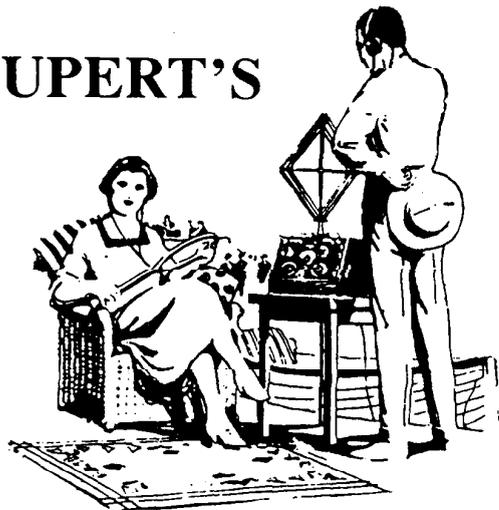
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**BRITISH VINTAGE WIRELESS SOCIETY**

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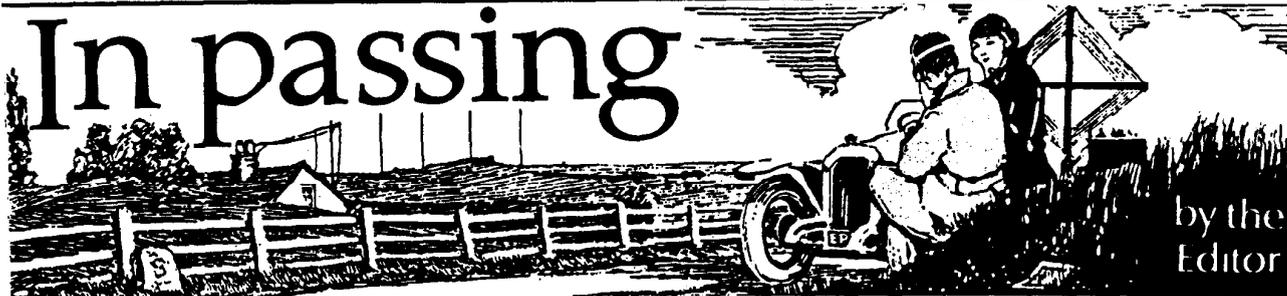
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**VINTAGE  
WIRELESS  
MUSEUM**



The Vintage Wireless Museum, headquarters address for the British Vintage Wireless Society is at 23 Rosendale Road, West Dulwich, London SE21 8DS. Telephone: (081) 670 3667. The Curator is Gerald Wells, whom visitors should telephone before visiting the museum.

# In passing



Correspondence for the Society's Bulletin should be addressed to The Editor, Robert Hawes, 63 Manor Road, Tottenham, London, N17 0JH. Telephone: (081) 808 2838.

## Auctions

Auctions arranged by the Society are increasingly successful, helping the exchange of items between members as well as raising income for general funds. We now have two kinds of meetings. First the large swapmeets, at the end of which we have small auctions to help dispose of things remaining unsold on stalls. These provide many bargains. Secondly, we have Major Auctions, the next on 16th August, for which lots are entered well in advance so that a catalogue can be printed and posted. These attract valuable and sometimes rare pieces of equipment as well as classic sets and all sorts of useful spares and seem to be going "up-market". Even so, the smaller auctions, which are so important to those who have limited cash for their hobby, attract interesting sets and surprise items like the Round Valve which went for £250 at the last sale. Thanks are due to our auctioneers Terry Ransom and Ron Deeproise and to John Howes and Jim Butterworth for their help. Members wishing to take part in the next Harpenden Major Auction are urged to apply immediately, whether buying or selling. Many who are expected to come have so far failed to return the form sent with the last Bulletin: arrangements cannot be made for people if they fail to let us know they are coming. We have to "screen" all entrants at the door because this is a "members only" event and for security reasons. If you arrive without booking in advance you may not be admitted - even with a ticket. So please return your form immediately.

## New Meeting

Our policy has always been to try to cater for members in as many parts of the UK as possible and we now have regular meetings in Avon, Kent and Hertfordshire. We hope soon to add Humberside to the list, because a long-standing member, Ernie Roberts of Hedon, Hull, has responded to our call for volunteers to run new regional meetings. He is now making enquiries with a view to arranging a pilot

meeting in the market town of Beverley later in the year and details will be sent out as soon as we have more news. Although the meeting is primarily intended for people in the area everyone will be welcome and because there are tourist attractions in the area as well as cheap accommodation, it is expected members may travel from afar and make a week-end of it. Anyone who would like to help at the meeting should contact Ernie at 33 Charles Street, Hedon, Hull, N. Humberside HU12 8HT, enclosing an SAE or ring him on 0482 898615.

## For your diary

After the next Auction, at Harpenden on 16th August our next meeting is on 6th September, a Swapmeet at our new venue in Portishead. It was fully

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booked last time, so if you wish to attend, please send an SAE immediately for details to the Organiser Alex Woolliams, 11 Norton Road, Knowle, Bristol BS4 2EZ. (Tel: 0272 721973).

Further dates of Society meetings are: 4th October, Swapmeet and mini-auction at Harpenden and also the Society's AGM; 8th November, Swapmeet and mini-auction at Southborough. (Details SAF), organiser John Howes, 11 Crendon Park, Southborough, Tunbridge Wells, Kent, TN4 OBE. (Tel: 0892 540022). All are official BVWS events, open only to members and profits are ploughed back into Society funds.

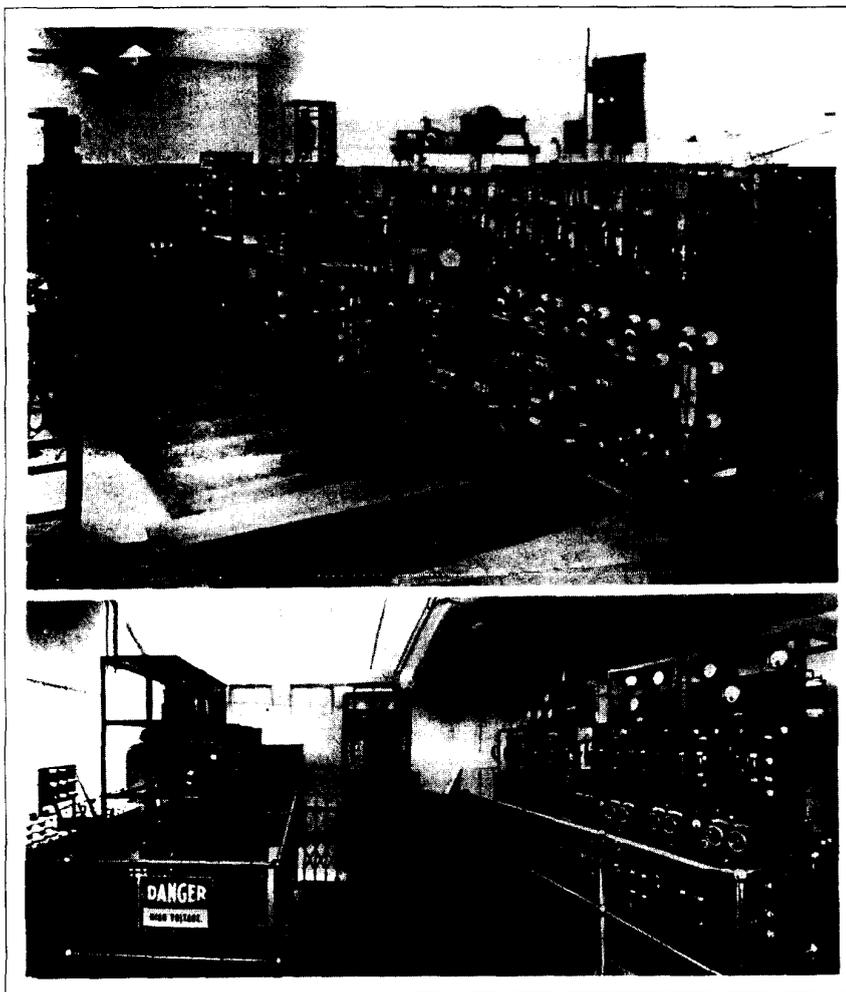
## Information Exchange

Are you stuck for a circuit for a set you've just found? Looking for somebody who has a set the same as yours for comparison? Seeking some grille-cloth, a vital spare, reproduction parts or a special kind of service like transformer winding? You may find help with these and other problems by joining our "Information Exchange". It costs nothing to take part, except a willingness to help other members in return. Our Information Officer Dave Adams is building up a useful list of participants and sources of supply. Send an SAE to Dave at 69 Silver Lane, West Wickham, Kent, BR4 ORX for details.

## New Supplement

Our latest Supplement is appropriately entitled "Just a Few Lines" and is in celebration of the diamond jubilee of the BBC television service, which began in August 1932 when they took over broadcasting from the Baird company. The anniversary coincides with that of the opening of Broadcasting House in the Summer of 1932. We hope that the celebrations for the latter event will include an appropriate reference to the Television anniversary. We are honoured to be able to publish

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exclusively these personal recollections of Mr. T. H. Bridgewater, OBE, the sole survivor of the original technical team which set up the studio in the basement of Broadcasting House to broadcast 30-line programmes. His career covered every facet of television from his experiences with Baird in 1928 until he retired as Chief Engineer, BBC Television in 1968. The Supplement is being distributed free to BVWS members but additional copies will be available for sale on application to the Editor.

### BBC Radio Show

A multi-media stage show and exhibition. "The BBC Radio Show", marking 70 years of BBC Radio and 60 years of Broadcasting House, opens on 22nd August and will run until 4th October. It will provide an opportunity for listeners to look behind the doors of the famous building and also to see a static

*The two 2LO transmitters: (Top) the earliest equipment, used at Marconi House, London from May 1922 and taken over the British Broadcasting Company in November 1922. This transmitter will be exhibited at the Broadcasting House exhibition.*

*(Bottom) the equipment on the roof of Selfridges store, London in March 1925 which in addition to putting out its ordinary programmes, was also made available for Baird to broadcast experimental television signals.*

*(Photographs by kind permission of GEC-Marconi and with thanks to Roy Rodwell of the Press Office for his kind assistance and advice).*

exhibition featuring milestones of radio history and a multi-media show to be performed several times daily, employing the latest audio-visual technology, live actors and audience participation. The exhibition is being designed by Neal Potter who did the Museum of the Moving Image displays and the British Pavilion at Expo '92 in Seville. Charles Chilton of "Oh What a Lovely War" fame, who entered the BBC as a lad in its first year at Broadcasting House, has

written the Show, John Cain, former BBC Controller of Public Affairs, who has been researching BBC history since his retirement in 1984, is writing a large-format paperback 1922-1992 history in time for the show.

The show is intended for the general public rather than vintage wireless buffs, who should not expect to see much vintage technology on show, there will be one special piece of hardware installed in the entrance-hall: the original 2LO transmitter which has come out of storage for the occasion- or rather the 75% of it that has survived.

It won't be a free drop-in show and ticket will have to be obtained by post in advance, costing £3.50, but there will be some concessionary prices.

### Replica contest

There is still time to enter our "Replica Contest" for which some members have already built equipment specially, some of which was on display at the last Harpenden meeting. Further displays will be mounted at future meetings. Gerald Wells of the Vintage Wireless Museum will judge the entries, which must be receivers built or restored by the entrant of designs published before 1940 (source must be named: ie magazine or manufacturer's kit details). Sets can be battery or mains and must be working; and may be home-built from specified original or restored components or from kits. The criterion for adjudication will be authenticity and judging will be at the Harpenden meeting on 4th October. Prizes will be original drawings by Norman Jackson of wireless subjects.

### Old Daventry

We hear that something of the old Daventry transmitting station 5XX, which closed down in April of this year, is likely to be preserved. The station - the BBC's 21st to open, began transmission in July 1925 from an ancient site which was once a Roman encampment. It is hoped that the hilltop site will be kept as open ground, on which the old 5XX building will be preserved as a "History of the Hill" museum to include relics of the transmitter. It is possible that the original 2LO transmitter equipment - the one used at Marconi House in May 1922 may go to the museum on permanent loan. One of the original masts will be left in place.

## Transmitting History

At 9:00 a.m. on August 12, 1901, as many curious Nantucket citizens watched on 'Sconset's Bunker Hill, the signal came in loud and clear....

# Siasconset Wireless Stations

by Captain John Lacouture,  
U.S. Navy.

*Captain John Lacouture attended the U.S. Naval Academy and Princeton and Cambridge Universities. He was a naval aviator for thirty years and commanded the aircraft carriers Saratoga and Independence.*

For years we have been coming to our cottage in 'Sconset near Bunker Hill, the site of America's first permanent wireless station. And, normally, each spring we spend several weeks on the Helford River in Cornwall, England, about twenty miles from the spectacular site on the cliffs at Poldhu where Guglielmo Marconi transmitted the first radio signal across the Atlantic. It seems inevitable, therefore, that I should write about the early days of Siasconset's Marconi stations.

This 'Sconset story began in Europe in the late nineteenth century with Marconi's wireless experiments in marine communication, first in his native Italy and then in Great Britain. He installed his equipment on lightships and lighthouses, on British naval vessels and ocean liners, and on shore stations, transmitting and receiving messages which ranged from reports of popular racing regattas to accidents at sea. Impressed by Marconi's accomplishments, Commander John D. J. Kelley, senior writer-manager of the New York Herald, alerted its owner and publisher, James Gordon Bennett, who was also a yachtsman and racing enthusiast, to the usefulness of wireless to newspapers. At Bennett's direction, Marconi put up stations on shore and on two ships to cover the 1899 America's Cup Races in lower New York Harbour. He became a national hero by sending 1200 messages that updated the races' progress, and his success confirmed the Herald's confidence in the potential of wireless communication as a tool of the press.

The news vacuum which had for so long frustrated those on the high seas could now be eliminated. Transatlantic liners could report their



The first Siasconset Marconi Station began operations on August 12, 1901. Wireless equipment was installed in the left ell.

position and estimated time of arrival. Their passengers could keep informed of world events and could exchange messages with persons ashore.

The enthusiasm of Kelley and Bennett for using the Marconi system to communicate with ships at sea would move the focus of events closer to Siasconset. As western stations the Herald selected Nantucket Island and, forty-two miles away, South Shoals where Nantucket Lightship was the first point of contact for ocean liners bound for New York City. Crookhaven on the south coast of Ireland became the eastern location.

When Siasconset was chosen as the specific site for a wireless station on Nantucket, Guglielmo Marconi was not present. He had worked continuously since the America's Cup Races to improve transmission distance and reception clarity and was deeply involved in preparing for his most spectacular triumph of transatlantic communication, which linked Poldhu, England, with St. John's, Newfoundland. His representative, W. W. Bradfield, and Commander Kelley selected a lot owned by Samuel Pitman on Bunker Hill behind 'Sconset village as the ideal spot for a marine communication station. They rented the Hussey cottage already on the site to hold the wireless equipment and to house the operators.

Early in August 1901, Antone Perry of New Bedford and a crew of five riggers began construction of the station under the supervision of

Commander Kelley. He, in turn, was assisted by Mr. Bradfield, J.C. Lockyer, and E. N. George, all from the Marconi Wireless Company in London. Twenty-five hundred feet of wire arrived on August 3 from New Bedford. Spars for the mast were also built there. The bottom spar - 77-1/2 feet of Douglas fir, 18 inches in diameter, weighing 3-1/2 tons - was the largest ever shaped in that historic whaling port. The topmast was white pine - 68 feet long, 11-1/2 inches thick, weighing 3/4 ton; and the topgallant mast was 45 feet long, 8 inches thick, weighing 700 pounds.

The spars were so large that the regular Nantucket steamer refused to load them, and the tug Petrel had to be chartered to tow them the seventy miles to the island. The location of Nantucket's wharves and the narrowness of its streets complicated the arduous task of dragging the huge masts, mounted on wheels, to 'Sconset. The largest spar required a team of eight horses. By August 10, forty-eight hours after arrival, all three sections were nevertheless raised in place. The whole procedure caused great interest among Nantucket's permanent residents, and many retired master mariners gathered to watch and advise. The 186-foot mast, located on land 55 feet high, placed the receiving wire 241 feet above sea level. Meanwhile, Bradfield and his assistants were busy in the Hussey cottage erecting the

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## Transmitting History

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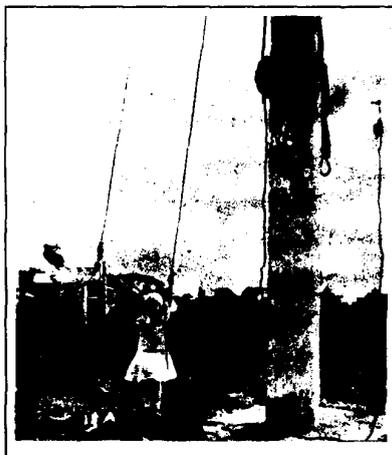
apparatus for the large receivers, the transmitter key, and other equipment. Within twenty-four hours after the mast was in place, the Siasconset wireless station was ready to transmit and receive.

Bradfield and Lockyer along with Perry and the riggers then planned to set out immediately by tug for treacherous South Shoals and Nantucket Lightship No.66. where they would secure a 45-foot wooden spar to her 60-foot steel mast, rig the cables, and install the wireless equipment. Although they were delayed at Nantucket by a reluctant tugboat skipper and at South Shoals by seasick riggers, Bradfield managed to complete the installation and departed from the lightship on Sunday evening, August 11. He left Lockyer to operate the wireless initially and to train two New York Herald operators. The first test was set up for Monday morning.

At 9:00 a.m. on August 12 1901, as many curious Nantucket citizens watched on 'Sconset's Bunker Hill, the signal from South Shoals came in loud and clear: three dots and a dash, the letter V in Morse code. "We've got her!" shouted Bradfield., and signals were quickly exchanged. Siasconset's signal, or call sign, was MSC. The first message from station to lightship was: "How are you all? What's doing?". The response from No.66. "Convalescent thanks. Foghorn going since last night".

News of the successful contact spread throughout the island. Soon, there was a string of visitors at the wireless station, marveling at the flying blue sparks and amazed that it was possible to communicate through space. On Tuesday morning, Margaret Fawcett, the little daughter of well-known actors, George and Percy Haswell Fawcett, raised the Stars and Stripes on the big telegraph staff. Construction personnel and station operators had given her the honour in gratitude to the Fawcetts for their many kindnesses. Those in neighbouring cottages followed the example and set their colours in recognition of the event.

In the meantime, the New York Herald built up publicity prior to receiving the first official message from a transatlantic liner. One article trumpeted that the Herald's wireless station on Nantucket Lightship would shorten the Atlantic crossing by one day and that westbound passengers could communicate with the American continent fourteen to



*Perce Haswell Fawcett, well-known member of Siasconset's actors colony, and daughter Margaret. The little girl raised the colours at the opening ceremony of the New York Herald's Marconi wireless station in 1901*

sixteen hours earlier. The paper announced that the route of communication from the liner would be first by wireless from the lightship at South Shoals to the 'Sconset station, then by telephone to the Nantucket office of the Southern Massachusetts Telephone Company and finally by telephone to the mainland and the Herald office in New York.

The Cunard liner *Lucania*, sailing from Liverpool on August 10, was selected as the first transatlantic liner to greet the New World with a wireless message sent from midocean. The Herald flashed: "...[It] is singularly appropriate that the old Cunard company's line... should inaugurate this magnificent achievement of science, genius and inventive skill." The long ocean voyage would be robbed of the terrors of isolation.

While everyone awaited the much-publicised approach of the *Lucania*, the first message to reach the Siasconset station actually came on Wednesday evening when the west-bound German liner *Lahn* asked to be reported. On Thursday, a passing tramp steamer made the same request. As Friday, August 16, approached and the *Lucania* reached transmission range, Commander Kelley of the Herald assigned men to forward messages from the *Lucania* quickly and sent the lightship a series of latest news bulletins to be transmitted.

Finally, the historic message from Captain Horatio McKay was received at Lightship No.66. and was

transmitted by Marconi operator Lockyer to Siasconset. As Kelley and Bradfield listened and watched breathlessly, operators Tom Tierney and E. Mitchell wrote out the words: "All well on board. We are 237 miles from Sandy Hook. Expect to reach New York Harbour Saturday." Within thirty minutes the Herald office has the story. The first private message from the *Lucania* was from passenger Carroll Payne to Clark Howell at the Atlanta Constitution: "Homeward bound. Passage rough. Though far from home message sent thanks to the Herald's enterprise."

By midnight, Siasconset station could read *Lucania's* messages directly, and by 2:45 a.m. there was good two-way communication between the ship and the station. Eight hours elapsed from the initial exchange of signals between *Lucania* and Lightship No.66. until the final exchange between 'Sconset and liner. As the passengers of the *Lucania* disembarked, they received a souvenir issue of the Herald covering the vessel's historic voyage. Copies were sent to 'Sconset and the lightship so that all participants would be able to show their grandchildren the story of the inaugural operations of the first, permanent Marconi system in the United States.

The early novelty of wireless fascinated everyone on board the vessels that were equipped with it. On August 20, 1901, Nantucket Lightship began to relay messages from the North German Lloyd liner *Kaiser Wilhelm der Grosse* via the 'Sconset station at about 10:30 p.m. For almost three hours, passengers stood outside in a driving rain to get the latest news. Because, in the time available, only a few could send souvenir messages, passengers offered as much as one hundred dollars to be selected.

Although its novelty wore off as more and more ships installed the equipment, wireless communication continued to prove its worth; and 'Sconset station settled down to a busy routine. Its first operators were Mitchell (chief), Fund, and Tierney; once the latter had mastered the system, he was transferred to South Shoals and became the first American assigned to duty as a regular lightship wireless operator. 'Sconset shifts changed at midnight, 8:00 a.m., and 5:30 p.m., and the busiest period was usually from afternoon to early evening. Messages from New York, including the closing stock market prices, came in for transmission to passing liners. Ships that met in mid Atlantic could exchange messages

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## Transmitting History

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that were relayed to Siasconset or Crookhaven and received days before the vessel reached its destination.

One of the principal, but unofficial, duties of the 'Sconset wireless station was to provide daily bulletins of the New York Giants' baseball games for the summer citizens of 'Sconset. Today, if one wonders "Why not the Red Sox?", one must remember that these bulletins went to members of the Lambs Club who were largely New York theatre people. Whenever there was a game, they gathered at the Ocean View House down the road from the station. If the Giants won, there was much celebration; if they lost, however, the flag was lowered to half-mast, and it was a gloomy night in 'Sconset.

In spite of increasing general, business, and marine communication, the New York Herald did not continue to operate its own wireless stations. Two years after James Gordon Bennett and Commander John D. J. Kelley opened the 'Sconset relay and demonstrated the commercial uses of the wireless telegraph between ship and shore, they sold the Siasconset station to the Marconi Wireless Telegraph Company of America. Kelley became the firm's treasurer and a member of its board of directors. (I wonder what happened to the station's painted sign, which Henry Paddack had presented to him: it included an owl, the emblem of the Herald, carved by Nantucket artist James Walter Folger.)

The Marconi Company's 'Sconset station became one of the most important in America; but as its work load increased, its facilities were no longer adequate. In 1904, an enlarged, refitted station was moved across the road and two taller wireless poles were erected. In 1907, an overheated exhaust pipe caused a fire that left only the chimneys, the foundation, and the generator standing by the time the chemical fire cart came from town. The structure was rebuilt, and the station's important operations routine continued until the end of World War 1.

Over the years, the general public would be reminded of 'Sconset station's vital communication role only in times of marine crisis. On December 10, 1905, for example, Siasconset received the first American distress call. Replacement Nantucket Lightship No.58, then stationed at South Shoals, had sprung a bad leak and was in danger of foundering.

FIFTH SECTION. **THE NEW YORK HERALD.** PAGES 1 TO 11.  
NEW YORK, SUNDAY, AUGUST 18, 1901.—CONTINUED. PRICE FIVE CENTS.

**INSTALLING THE NEW YORK HERALD'S WIRELESS TELEGRAPH STATION AT SIASCONSET**

Practical Application of the Modern Miracle of the Wireless Telegraph Message—How the Isolation of the Transatlantic Voyager Was Done Shortened by a Whole Day.

On Sunday, August 18, 1901, the New York Herald announced that its Siasconset Marconi wireless telegraph station had transmitted by telephone the historic first message of the Cunard Liner *Lucania*, as relayed from Nantucket Lightship No. 66 on South Shoals.

Upon receiving the call HELP (CQD before the days of SOS), 'Sconset alerted the Coast Guard and other ships in the vicinity. The U.S.S. *Azalea* rushed to the lightship's assistance and arrived just in time to remove the crew before the vessel sank.

On the night of January 23, 1909, two ocean liners collided in dense fog sixty miles south of the Siasconset wireless station. Duty operator Jack Irwin immediately picked up their call for help and flashed messages to all naval stations and incoming vessels. Soon, eight tugs and ocean liners were rushing to the scene where J. P. Morgan's *White Star* liner *S. S. Republic* with 750 passengers and crew had been struck broad-side

amidships by the bow of the Italian liner *Florida*.

Impeded by the fog, the *Baltic* was nevertheless first to arrive and found that the *Republic* was quickly sinking. The *Florida*, although badly damaged herself, had removed all of the *Republic's* passengers and crew. The *Baltic* went alongside the *Florida*, removed most of her passengers as well as all the *Republic* personnel, and took them to New York. The *Florida* eventually made port under tug escort. As a result of this dramatic rescue, Congress passed a law in 1910 that made the installation of wireless mandatory on all American ships carrying more than fifty passengers and crew on routes longer

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## Transmitting History

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than two hundred miles. This, of course, increased markedly the work load of the Siasconset station.

The wireless heroes of the Republic disaster were its telegraph officer, Jack Binns, and Siasconset station operator Irwin. Binns had transmitted the original CQD to 'Sconset and sent out status reports from the badly damaged, sinking ship almost to the last, Jack Irwin received much credit for alerting rescue operations, but curiously, an act of personal kindness two years before would be of greater historical note than his heroic action in the sinking of the Republic

In September 1906, through Irwin's help, David Sarnoff, an eighteen-year-old immigrant from Minsk, Russia, became an office boy in the Marconi Company's New York office. By 1908, when Irwin was one of four operators at the 'Sconset station, he had trained Sarnoff to replace him whenever he went to sea on one of the company's ships equipped for Marconi wireless. While living under Oscar Folger's roof in 'Sconset, David studied hard; but who would have thought that one day he would be General Sarnoff, founder and chief executive officer of R.C.A. (Radio Corporation of America)?

During the most famous sea-going disaster of the twentieth century, the

Siasconset station played a critical role. Late on the night on April 14, 1912, duty operator Matt Tierney received distress signals from the sinking Titanic. Siasconset was the first mainland wireless station to receive them, and he immediately alerted all other stations of the tragedy.

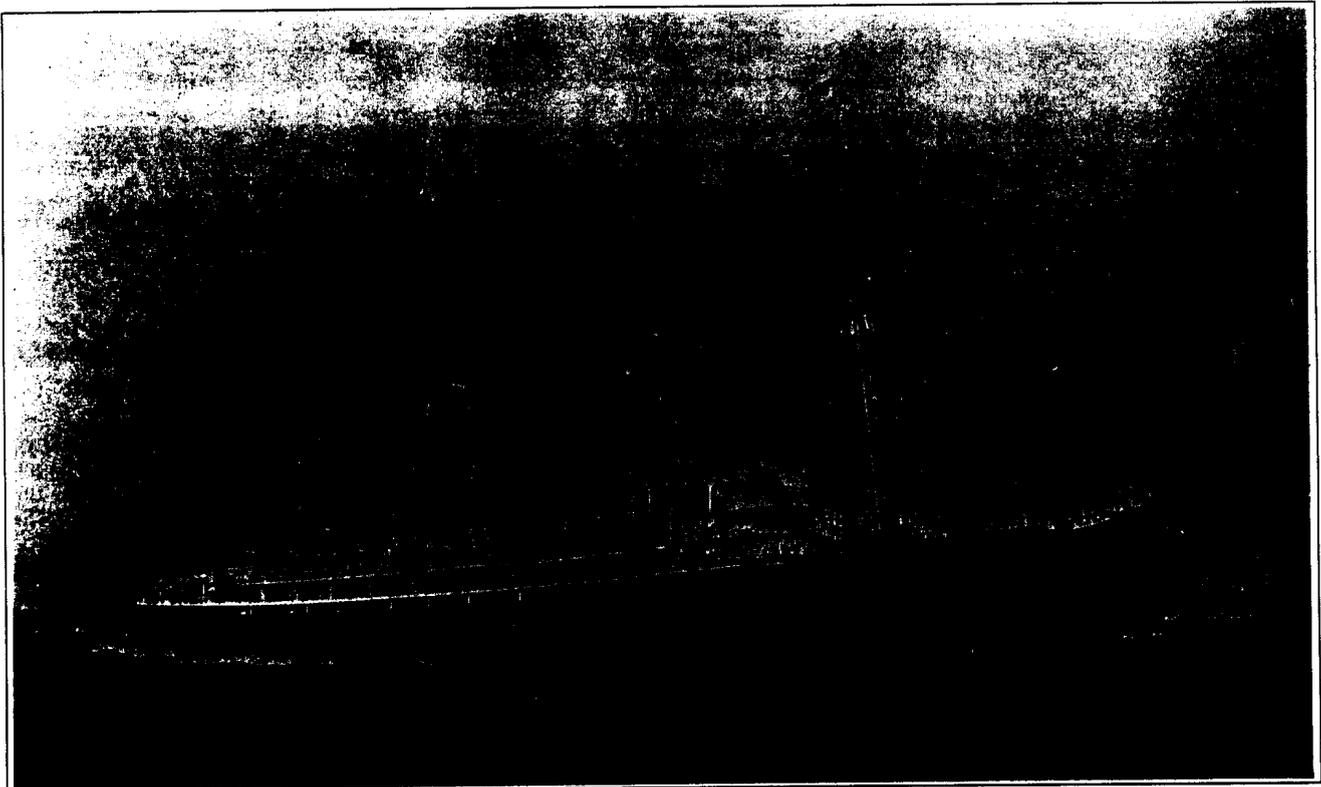
With the start of World War I, new factors complicated the work of Siasconset station. On September 25, 1914, the government closed it for an alleged violation of neutrality laws. A Navy Ensign assigned as censor had reported the violation. The company questioned the legality of this closure but was overruled by the government. On January 17, 1915, the station reopened under Navy supervision, which lasted for the duration of the war. On October 8, 1916, prior to our entry into the conflict, the station picked up, within a period of six hours, the distress signals of six ships, all torpedoed and sunk off Nantucket by one German submarine, the U-53. Soon after World War I ended, the second Siasconset station closed permanently; but this was not quite the end of wireless communication on Nantucket.

In 1920, the International Wireless Telegraph Company thought a commercial wireless operation was

still needed on the island and built a large station just south of Sankaty Golf Club. This third, short-lived station had the latest equipment and could communicate with steamers out to 1800 miles. Placed in operation on October 13, it did a thriving business for a while. For some reason - probably new, competitive communication developments - this last 'Sconset wireless station shut down for good in April 1922.

To commemorate the site of Siasconset's wireless operations and the seventieth anniversary of the reception of the *Lucania's* historic message, the Nantucket Historical Association erected a plaque outside the Cahoon cottage at Bunker Hill on August 16, 1971. The importance of this "famous first" and the vital services performed are evidenced by the replacement stations maintained in the area over the next several years. The 'Sconset stations deserve to be remembered for the significant role they played in the early years of American wireless communication.

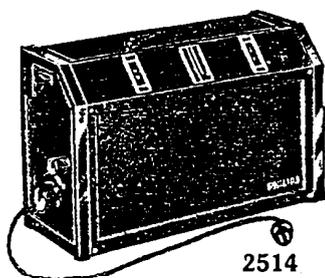
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Cunard liner S.S. *Lucania*, built in Glasgow, 1893. Eight hours elapsed on August 16, 1901, from the initial exchange of signals between the liner and Lightship No. 66 until the final contact between *Lucania* and 'Sconset.

## More "Rare Beasts": The First Philips Set

Following Geoffrey Dixon-Nuttall's article, "A rare Beast", in *BVWS Bulletin* 17/2 John W. Stokes, Editor of the *Bulletin of the New Zealand Vintage Radio Society*, writes more about early Philips sets.



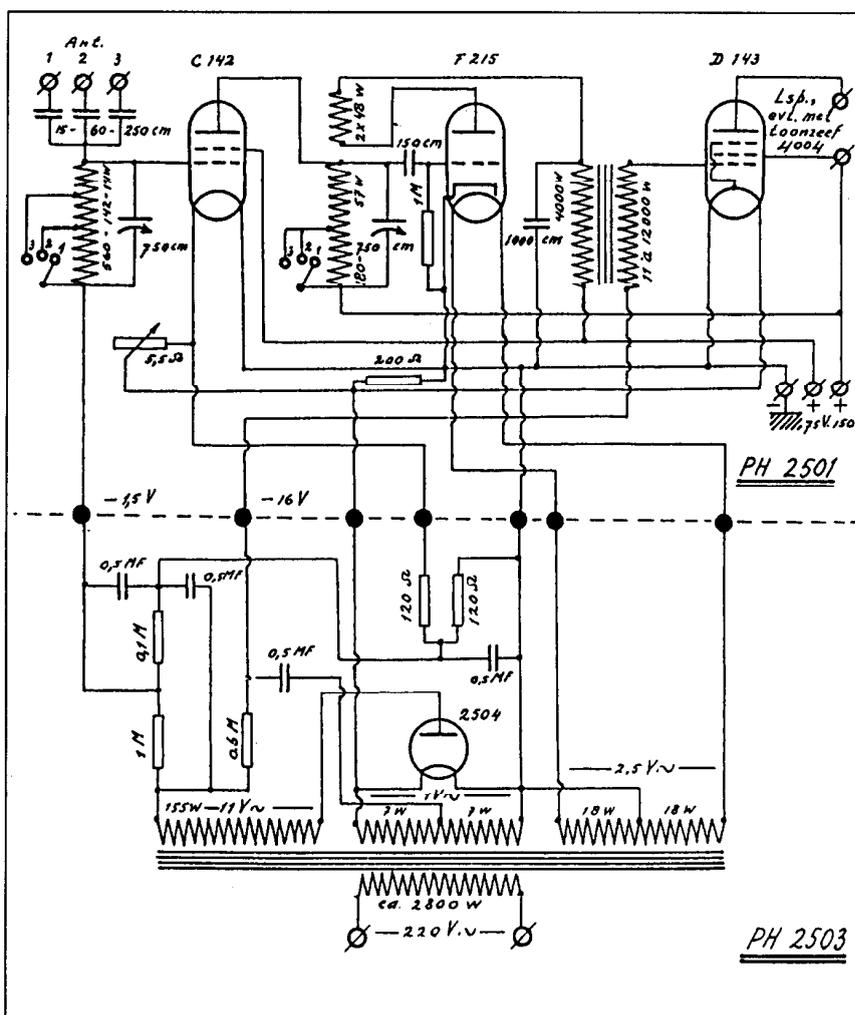
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Because of the widespread interest in Philips receivers nowadays apparent amongst collectors in many countries, the question sometimes arises as to which was actually the first model produced. Because in the very early days, another firm was also involved, the position is not quite so straightforward as it would otherwise have been.

That firm was *Nederlandche Seintoestellen Fabriken (N.S.F.)* of Hilversum, which had been established in 1917 as a manufacturer of marine radio equipment. Later, in 1924, N.S.F. had started to make domestic receivers. This firm's know-how and experience were apparently considered worth acquiring by Philips to provide a springboard for their entry into the field of receiver manufacture.

So it was that in 1926 Philips took over the firm of N.S.F. and by the end of the year were ready to launch their first receivers.

Just prior to this, however, they had marketed a few radio accessories which included a cone speaker and two models of HT battery eliminators. Other similar items were to follow over the next few years until production of this class of goods was discontinued in 1931.



The first receivers to carry the Philips name were two small 3-valve sets, types 2501 and 2502; the former an AC mains model and the other of similar size and shape to the one used on the later and better-known type 2802 short-wave receiver.

Both models used the same circuitry, a SG RF stage, a regenerative detector and pentode output the design of which has been attributed to N.S.F. The valve line-up consisted of C142 tetrode, F215 triode, D143 pentode. Only the F215 was indirectly heated, its heater rating being 2.5 V, 1.5 A. The other valves, including the bias rectifier to be mentioned later, had filaments rated at one volt.

To the writer, the chosen voltages reflect some uncertainty as to which way to go on the part of Philips at the time. The figure of 2.5 volts had by then already been chosen as an industry standard in the U.S. for American indirectly-heated valves, a fact which must have obviously influenced Philips in their choice of the same voltage. But the use of a

Philips Type 2501 radio with built-in power pack type 2503. Note the unusual method of obtaining bias by means of a separate rectifier. The valves used were specially developed for this receiver; note that the screen-grid valve is directly heated. (Circuit diagram published by arrangement with *Nederlandse Vereniging voor de Historie van den Radio*).

voltage as low as one volt for directly-heated valves was going one step further than the American figure of 1.5 volts. However, the 1-volt valves soon became obsolete and the figure of four volts became the European standard for AC mains valves.

Apart from the valves, the main point of interest to be found in the 2501 was its unusual power supply arrangements. Although using a separate power pack, as was common practice in other countries at the time, in Philips' case only the HT supply was derived from this unit. Probably to save having to develop a completely new combined A, B and C supply Philips opted for using one of their existing HT battery eliminators

## Vintage Technology

> Continued from previous page

and providing the LT and bias supplies by means of an inbuilt filament transformer. This transformer had three secondary windings, one for the detector heater, one for the filaments and one to supply grid-bias voltages via a diminutive half-wave rectifier, type 2504.

The question now arises as to why Philips should have chosen such a roundabout way of obtaining a bias supply when the use of self-bias or back-bias would have been far simpler and cheaper. After all, even Philips, who were specialists in bringing out new valve types at the drop of a hat, must incur extra production costs by using a special valve solely for the purpose of obtaining grid bias. So why do it?

Maybe it was due to Philips' unfamiliarity with the state of the art; perhaps they didn't realise that it was possible to arrange back biasing when using a separate 'B' eliminator, though at the cost (in this case) of a reduction of 16 volts in the available HT voltage. Self-biasing, too, although necessitating separate filament windings for the RF and output valves, would still have been simpler and cheaper than the chosen arrangement. Another possibility could have been the desire to avoid the use of patented circuitry which would have incurred the payment of royalties, often an important consideration in those days. Remember, even grid bias itself was once a patent! But, whatever the reason was, subsequent Philips receivers used conventional power supply systems.

*Editor's note: The above article is reprinted by kind permission of the New Zealand Vintage Radio Society, having appeared in their Bulletin in February 1989. It was brought to my attention by John W. Stokes. He also sent the following letter, commenting on Geoffrey Dixon-Nuttall's recent article, which he read with interest, having himself wondered about the origin of "such an odd-ball receiver". He sends the following notes:*

1. The mystifying "R6&7" volume control shown in Geoffrey Dixon-Nuttall's diagram cannot be a 5.5 ohm fixed resistor, plus a 60 ohm variable one as, in spite of what the author thinks, the filament current of V1 is 0.25 amps. A 5.5 ohm fixed resistor in series with a 1-volt supply wouldn't leave much for the valve. Actually, the 5.5 ohm resistor is a filament rheostat and there is no 60 ohm at all.

2. In Fin Stewart's "Illustrated History of Philips Valves" the filament current of the type C142 (Mullard PM11) is correctly shown as 0.25 amps, whereas the filament current of the D143 (Mullard PM21) is wrongly shown as "0.6" amps when it should be 0.06 amps.

John also sends the good, clear diagram of type 2501 with power pack type 2503, (with source identified) printed here, which may be of interest.

## Insulation Degradation

a technical note by  
Ray Whitcombe

For many years Synthetic Resin Bonded Paper (SRBP) insulation has been used in radio and electronic components and assemblies. Its use is still with us, and it must have been one of the earliest materials used, no doubt due to its versatility in both the electrical and mechanical spheres. Such is its scope that we now take it for granted, and perhaps ignore some characteristics that may cause trouble.

Firstly, how good an insulator is it? Well that depends on the grade used, in general the stronger mechanically are weaker in the electrical sense, the problem arising from the absorption of atmospheric moisture. This effect has sometimes caught designers unaware, and in one case necessitated the 'drying out' of tag panels in a desiccator, and then sealing with a suitable sealant in order to prevent leakage-induced noise in the early stages of a HI-FI amplifier. This problem was solved later by using a different grade of SRBP.

In the restoration and service of vintage equipment one will come across the odd fault that can be attributed to faulty insulation and naturally such problems can present very strange symptoms. The problem arises from the absorption of moisture, but of more import is the level of pollution in the atmosphere which adds to the trouble, and may cause a permanent fault to develop as against a drying out problem.

The places to suspect leakage-related problems are in the high resistance sections of circuitry, and also places with high potential differences across adjacent connections (tags). This can be on normal tag panels, but also in such places as wafer switches and IF transformers, etc.

I will give several examples I have come across of late.

A) On an HMV 452 the AGC line is terminated on a tag adjacent to the HT line. Multi-megohm leakage put a positive bias on the AGC which 'killed' the receiver's sensitivity! This leakage could not be reduced by cleaning, or drying, and the AGC had to be stood off on a separate insulator. In the same set there was also leakage across the tag panel of the 1st IFT; in this case it was cured by cleaning with trichloroethane (Genklene).

B) Wafer switches can pose a particularly nasty problem. This seems to arise from migration from the silver plating on the contacts onto the SRBP parts. This is associated

with heavy tarnishing (caused by atmospheric sulphur); the sulphide actually creeps onto the insulation base and form a film resistor! In a particular case this caused the wiper assembly on a tone control switch to leak, and then break down completely by tracking to the earthed spindle. Another case introduced leakage on a wave change switch, thus reducing sensitivity and introducing noise. In these cases normal cleaning will not help; the tarnish has to be scraped away, and this will involve dismantling the switch, or in bad cases replacement. However be warned that switch cleaners can make this trouble worse, perhaps by improving the contact to the conducting film. Products such as WD 40 can have an initial bad effect; always allow the propellant and excess solvent to evaporate as these constituents appear to have a low resistivity in certain cases. After this period the remaining constituents are very good at preventing further trouble, lubricating and preventing noisy operation.

C) On cleaning in general, always make sure that contaminants are washed away before applying protective fluids, as a 'soup' of muck and oil is a recipe for insulation trouble. This is very evident on SRBP switches and valve holders where build up can occur between the 'sandwich' formed from two layers of insulation. The best method is to remove the offending unit and immerse it in a jar of suitable cleaner, shake it, dry it, protect it with WD 40, dry it, then you may have a good component. If not you may have to dismantle and scrape the surfaces as well.

NB:- The magnitudes of leakage cannot be measured by instruments such as the AVO; in general the value is far too high and the test voltage is too low. Apart from testing in circuit, the only real way is to employ an insulation tester that will give indications up to 1000 MΩ with an applied voltage of at least 500 volts. I use an electronic meter which will measure up to 5000 MΩ at 250, 500, and 1000 volts. You may feel that these values of insulation would give no trouble, but consider an AGC line at say 2 MΩ next to 250 volts; a leakage of 500 MΩ will add 1 volt positive to the AGC.

On the tone control problem mentioned above you may think that the tracking was caused by something more definite than a film of sulphide. But close inspection in this case revealed a 'ring' which reached to the spindle bush; this was not burnt and still registered a low resistance on an AVO. To clear it involved scraping a 270° section clear of the surface film.

## Vintage Meters

# The low-priced Multimeter

DOES the authentic vintage wireless mechanic service 'Thirties radios using 'Thirties instrumentation, repair 'Twenties wireless sets using 20's battery testers, and test anything earlier with a wet finger? Desmond Thackeray looks at some of the multi-meters available to the impecunious.

by Desmond Thackeray

### The "Budget" Meter

Progressively from the mid-twenties, the valved radio receiver ("the Wireless" as it was euphemistically called) established itself in British homes, and immediately changed the lives of those involved.

Now there was the weekly (?) trip to get an accumulator charged at the bicycle shop, the putting aside of money towards the next high-tension battery, and the acrimonious exchanges when a valve filament burned out. Not surprisingly, there was a consequent sale of cheap battery-testers with which the home owner could at least determine some of the reasons for a dead receiver. In its elementary form, the two-range "watch-case" voltmeter was a simple moving-iron instrument with a single fixed coil for the lower range, augmented by a resistance coil to drop enough voltage for the upper range. On either voltage range the current burden was as much as 30-40 mA f.s.d., an appropriate load for revealing an ailing battery. This current sensitivity is exploited in some models by providing a pair of terminals specifically for the current function, a convenience to the user who might want to wire the meter to measure valve or receiver current. A visually striking implementation is the Pifco "Radiometer" model which, at a distance, looks like a small alarm clock that has lost its gongs. This cost 12/6d in both 1931 and 1937, and is described on the carton (which I have never seen) as the "Sherlock Holmes of your radio set". The incorporation of a twopenny dry cell permits its use for continuity tests; and this feature was also included in the "new" Radiometer version "for A-C and D-C use" marketed in a rectangular



Continued on next page >

## Vintage Meters

> Continued from previous page

case at the same price. It did however lack the chromed bezel and watch-bow of the "old" model. Judged by appearances at Harpenden, the rectangular model in black or red is the more frequent survivor, and is often accompanied by its striking red and yellow carton.

The purist may quibble that these three-range meters are really a cosmetic variation on what are really (i.e. electrically) two-range meters, and therefore fail to meet the test of even the most primitive of arithmeticians who count "one, two, many". So, for the budding radio experimenter, how about spending the 12/6d (in 1935-1936) on the unusual Telsen 5-range universal meter, which had the (perhaps not very useful) additional range(s) of 16 volts and 300 mA. This product seems to have been launched during the Telsen Company's brief second coming, from its Manchester address, and is distinguished by a lozenge-shaped window. Those who missed this bargain could solace themselves with the *Dix Mipanta* at 19s/6d from Electradix, which had three voltage ranges. Again, I have yet to see a surviving example of the *Mipanta*, so perhaps original sales were small.

As the use of lower filament voltages became widespread, many of these meters became less useful: and not all were suitable for measurements on receivers using A-C heated valves. However, by the end of the thirties the wireless owner was no longer expected to understand anything electrical, and the home experimenter would set his sights a little higher.

### Upmarket to Fifty Shillings (the cost of a gent's suit)

The more ambitious wireless enthusiast needed to dig deeper into his pocket. Just for direct current and voltage measurements alone he would have to spend something approaching the weekly wage of a labourer to buy a moving-coil multimeter. Brand loyalty might steer him towards the two *Pifco Radiometer* moving-coil meters priced at 42/- which drew 2 mA on voltage ranges for 6 and 250 volts, and were shunted to 40 mA for the single current range. But a more versatile buy at 50/- would have been the *Dix Onemeter "B"* with two voltage ranges of 120 volts and 6 volts and four current ranges of 3mA, 12mA, 120mA and 6 amps. The specification also mentions a 300 mV range which was no doubt electrically

the 3 mA range also. However, *Pifco* seem to have responded in 1934 by introducing the *Rotameter De Luxe* at 42/- which had four voltage ranges of 5, 20, 100 and 400 volts, three current ranges of 10, 50 and 250mA, and a resistance range with seemingly no adjuster for zero ohms. The movement sensitivity is again 2 mA, and a rotating drum carries the eight scales and shunts, a scheme which makes repair work awkward.

However, all these were distinctly upstaged by the introduction of the *D. C. Avominor* at 40/-, though this was later increased to 45/-. Even so, a reasonably accurate moving-coil multimeter at this price with six voltage ranges, three (later, four) current ranges, and resistance range(s) (with adjuster!), was clearly destined to be a best buy in 30s multimeters. Apart from the *Onemeter "B"*, which I have never seen, the other moving coil multimeters I've mentioned, the *D.C. Avominor* and the *Pifco* ones, all survive despite, very often, 50 years of (mis)use. There was at least one other multirange meter below the 50/- ceiling, and that is the standard model of the *Pifco Rotameter* with three voltage and three current ranges that sold at 29/6d. Like its DeLuxe companion it had the rotating drum carrying scales and range resistors. But how many others were there, that I wot not of at all, perhaps little advertised, poor on survival, or the victims of low sales? U.S. magazine advertisements show a considerable production of multimeters available primarily for the American market. By and large these do not seem to have travelled as far as Europe. But advertisements show that at least some of them selling at no more than \$10 US had A-C voltage ranges in the specification as well, and therefore seem to us to represent quite amazing value for money. *Pifco* meters also reached the New Zealand market, offered by the Electric Lamp House of Wellington with a retail price mark-up of around 70%, for the first shipment arriving in 1935. And the *Onemeter* reached both New Zealand and Australia, where it would have been in direct competition with meters imported from America.

**Meters Curious and Uncommon**  
Vintage test-meters that I cannot date or price for lack of advertising literature there are too. They range from totally unmarked examples to one that is clearly marked "*Amplion*" (not "*Graham Amplion*" please note). And the proliferation of post-World

War 2 cheapies provides some scope for confusion. On the other hand I have yet to see working examples of some quite clearly advertised models from the 30s, such as the *Onemeter "B"* from Electradix, and the High-Resistance *D.C. Avominor* (£3.10s) introduced in 1938 for television buffs. Have any survived at all? Then there are the *Avometer D* and the *Avominor "E"* made for military and related service, that bear a strong resemblance to more public models but with idiosyncratic adaptations. The "*D*" in fact could carry more ranges in the blank regions of its switches, for the extra labour of wiring the unused switch contacts. And the "*E*" has a fuse as did very early AVOMETERS, but no A.C. ranges, though its case is much like that of the *Universal Avominor*. Both D and E have x2 rotary switches to double the number of ranges. Though both are good survivors and were sold as Government surplus items, some appear today with service markings scraped off. Such damage was no doubt incurred when they fell off the backs of military lorries. AVO, or strictly ACWEECO, made a variety of other instruments over the years, some advertised only rarely, and some of course dedicated to non-wireless applications. In the latter category appear several different photographic exposure meters. These were about half the price of the original Weston and would therefore have been a good "buy". Just the thing to use when taking photographs of 30s radios with your Kodak? Did they but choose. could AVO now halve the price of today's Weston Master?

### A Note of Caution

While I have described meters above as survivors when they do in fact appear superficially intact and the needle swings, nearly all the multimeters I have ever looked inside have at some time been "got at" by repairers with a marked lack of knowledge and skill. Others seem to have been struck by lightning, or spent some time under water. Therefore it is wise to reckon that "bargains" in second-hand meters have nearly zero probability, despite what the vendor says.

### Acknowledgements

I am, as usual, most grateful to other members with information and hardware, and to Thorn EMI for their help. Also I am indebted to *Pifco Ltd.*, the lineal descendant of the Provincial Incandescent Fittings Company, for enlarging my information on their sometime range of testmeters. The company was formed in 1900 and continues today as a component of the group of companies which includes Salton and Carmen.

## “70 Years of Broadcasting”

The Museum of East Anglian Life at Stowmarket in Suffolk is to stage a temporary exhibition entitled *Seventy Years of Broadcasting*. The exhibition opens on 29th August and runs until 1st November 1992, seven days a week from 10.00 a.m. to 5.00 p.m.

The exhibition portrays the history of radio broadcasting through an interesting combination of radio displays and text. There will be more than 50 radio receivers and radio-grams on show, all of which were used during the period 1922 - 1992.

The radios to be exhibited are part of a collection accumulated by Harold Page an East Anglian whose family have been connected with the retail section of the industry since 1921.

A member of the British Vintage Wireless Society, Harold Page spent 40 years retailing until his retirement five years ago. In 1986 he won the coveted Bang and Olufsen Dealer of the Year Award. He is also a Past President of the Radio Electrical and Television Retailers Association (RETRA).

His father started a business making wireless sets in a garden shed in 1921, following service with the Royal Corps of Signals, and the business blossomed. A collector all his life, Mr. Page hopes eventually to open his own wireless museum in East Anglia.

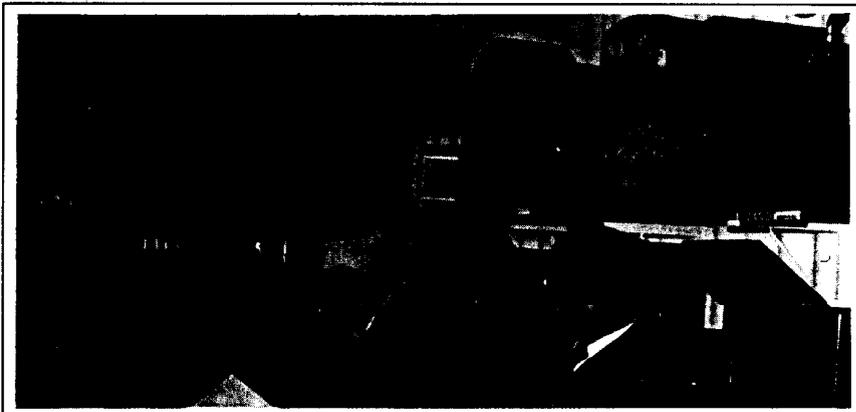
### “Making Waves” Exhibition

Readers in London and the South East might have a special interest in a forthcoming exhibition at Vestry House Museum, Vestry Road, Walthamstow, London, E.17. From 22nd August to 10th October

They will have on show “*Making Waves; The Story of Radio*”, a touring exhibition from Southend Museum Service, supplemented by a fine display of early radios from the collection of Gerald Wells of the Vintage Wireless Museum.

From Marconi's experiments to messages from the moon, “*Making Waves*” takes a close look at the technicalities of radio communications, while not forgetting the delights of vintage wireless and over seventy years of British broadcasting, says the Museum Keeper. *Caroline M. Reed.*

For opening times, contact the museum on 081 509 1917.



### Spanish Museum

Visiting Spain? If so, you are welcome to visit the little museum in San Celoni, Barcelona, run by Juan Julia, who would be pleased to meet fellow enthusiasts. He is pictured here at a recent opening and his exhibits range from complete sets of various countries to microphones, loudspeakers, ephemera and novelty sets. Contact the Editor if you intend visiting.

## Vintage Technology

# Receiver Techniques of the 1920s.

## Part 2

by Pat Leggatt

### A new Series

Here is the second of a series of short articles by Pat Leggatt reviewing the circuitry and other features of wireless sets of the 1920s. Each article will outline a particular aspect of sets of this period.

### Long Wave Tuning

In the last issue we looked at arrangements for tuning the aerial and these covered the medium wave broadcast band well enough. For long wave reception many receivers incorporated sockets in series with the tuning coil, into which could be plugged an external 'loading coil' for long wave or a shorting link for medium. The long wave band was of interest to amateurs well before the introduction of regular UK broadcasting, carrying the Sunday evening 'Dutch Concerts' from The Hague on 1000 metres from November 1919, the German Koenigswusterhausen on 2000 metres, and the Eiffel Tower on 2600 metres, as well of course as commercial telegraphy. Later, from 1924, the BBC's station 5XX transmitted on 1600 metres.

### The Headphone Condenser

These aerial tuning arrangements applied to crystal sets as well as those with valves. If a momentary digression from the subject of tuning may be excused, a minor feature of crystal sets is worth mentioning. It was rightly considered good practice to shunt the headphone terminals of a crystal set with a condenser of about 2000pfd (Fig 3), but some early explanations of the purpose of this were more confusing than helpful. A view carried over from spark

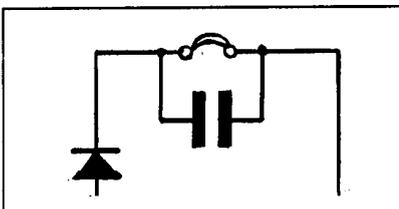
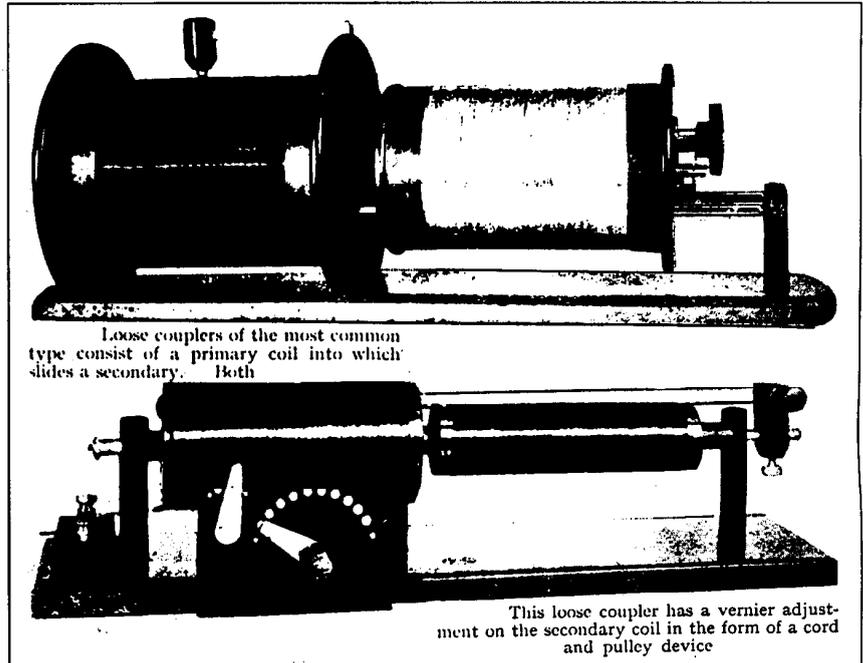


Fig 3



Loose couplers of the most common type consist of a primary coil into which slides a secondary. Both

This loose coupler has a vernier adjustment on the secondary coil in the form of a cord and pulley device

Fig 4

transmission, but not of course valid for telephony, was that the condenser was there to tune the headphones to the incoming spark repetition frequency, thereby increasing sensitivity. Another idea was that the function of the condenser was to bypass radio frequencies from the headphones, with the assumption that this was done to avoid some unexplained difficulty if RF currents were allowed to pass through the 'phones. A third, more valid, view was that the condenser acted as a reservoir, but the explanation was spoilt again by hangover from spark techniques in saying that the condenser accumulated charge from the detector and at unspecified intervals discharged into the headphones. In fact this last explanation is correct, though not very clear, since the condenser is charged at the peak of each incoming radio frequency cycle and does discharge into the 'phones during the intervals between RF peaks, thus maintaining the output in the same way as the reservoir condenser in an AC rectifier power supply circuit. Quite often the self-capacitance of the headphones was found sufficient for this purpose and the external condenser was omitted.

### Isolating the Aerial

As time went on, attention turned to the more desirable concept of tuning the receiver rather than the aerial and this necessitated isolation of the aerial impedance from the receiver tuning circuits. Not only did this make

receiver tuning more controllable, but the avoidance of tuned circuit damping by the aerial offered a useful improvement in selectivity. Good selectivity had hardly been a significant requirement in the early days when only one station was likely to be within receivable range; but it assumed increasing importance as stations multiplied.

The required loose coupling of the aerial could be achieved either by a small series condenser, or by feeding the aerial to a tapping well down on the tuning coil, or by using a loose-coupled HF transformer. Such transformers sometimes took the form of the cumbersome 'loose coupler' (Fig 4) in which one coil could be slid co-axially within another to a controllable extent; or of a 'variocoupler' of similar construction to the variometer already described, but with the windings separately connected as transformer primary and secondary.

Although reduced tuned circuit damping could result in higher 'Q' and hence greater HF gain, it was often found that the overall effect of loose aerial coupling was to reduce receiver sensitivity. To obviate this a valve HF stage could be added, giving effective isolation of the aerial without loss of signal. With an early triode used as the HF amplifier, one was lucky to achieve a stage gain much greater than unity, but at least there was no loss.

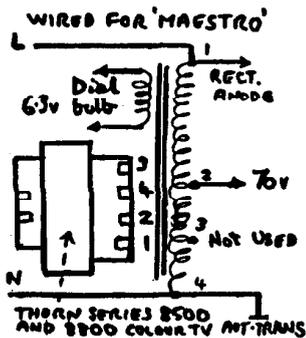
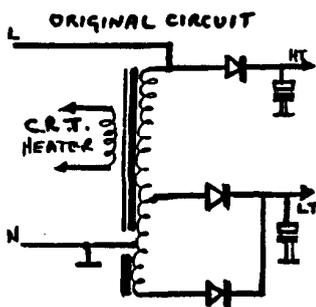
# Feedback

## Line-cord Replacement

by R. J. Grant

While repairing a Pilot "Little Maestro" receiver, I discovered that the line-cord fitted was open-circuit. In search of an alternative, I found an auto-transformer from a Thorn group 8000 series colour television receiver of the mid-1970's. The LT tapping 32v-0-32v was ideal, as around 70 volts was required for the heater chain. And there was also a separate 6.3v winding for the dial bulb.

If the smoothing capacitor is placed under the chassis, there is room for this transformer behind the rectifier valve, so it does not look too out of place.



**Letter:**

from David J. Boullin, Editor of "Radio Time", a magazine about radio-controlled timepieces.

**Wrist-watch radio**

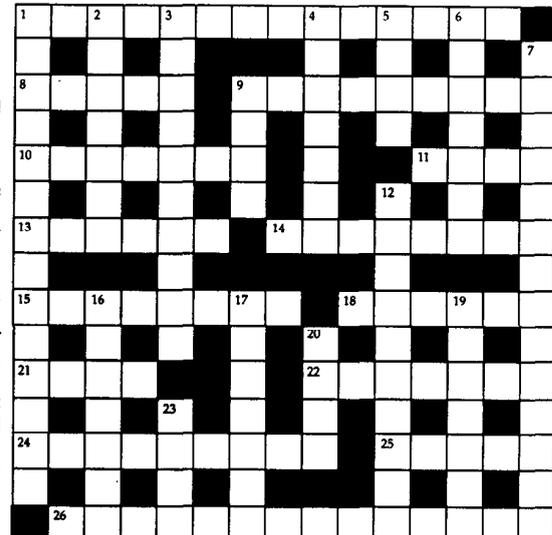
David Read's article on the wrist-watch radio (Bulletin 17/1) intrigued me. A Junghans radio-controlled watch is now available, which as far as I am aware is the world's first, but I wonder if any of your members have ever heard of or come across a combined watch and radio? The

**Wireless Crossword No.4**

Here's an attempt at a crossword using a few "wireless words" of which there really aren't enough in our vocabulary. Readers who think they can do better are invited to contribute their efforts. (This one comes from Geoffrey Dixon-Nuttall).

**Clues Across:**

- 1. Part time controller of 9. (14)
- 8. Sharp fielder. (5)
- 9. Original Big Band sound. (9)
- 10. Amuses Baby; annoys the rest! (7)
- 11. Singular disease of divers. (4)
- 13. Shoots on a (family) tree. (6)
- 14. Take care, mate - it could be fattening! (5,3)
- 15. Oil races; I find a computer maker. (8)
- 18. A Sign of fish! (6)
- 21. Raymond Swing's middle name. (4)
- 22. Transatlantic message-sender sounds like "damage rabbit". (7)
- 24. Among experts I'm IT at ionising gases, but a fraud actually. (9)
- 25. Nationwide, but said to be bound like a chicken. (5)
- 26. Takes the pulse of the picture. (5,9)



**Clues Down**

- 1. Kink remover. (10,4)
- 2. O, is term becoming wetter? (7)
- 3. Enters in the lists, with several pages! (10)
- 4. Uncertain outcome of nuclear disaster. (7)
- 5. American sleepers. (4)

- 6. Go back and stand another round. (7)
- 7. Allows the group to go through. (4-4,6)
- 9. Beheaded parasite in the river. (4)
- 12. The purpose of a Carat? Broil to measure a gun barrel. (10)
- 16. Emptiness; give me a second and I'll go nutty! (7)
- 17. Root crop gives S.P.I. (7)
- 19. Go through the hoops. (7)
- 20. Agents subject to acceleration. (1-3)
- 23. Powder produced from the beginnings of treating a little chalk! (4)

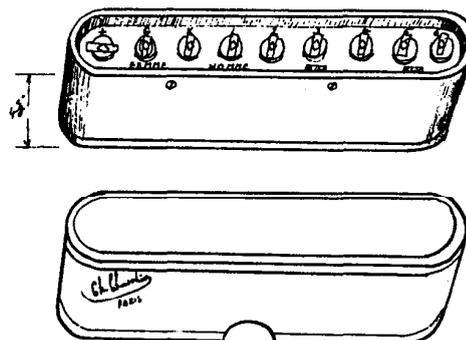
crystal-set in a watch-case described by David Read is not, of course, a timekeeper. Does anyone know of a true wristwatch incorporating a radio?

**Letter:**

from Ron Jones

**Puzzle from Paris**

I have acquired a grid-bias battery in a boot sale which is puzzlingly marked "Femme" and "Homme" on sockets which are obviously both female - and I'd like to know why it has nine terminals and only six batteries inside.



**Corrections: (Vol 17 No.2.)**

In the review of John W. Stokes' new book "More Golden Age of Radio", we referred to Edison as producing a "Mickey Mouse" radio. This was incorrect. It was Emerson and not Edison who produced these radios, as Mr. Stokes correctly describes in his book. We are pleased to report that the book is now available from Vestal Press Ltd., 320 N.Jensen Road, P.O. Box 97, Vestal, NY 13851-0097. (Tel: (607) 797-4872) at \$39.95. The book is a companion to Mr. Stokes' earlier one, but includes new material and care has been taken to avoid duplication.

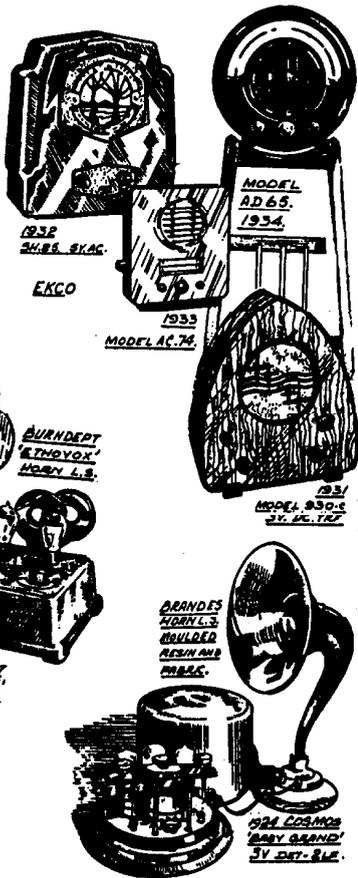
In the article by Ray Herbert "Amateur Television Transmissions 1930-35" Owen Relly's call-sign is incorrectly given in the text as G22AO but should have been G2AO. It was correct in the picture captions. Apologies to Ray Herbert.

An apology is also due to Prof. Berthold G. Bosch of Germany for the miss-spelling of his name as "Gosch" in issue 17/1.

**Answers to crossword**

- 23 Talc.
- 16 Inanity, 17 Turnips, 19 Croquet, 20 G-men,
- 7 Rand-Pace Filter, 9 Chisel, 12 Calibrator,
- 3 Catalogues, 4 Unclear, 5 Ties, 6 Retreat,
- Down: 1 Suppressor Grid, 2 Moisture Separator,
- 22 Marconi, 24 Imitation, 25 Trust, 26 Synch-
- 14 Cream Tea, 15 Olivetti, 18 Pices, 21 Gram,
- 9 Orchestra, 10 Rattles, 11 Bend 13 Springs,
- Across: 1 Semiconductor, 8 Point,

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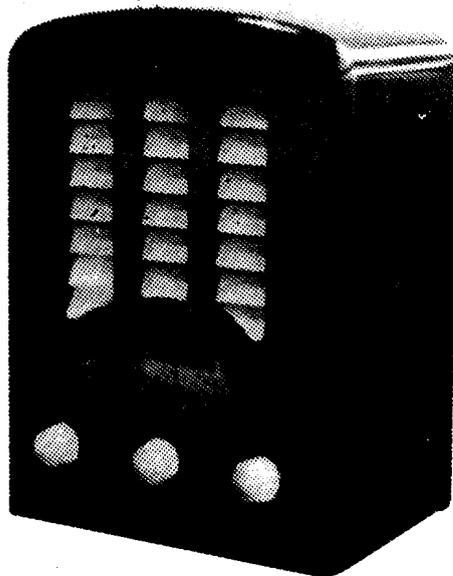
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