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Newsletter & JOURNAL Of The

CALIFORNIA HISTORICAL RADIO SOCIETY

2000 Official Membership Directory

&

CHRS Repair & Restoration Directory

California Historical Radio Society
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FOR THE RESTORATION AND PRESERVATION OF EARLY RADIO

ABOUT CHRS

The California Historical Radio Society, (CHRS), is a non-profit educational corporation chartered in the State of California. CHRS was formed in 1974 to promote the restoration and preservation of early radio and broadcasting. Our goal is to provide the opportunity to exchange ideas and information on the history of radio, particularly in the West, with emphasis on collecting literature, programs, and the restoration and display of early equipment.

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CHRS News from the President

HAPPY HOLIDAYS - From all of us at **CHRS**. We hope you are having a great time with friends and family. All of our best wishes for a joyful December and a prosperous New Year.

Well, where did 2000 go? In the blink of an eye, in two dots and a dash, this first year of the 21st century is just about toast. It was another good year for **CHRS**. Our membership continues to hover at about 500. The attendance at our events seemed to improve as the year went on. Our pot luck picnic in September was quite successful. Thanks to all who contributed their yummy specialties. We will do it again in 2001! It was good to see the members who came out to our events, especially at our more remote locations. Our last meet at Foothill in November was quite noteworthy. It was well attended, there were lots of new, and first time sellers, and, thanks to generous donations of tubes and gear by **Dale Sanford**, **Russ Turner**, **Bart Lee** and many others, our auction brought in $1700 for the Club! Thanks to those who donated items and thanks to those great bidders! Also kudos go to the auction staff, **Paul Bourbin**, **Bart Lee**, **Jerry Cantou** and **Bill Wray**. Thanks to all who made arrangements for our events this year. We had a General Membership Meeting on December 2nd at St. Anne Church in San Francisco. We must apologize for the poor notification. It was scheduled too late for the last **Journal.** We notified as many people as we could by email and the web page mailing list It was also on the HOTLINE, the web page and in ARC. The turnout was great. We had about 25 members attend. The discussion was lively. People had good ideas and suggestions. We will have a complete wrap up and the official minutes in the Spring **Journal**. This meeting was very successful and we will schedule another one for next December. We may also schedule another meeting for the middle of the year. Watch for details.

SECRETARY - I don't know how long **Russ Turner** has been Secretary of **CHRS** but it has been many years. **Russ** has recently retired to the sunshine of the Palm desert. We are envious. He has a separate space for his radios and hopes to open a small radio museum. We are envious. But envy aside, we are awfully thankful to **Russ** for his untiring efforts to help the Club. Whenever we need a hand, whenever there's a job to do we could always count on him. So we wish **Russ** and his little radio museum a bright future. As **Russ** has ties to the Bay Area, he says we will see him at some of our events. Thanks **Russ!** But, who will keep the records at our auctions or minutes at our meetings or deal with the Club's insurance? Why, **Bill Wray** of course. **Bill** has been elected by the Board to be our new Secretary. Let's all wish him well and thank him for volunteering to do this important job.

WHAT YOU ARE READING - We are calling this mailing a Journal because it has a great historical article about **Marconi** by **Bart**. The Membership Roster is laid out by expiration date. This is a quick way to see when your membership expires. If you sent in a renewal recently it might not have been recorded yet. Your 2001 renewal form is on the back page. Check the roster or your mailing label to see when your membership expires. Cut the form out , complete it and send it back, (with dues and donations), as soon as possible. The restoration and repair guide has a few updates. If you wish to be added, please let us know. There are a few new want ads and some vintage tips. This is not a fancy mailing, but we hope you will find it useful and informative.

The 2000 CHARLES D. "DOC" HERROLD AWARD - Has been awarded to **Hal Layer**. **Hal** is a long time **CHRS** member who is an active radio historian. He has written many articles including the definitive article on low frequency receivers. He maintains historical archives and allows researchers access, as in the research phase for the creation of the new radio room at the SF Maritime Museum. **Hal** also has been providing and printing the Club's mailing labels for many years. **Thanks Hal**, and congratulations on this prestigious award!

2001 EVENT SCHEDULE - It's about the same as 2000. We have at least one event every month, except January, (no events). Note there are two events in June and April. We will be in Oakland again for our first meet in February. It has been a good place for this meet as it has rained the last two years and we just set up under cover and kept dry. The biggest change will be at the September meet / picnic at the Western Railway Museum. We will hold the meet in the new parking lot outside of the new visitor's center. This means no lining up and unloading. You can sell from your car or truck. Our pot luck picnic will still be under the trees.

2001 MAILING SCHEDULE - We have set up a mailing schedule to keep you informed on a regular basis. These mailings will consist of two **Journals** and two newsletters. The news- letters will also contain some articles.

1. The Spring **Journal** will be mailed by March 31, 2001
2. Newsletter, Membership Directory & Repair Guide will be mailed by June 30, 2001
3. The Fall **Journal** will be mailed by September 30, 2001
4. Newsletter, renewal notice, 2002 schedule will be mailed by December 31, 2001

Therefore the submission deadlines for the **Journals** will be January 31 and June 30. Submission deadlines for the newsletters will be May 30 and November 30. In reference to the **Journal**, our 25th Anniversary edition was spectacular! Thanks to **Stephen Sutley** and **Steve Parr** for a job well done! And thanks to all the members who contributed articles. This one is a keeper!

DADDY'S LITTLE PICKER - Congratulations to Mr. Transistor, **Jeff Hollinger** and his wife **Julie** on the birth of their daughter **Naomi Grace Helen Hollinger** on August 24th. We wish much happiness to the **Hollinger** family. Apparently **Jeff** is already showing **Noami** transistor radio flash cards so she can spot those sets below table height at shows and meets.

HINTS & KINKS - Is ready to be printed. This information comes from **Alan Voorhees**. I know we have said this many times before, but, I can only give you the information that I receive. I am truly sorry. I know some of you have waited an extraordinarily long time for your copy. Your membership records indicate that you are owed a copy of **Hints & Kinks**. As soon as they are printed they will be mailed out. I hope it will be soon. I apologize again and thank you for understanding and being patient.

The CHRS LISTBOT - Is an email ring that was set up for the 1899 activities last year. It works this way. If you are a member of the "listbot", you can send one message that everyone on the list will receive. This is just another way to exchange information or keep in touch. **Paul Bourbin** is the keeper of the "listbot". If you wish to join, contact **Paul** at: paulbourbin@hotmail.com and he will sign you up. This is a private list, so there is no "spam".

TREASURER'S REPORT - Will Jensby provides the following information about our finances: our balance on 11-30-00 was $15,859.57. This includes $7,500 in a CD and $1, 350 in the Museum fund. At that time our outstanding bills were $1335 for insurance and an unknown amount for printing. Overall our accounts are in good shape.

That's all for this time. Again, our warmest wishes for a **Happy Holiday Season**. We look forward to 2001 to be a great year for **CHRS**. I think we are finally starting to get it right and hopefully al the bumps will be smoothed out. I want to thank all the staff members who really make this Club function. As always, I am available for your questions, suggestions or comments. Please contact me at , 415-821-7671 or email me at kushseal@flash.net.

Best Regards,

CHRS 2001 SCHEDULE

Here is next year's schedule of meets and events. Note that there are 2 events planned for April and June. Remember, no activity before scheduled start time and you must be a current member to sell. Check the ***CHRS HOTLINE, 415-821-9800*** or our website at **www.antiqueradios.com/chrs**, for the best and latest information.

February 3rd, Saturday, 8AM - Oakland. Foothill Square Shopping Center. From I580 Eastbound, take the 106th Ave / Foothill Blvd. exit. Make left turns at the first 2 stop signs and go 1 block. From I580 Westbound, take the Foothill Blvd. / MacArthur exit. Stay in the right lane and go 5 blocks. Sellers fee applies. Do not fear. In case of rain, simply set up under the covered areas! SWAP MEET

March 3rd, Saturday, 9AM - Sacramento. Towe Auto Museum on Front St. near Old Town. From I80 take the Downtown Sacramento exit. Stay on Capital Ave. Make an immediate right turn across the Tower Bridge onto Front St. Drive ahead to the Towe Auto Museum. Let's support our Sacramento Chapter by having a big turnout. Sellers fee applies. Thanks to ***Don Steger***. SWAP MEET

April 7th, Saturday, 8AM - Concord. Solano Drive In Theater Flea Market. From points West, take I580 East, take the Hiway 24 exit, take I680 toward Concord, take Hiway 4 East, take the Solano exit and head for the big screens on Olivera Rd. You will be directed to our area. Please pay $5 flea market sellers fee. Thanks to ***Stan Lopes*** and ***Norman Cox***. SWAP MEET

April (TBA), Saturday, 9AM - Presidio of San Francisco, Building 1444, (the Army Coast Artillery Radio Station). Join us for ***Earth Day 2001*** as we survey the site for artifacts, map the location, assist in native plant restoration, operate field military radio gear and generally have a good time. Bring your families, gardening tools, portable radios, a picnic lunch and enjoy the scenic wonders of the Presidio, and help the environment. This is our sixth year. Don't miss it!

May 5th, Saturday, 8AM - Los Altos Hills. Foothill College, Lot "4". From I280 take the El Monte exit west. Follow the signs into the Campus. Go right at the tee, up the hill to Lot"4". Sellers fee applies. Buyer parking is free. SWAP MEET / AUCTION.

June 2nd, Saturday, 8AM - San Rafael. Erik's Downtown Drive-In. Corner of Second and Lindaro. From Highway 101, take the Central San Rafael exit. Go west on 3rd. St. and left on Lindaro. Look for the purple drive-in restaurant. Sellers fee applies. Come early and have a great breakfast at Erik's. Thanks to ***Lee Allder***. SWAP MEET

June 16th, Saturday, 9AM - Merced. Cliff's Radio Warehouse. Corner of 13th and "X". From the North, take Hiway 99 South, exit at V St. turn right and right again onto 13th St. Make the first right past the AM/PM mini-market. Sellers fee applies. Come on down to ***Cliff's***, we always have big fun. Thanks to ***Cliff Berthelsen***. SWAP MEET

July 7th, Saturday, 8AM - San Francisco. St. Anne Church of the Sunset. Corner of Funston, (13th Ave.) and Irving. Funston is 6 blocks east of I9th Ave. (Hiway 1). Sellers fee applies. Thanks to ***John Wentzel***. SWAP MEET

August 4th, Saturday, 8AM - Los Altos Hills. Foothill College, Lot "4". From I280 take the El Monte exit west. Follow the signs into the Campus. Go right at the tee, up the hill to Lot"4". Sellers fee applies. Buyer parking is free. SWAP MEET / AUCTION.

September 1st, Saturday, 9AM - Fairfield. At **The Western Railway Museum** on State Route 12, between Fairfield and Rio Vista. Swap Meet and Picnic. Its more than a radio swap meet. It's trains. It's antique electric streetcars and interurban trains. Take rides on this historic rolling stock. Bring the whole family. It's a great location for a meet and picnic on the lawn beneath cooling shade trees. The kids may enjoy seeing the ducks on the pond. Your battery radios and wind up phonographs are welcomed. Vintage entertainment is always appreciated. Again this year, our Members have requested bring your favorite dish to share with others.

A large bar-b-que grill is available. There is no sellers fee. Everyone must pay a special reduced Museum admission price for CHRS of $6. Children under 12 also have a special reduced price of $3. *This fee is an all day pass for the grounds* and includes the train rides, the car barns, gift shop, and you might get a private tour by one of the Museum volunteers. From the Bay Area, take I80 east, take State Route 12 towards Fairfield. As you see Travis AFB, in the distance, the road veers right. You will then go over three hills and at the bottom of the third hill, look for the Western Railway Museum on your right. Please RSVP on the HOTLINE, 415-821-9800 or Email, (kushseal@flash.net), with the number of people who will be attending, and the types of food that people will be bringing. Thanks to ***Paul Bourbin***. This year, no line up to unload. SWAP MEET on the blacktop, (the new visitors center 's parking lot) / POT LUCK PICNIC under the trees !

October 6th, Saturday, 8AM- Pismo Beach - Oceano Airport. 561 Airpark Dr. Joint meet with **SCARS**, (Southern California Antique Radio Society). This is a good opportunity to meet fellow collectors from So. Cal. and to see the "new" **Bob's Radio and TV** shop featuring ***Dan's*** museum. Campgrounds available. Take this opportunity to fly your plane to the event. Working on reduced hotel rates. See **www.aircamp.com** (events) for map and details. Our meet will be live on the Web! Open House to follow at Bob's Radio and TV, 238 Ocean View, Pismo Beach. Questions? Call ***Dan*** at 805-773-8200. Thanks to ***Dan Steele***, and to ***Thurston Armstrong***, President of SCARS. SWAP MEET / OPEN HOUSE

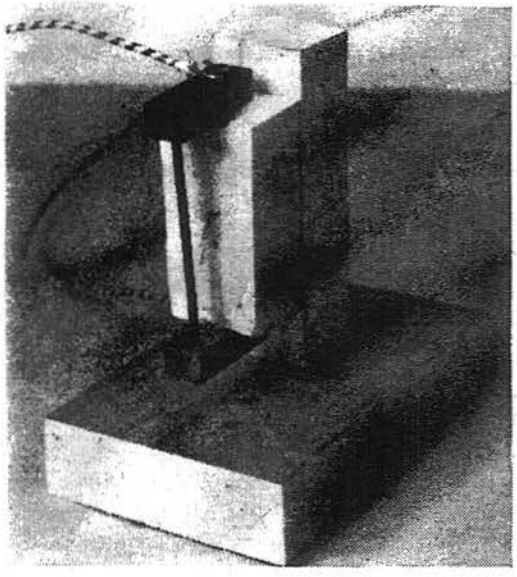
November 3rd, Saturday, 8AM - Los Altos Hills. Foothill College, Lot "4". From I280 take the El Monte exit west. Follow the signs into the Campus. Go right at the tee, up the hill to Lot"4". Sellers fee applies. Buyer parking is free. SWAP MEET / AUCTION

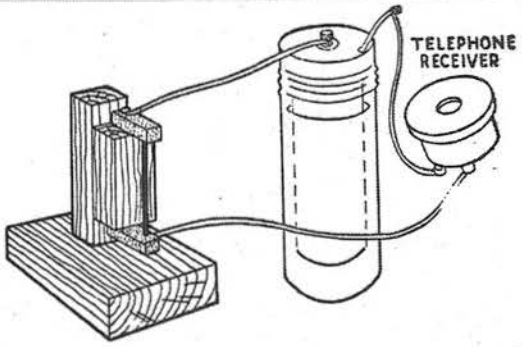
December 1st , Saturday, 2PM - San Francisco. St. Anne of the Sunset Church. Entrance on Funston Ave. between Judah & Irving Streets. Free parking in the school yard. Follow the signs to the **Cliff Heinz Room**. Funston Ave. is 6 blocks East of 19th Ave, (Highway 1). This is a **GENERAL MEMBERSHIP MEETING - *EVERYONE IS INVITED***, to express their views and suggestions about **CHRS** now, and in the future. Our 2000 meeting was very successful, so we will do it again. See you there!

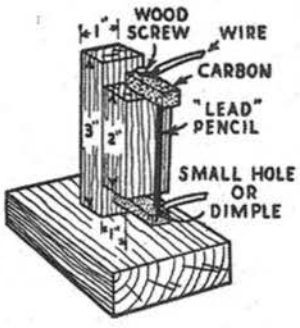
Sacramento Chapter - Meets the 3rd Tuesday of every month, 7pm at the SMUD building, corner of Elkhorn and Don Julio in Sacramento. All members are invited to attend.

Hear Flies Walking With
20-MINUTE MIKE

RADIO speech microphones are sensitive and costly. Here's a fine substitute equally as sensitive under ideal conditions but having a cost of approximately zero. The sensitive unit







is merely a combination of two carbon blocks and a two-inch length of graphite rod taken from a lead pencil. When properly mounted and used with a pair of earphones and a single dry cell, such a microphone will detect the footstep of a fly that may be walking over it. When placed on a wall, people talking in the next room may be very clearly heard.

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MARCONI'S TRANSATLANTIC TRIUMPH
— a skip into history

Bartholomew Lee
San Francisco, CA

On the afternoon of December 12, 1901, Guglielmo Marconi heard the first radio signals (three "dots" of Morse Code) to cross the Atlantic Ocean. The Morse "S" of three dots was transmitted from England to Newfoundland using his new system of wireless telegraphy.[1] Graphics of Marconi's calendar [19], and that of his assistant, George Kemp [14], noting date and time they heard the pre-arranged signals, are reproduced here. (Fig. 1) Marconi noted "Sigs at 12:30, 1:10 and 2:20." Kemp notes "Got Sigs 3 Dots" and of their 500-foot long kite antenna "... kept it up three hours which appeared to give sigs good." (Fig. 2)

Figure 3 is an artist's conception of the lofting of that kite [13]. The antenna wire from which the kite flew was then affixed to a pole from which the kite remained aloft (Fig. 4) [16]. The site in Newfoundland, known as Cabot Tower, Signal Hill, is commemorated on a 1930s postage stamp (Fig. 5) [17].

Marconi thus opened the century of telecommunications. One hundred years has brought even hand-held transceivers (ironically, Nikola Tesla's dream) linking to the world's telephone systems. The world now enjoys world-wide, high-bandwidth data, video and voice links including broadcasting. Parabolic antennas, pioneered by Marconi [15], listen to radio telemetry from deep space probes.

It is, however, not at all clear, even now, how Marconi's spark signals managed to get across the Atlantic, from Cornwall in England (at Poldhu on the Lizard Peninsula) to St. John's in Newfoundland, more than 1,800 nautical miles, in the middle of the day. The leading authority, Professor Hugh G. H. Aitken in *Syntony and Spark*, notes the apparently poor propagation conditions, by most modern understandings of the phenomena: "... the transmission times and frequencies were, as later learned, the worst possible in view of propagation conditions on the North Atlantic path." [2]

Daylight does not promote propagation of Marconi's system of relatively low-frequency, long-wave wireless. Marconi himself found this out the next year. Using an inker and coherer for reception, he could no longer record signals at sea at 700 miles, as he later recalled in his 1926 article *Looking Back Over Thirty Years of Radio* [14]. Yet, on that same 1902 voyage on the *S.S. Philadelphia*, Marconi replicated the more than 1,800 miles distance from Poldhu to St. John's with shore-to-ship reception, but only at night, reaching out 2,099 statute miles [14, 19]. He had thus first identified what he called this "night effect." Soon enough, higher power and longer wavelength stations regularly crossed the oceans.

Later familiarity with short-wave propagation by reflected sky wave has led to some speculation that perhaps Marconi managed to hear a high-order harmonic of his transmitter's fundamental frequency. This note will look at propagation conditions for the afternoon of December 12, 1901. Those conditions, taken together, suggest that Marconi enjoyed a rare confluence of circumstances. Unusual propagation conditions permitted his first transatlantic signaling on his likely fundamental frequency or close to it. Conversely, higher order harmonic propagation is unlikely.

The first issue is the frequency on which Marconi's Poldhu transmitter (Fig. 6) operated. The very question is misleading. A spark transmitter works by production of a radio frequency hash. This emission centers on a band of frequencies around its inductance- and capacitance-determined resonant-peak frequency. Perhaps the most widely known contemporary explanations of this technology are in Marconi engineer Elmer Bucher's 1917 *Practical Wireless Telegraphy* [6] and the U.S. Navy's *Robinson's Manual of Radio*

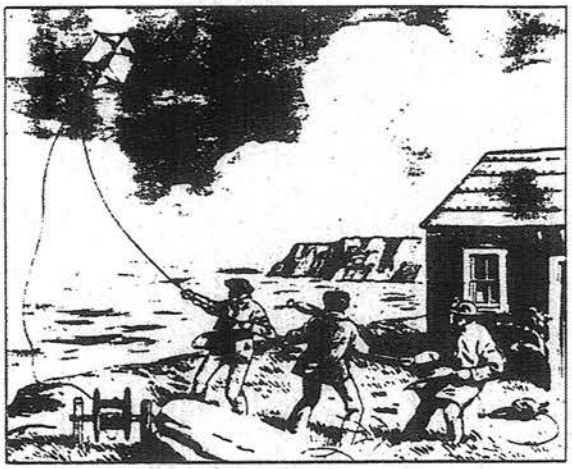


Figure 3. *The antenna supported by the kite at Signal Hill, Newfoundland, used on December 12, 1901 to receive the signals from Poldu.*

[1] Marconi's story is, of course, well known. See, e.g., Baker, A History of the Marconi Company, [4] and Aitken, Syntony and Spark, The Origins of Radio, [2] at Ch. 5. It is perhaps most accessible in the 1984 illustrated pamphlet from the Maconi Company, compiled by Pam Reynolds, titled Guglielmo Marconi [19].

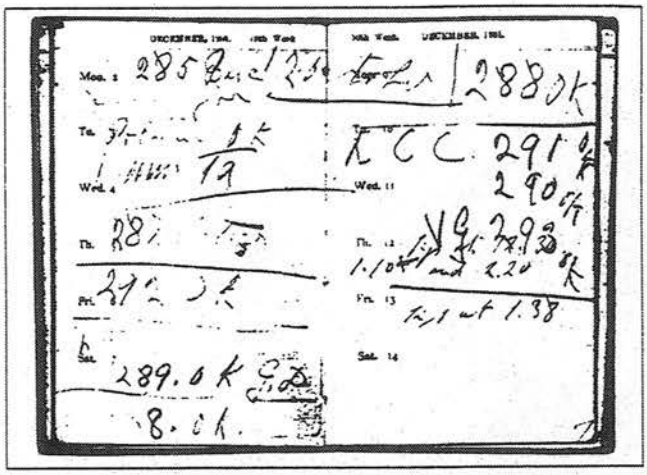


Figure 1. *Page from Marconi's diary for December 12,1901. In it he recorded the reception at Signal Hill of the three dots of the Morse code "S" being transmitted from Poldu in England.*

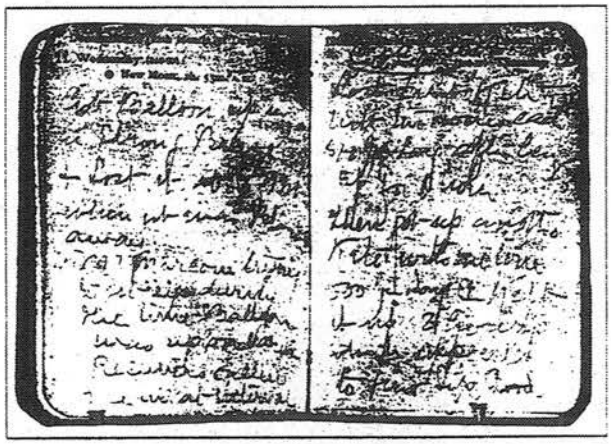


Figure 2. *Pages from the diary of George Kemp, Marconi's assistant, for December 12, 1901, recording the reception of the first transatlantic signals from England: "Got Sigs 3 Dots."*

Telegraphy [20]. The bandwidth of the hash is great, and measured logarithmically in terms of its "decrement" or spread [6]. Moreover, the antenna system often, if not usually, resonated on a different frequency. This "coupling" mismatch resulted in a second peak of a second band of frequencies, usually of a shorter wavelength than the transmitter's peak [20]. Engineers came to call this condition a "double hump" because it looked like a camel's back when graphed [20]. An illustration (Fig. 7) from Bucher's book shows the graphs resulting from close coupling an antenna to a transmitter [6]. It would be only in the period before the First World War that techniques of tuning regularly focused the radio-frequency energy of spark transmitters into a single relatively sharp peak [20]. Marconi enjoyed no such precision in 1901.

Marconi had set up a large antenna array of circular form to put his 25,000 watt spark signal into the ether; an illustration appears in Fig. 8 [16]. A storm took it down shortly before the tests, perhaps providentially. He then put up a jury-rigged antenna of about fifty nearly vertical wires in a narrow fan, illustrated in Fig. 9 [19]. The more fully reconstructed shoreside Poldhu site[2] is also illustrated in Fig. 10 for comparison [12]. It is likely that the resonant characteristics of the new antenna differed significantly from the earlier version, and likely that its resonant frequency was higher, because it was so much smaller [2]. This circumstance lends itself to a

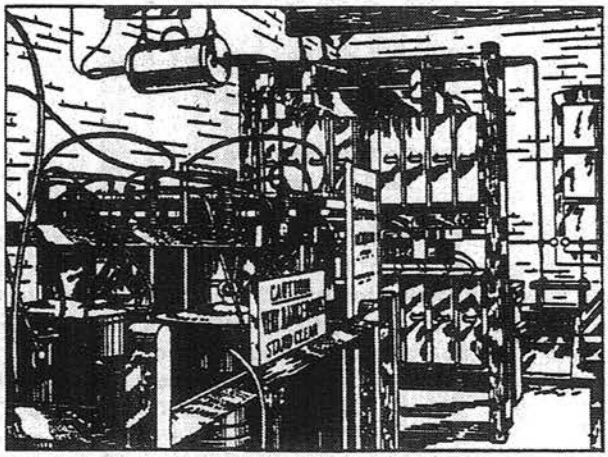


Figure 6. *The transmitter at Poldu in Cornwall, England from which the first transatlantic wireless signals were sent in December, 1901; (after a contemporary photograph, artist unknown).*

[2]"Poldhu is the name of a small cove on the western side of the Lizard Peninsula, which has become one of the best known places in Cornwall [circa 1912], since the erection of Signor Marconi's telegraph station..." [12]

Figure 4. *The station location at Signal Hill, where Marconi set up his instruments for the historic first reception of the transatlantic signals.*

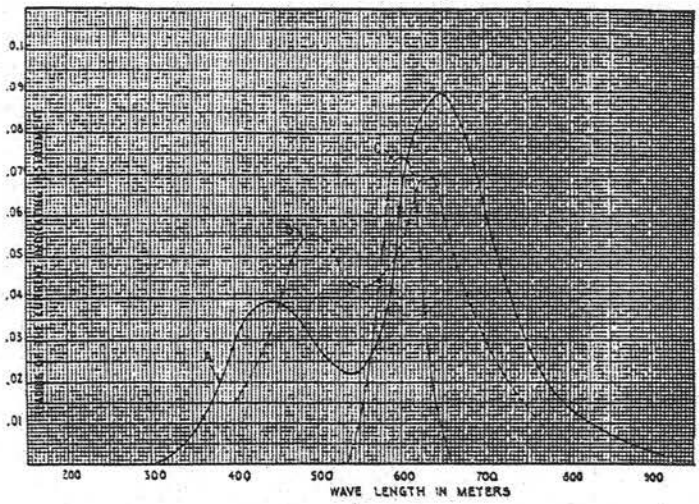


Figure 7. *Graph showing the effect of changing the coupling from the oscillation transformer to the antenna.*

Figure 5. *The 1930s Newfoundland postage stamp showing the Cabot Tower at Signal Hill, St. Johns.*

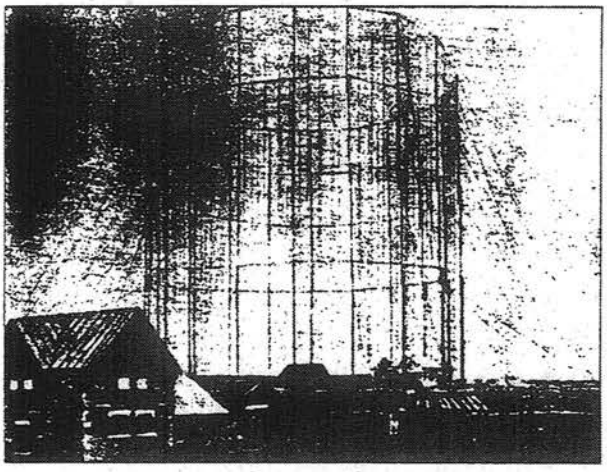


Figure 8. *The large circular antenna structure originally erected at Poldu, Cornwall, for the transatlantic tests.*

second, higher-frequency peak band being transmitted along with a fundamental peak band of frequencies. Moreover, the emitted radio-frequency electromagnetic waves perhaps took on a vertical polarization because of the accidental antenna configuration, which, if maintained, would have been good for reception by the kite wire.[3]

Still, the fundamental frequency is not known. Reports are 820 kilocycles per second (kilohertz, or kHz) (366 meters) and 100 kHz (3000 meters), a full order of magnitude disparity [2]. The 366 meter conclusion is that of H.M. Dowsett, a Marconi engineer at the time [2], as well as Marconi's later, 1908 report [4]. Harmonics and what were later called spurious and parasitic emissions were inherent in the nascent technology. Poldhu's signals were likely all over the ether, what would now be called the radio-frequency spectrum. On the other hand, there was hardly anyone to interfere with (perhaps only Tesla), and no one else "on the air" that winter day. Marconi's receiving circuits tuned very broadly, optimizing the chance of reception.

Engineers use the term "propagation" to describe the processes by which radio signals travel, particularly through the atmosphere. High-frequency propagation is mediated by the state of the ionosphere between the transmitter and receiver [5]. Modern concepts such as maximum useable frequency and minimum useable frequency were unknown and unanticipated in 1901. Indeed, they were not initially appreciated for another 25 years. Some of the earliest frequency *versus* distance curves, compiled by the U.S. Bureau of Standards in 1932, appears in Fig. 11 [10]. Marconi himself first came to believe that the longer the wavelength, the longer the distance possible for the same power and antenna height.

[3]This is so because both the temporary transmitting antenna array and the kite-cable receiving antenna were in effect vertically polarized.

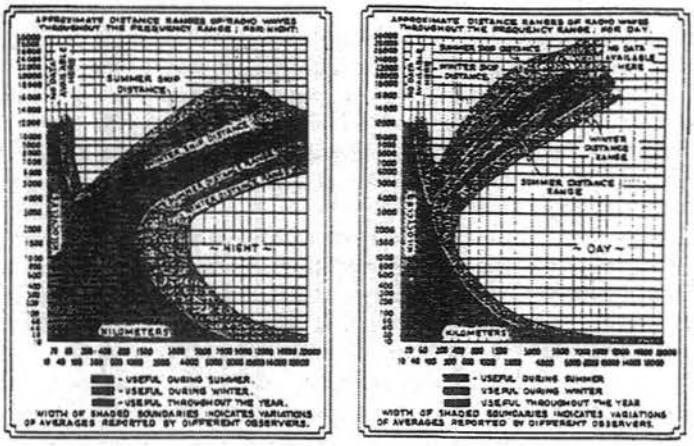


Figure 11. *Frequency vs. distance graphs compiled by the U.S. Bureau of Standards in 1932. Abstracted from* Short Wave Craft, *July, 1932.*

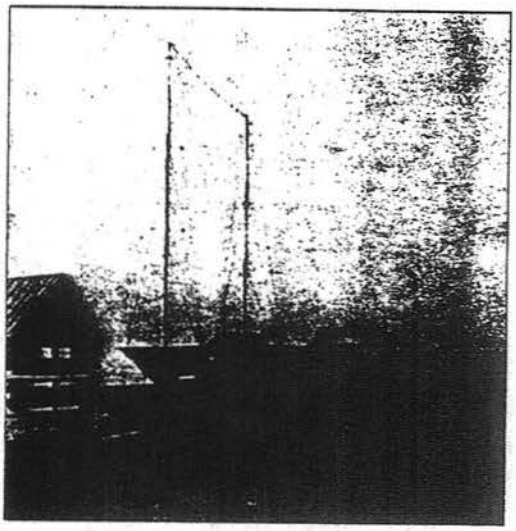


Figure 9. *The fan-shaped vertical antenna erected at Poldu as a replacement for the circular antenna shown in Fig. 7, which was destroyed by a storm.*

This is true enough, as the curves show, but misses the short-wave length, higher-frequency path of ionospheric "skip" propagation to which Marconi turned in the early 1920s, without identification of the physical mechanism. See, *e.g.*, his 1924 article *Results obtained over very long distances by Short Wave Directional Wireless Telegraphy* ... [15]. Physicists Oliver Heaviside and Arthur Kenelly had suggested an ionosphere as early as 1902, but not until 1925 or so was the mechanism of reflection suggested [2]. It was primarily amateur radio operators who explored the 200 meters-and-down "wasteland" to which they had been consigned by law. These radio amateurs first realized the power of these shorter wavelengths to reach great distances, *circa* 1920-'21, according to Professor Aitken (and the American Radio Relay League) [2].

Intensity of ionization in the upper atmosphere depends on the amount of solar (primarily ultraviolet) radiation from the sun. With the coming of darkness the ionized layers, denominated D, E, F, etc., shift and merge. Thus both season and time of day play roles in successful radio propagation.

The amount of ultraviolet radiation depends in turn on the number of sunspots from which the ultraviolet radiation emanates. For several centuries, it has been known that sunspots increase and decrease in approximately eleven-year cycles. Observation shows spots increasing then decreasing

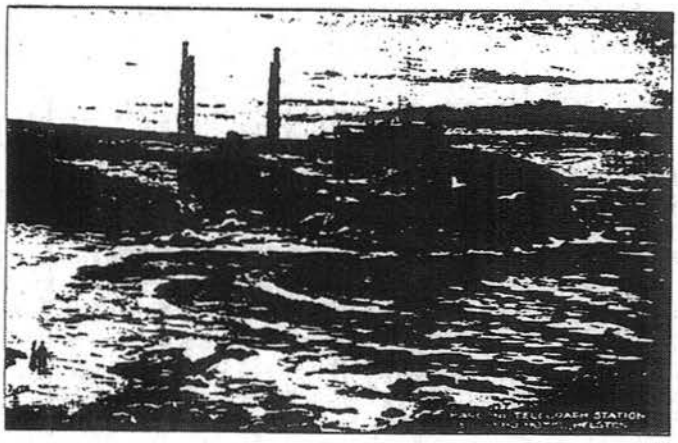


Figure 10. Another view of the reconstructed Poldu site, from a postcard.

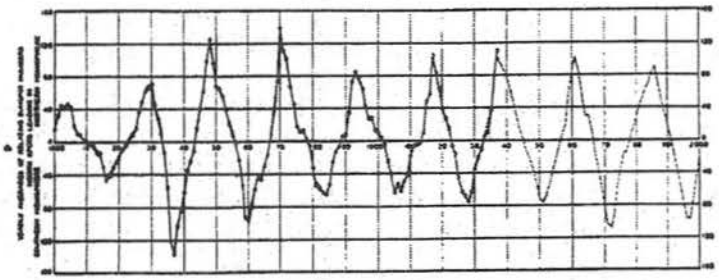


Figure 12. *Sunspot records from a Bell System study, showing the situation in December, 1901. These are measured and computed sunspot numbers from 1800 to 2000 AD. The solid line represents measured values, while the dashed line is a computed projection from the measured values.*

in one hemisphere of the sun, then increasing and decreasing in the other hemisphere of the sun. In times of high sunspot activity, the frequencies useable for ionospheric or "skip" propagation increase. In a good cycle, such as number 19 which peaked in 1957-'58, world-wide, low-power communications as high as 28 mHz (megahertz) (10 meters) and sometimes higher, are common. 1999-2000 is similarly a peak year with sunspots already averaging more than 110.

Conversely, when sunspot numbers are low, only the lower frequencies lend themselves to ionospheric propagation. A sunspot minimum is a good time, for example, for the 160-meter amateur band (1800 kHz) to open up to distant parts of the world. Optimal propagation obtains in a band of frequencies, often between three and thirty mHz, which is higher or lower depending on whether there are more or fewer sunspots. The lower limit is known as the absorption frequency and the upper the maximum useable frequency. Frequencies either side of three to thirty mHz are, however, often useable at the valleys and peaks of the sunspot cycle.

Examination of sunspot records for a century ago shows a nearly unique datum: *on December 12, 1901 the number of sunspots was exactly zero, a dead-low minimum.* It was a transition year between the sun's hemispheres. A chart from a Bell System study appears in Fig. 12 [1]. Solar ionizing radiation on the atmosphere was at a minimum. Thus useable frequencies for skip propagation, bounded at the lower end by the absorption frequency, would be at near absolute minima. A zero sunspot number means ionospheric propagation at the lowest frequencies the band of useable frequencies ever reaches.

This effect was noticed as early as 1931, with the refinement that the more northerly the path, the longer the useable wavelength (i.e., the lower the useable frequency), by as much as a ninety percent increase for upper latitude paths as opposed to 10% for equatorial paths [18]. Nighttime skywave propagation at 800 kHz is common under such conditions, albeit detected on modern high sensitivity receivers.

A Branly metal filings coherer, connected to a direct-current circuit to actuate a landline or marine telegraph inker, is a low-sensitivity device. Marconi, however, used a highly sensitive "Italian Navy" self-restoring coherer, really a mercury oxide detector, a drop of mercury between two conducting rods of iron or carbon. [4] Marconi also listened on a telephone earpiece, rather than employing an inker. He did this deliberately to take advantage of the telephone earpiece's much higher sensitivity, as well as the extraordinary sensitivity of the ear itself. (Within about a dozen years, wireless operators using galena crystal detectors alone, and they were not much more sensitive that the Italian Navy coherer, would copy spark signals occasionally several thousand miles distant.) The historical price Marconi paid in 1901 was the absence of an inker's paper record, a fault he remedied in 1902 on the *S.S. Philadelphia*, but at the price of reduced sensitivity.

The season and time of day also lend themselves to enhanced lower-frequency propagation. December 12 is within 10 days of the winter solstice, leaving the Northern Hemisphere in maximum darkness. At this time of year, the thunderstorms of the tropics and temperate latitudes are farthest away. The likelihood of noise interference is minimum. Through an Italian Navy coherer, lightning-generated random static would not sound like the repetitive pattern of three clicks Marconi and Kemp listened for, the Morse Code "S."

At this depth of winter, the days are shortest as well, minimizing the cumulative effects of solar radiation on the lower, blocking, ionospheric layers. The lower, D, layer results from solar x-rays. It usually blocks reflection or refraction of radio waves or "skip," by the E or F layers above it. The winter D layer would have been relatively weak during the short day, having had less time to build. Moreover, Marconi himself noted in 1924 regarding his 3.25-mHz (92-meter wavelength) tests: "... the intensity of the signals vary... inversely in proportion to the mean altitude of the sun when above the horizon." [15] He is likely reporting a "D" layer phenomenon.

Newfoundland and Southern England are at about 50 degrees North latitude; the arctic circle is at 66.7 degrees North. Winter sunlight at this latitude is very low angle, even at Noon, is well filtered atmospherically and thus also less destructive of nighttime ionization patterns, especially to the North. Marconi noted the effect in his 3.25-mHz short-wave tests of 1924, out to 1,400 miles at sea: "... the signals' intensity is symmetrical to the mean altitude of the sun at all times...." [15]; in other words, the further North, the stronger was the reception.

Day and night come as sunrise and sunset, but from a global perspective, dawn moves around the world followed by sunset. The edge of daylight or darkness is often called the "terminator." It is necessarily a great circle, the light of the sun on a revolving Earth. As the axis of the Earth points towards the sun in summer, the terminator extends up to the far side of the arctic circle (the "midnight sun" phenomenon). Then, in winter, the terminator is tangent to the arctic circle, leaving the polar region without any daily winter sun.

The terminator may be visualized on a Mercator or similar projection map of the Earth as an inverted "U" shaped curve in winter. Radio propagation along the terminator is often enhanced by apparent refraction and long path "ducting." This phenomenon is familiar to amateur radio operators and short-wave listeners as "gray-line" propagation. It is experienced more as a band rather than a sharp line, with signals intensifying, peaking and then diminishing as the terminator approaches and then recedes. On the afternoon

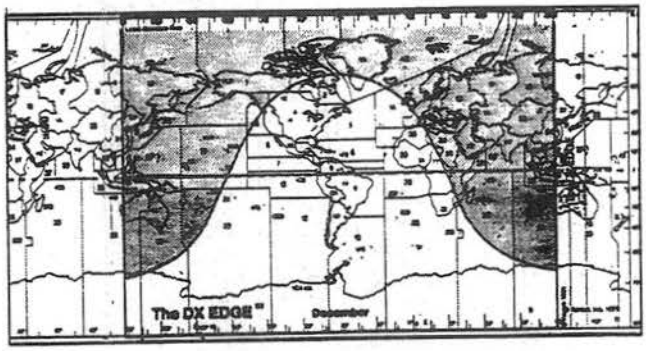


Figure 13. *The DX EDGE™ propagation mapping system for December.*

of every December 12, including 1901, the gray line runs just west of England and well west of Newfoundland. Between 12:30 PM and 2:20 PM both the Poldhu, England transmitter and the St. John's, Newfoundland receiver were within a few degrees of the terminator, with Poldhu on the sunset side. See the accompanying illustration (Fig. 13) using the DX EDGE™ propagation mapping system [9].

Marconi thus enjoyed

1) an optimal solar season of zero sunspots for enhanced lower frequency and daytime propagation,
2) an optimal Winter season of minimal atmospheric noise and as well as enhanced daytime propagation, and
3) a good time of day at his latitude for gray line propagation.

That Marconi heard the three clicks of his coherer in his telephone receiver earpiece has always been a matter of faith in the integrity of the man [2, 4], true enough borne out by all later successes. Yet Marconi could hardly have chosen a better time or place to make his attempt, knowing as he did that the human ear is a very sensitive instrument.

Recent work on radio propagation suggests the importance of these aspects of Marconi's triumph. In 1991 a group of experimenters traveled to St. John's, Newfoundland in November to listen for distant signals ("DX") in the broadcast band, 500 kHz to 1600 kHz, or roughly 600-meters to 200-meters wavelength, bracketing Marconi's likely 366-meter wavelength and 820-kHz frequency. With modern receivers and long-wire Beverage antennas, and despite auroral interference, even low-power stations in Europe, South America and Africa provided "a tidal wave of transatlantic DX" to the radios at St. John's, confirming that "the best medium wave location is next to the ocean." [8].

Figure 14. *Face of a present-day French phone card imbedded with a silicon chip, showing Marconi.*

Figure 15. *Face of a 2000 lira Italian banknote, commemorating Marconi.*

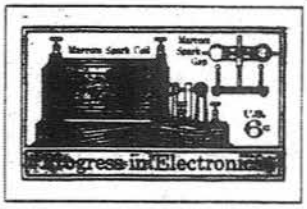


Figure 16. *The 1973 US postage stamp, showing the Marconi apparatus.*

Recent research also suggests that at lower frequencies (circa two mHz) signals from a transmitter newly within the sunset terminator may be enhanced for a receiver on the other side of the terminator [7], which was the situation between England after sunset and Newfoundland, between local 12:30 PM and 2:20 PM, at 50 degrees North in December. This is sometimes attributed to the temporary formation, just behind the terminator of an "F layer" in the ionosphere, providing a reflecting or refracting surface for low frequencies across the terminator into the areas not yet in sunset or darkness [7]. Such conditions, if indeed they did obtain on December 12, 1901, would have provided yet another etheric facilitation of the one skip needed by Poldhu's three dots to get the 1800 miles to St. John's and into history.

Marconi's achievement is still celebrated in many ways; two of the most interesting are a French "phone card" (Fig. 14) with a silicon chip on it [11], and on Italian money (Fig. 15) [3]. The United States Postal Service also honored Marconi in 1973 (Fig. 16) [21].

Sources and Notes

[listed alphabetically, inner citations also alphabetical]:

1. Anderson (C. N.), *A Representation of the Sunspot Cycle*, Bell Telephone System Radio Monograph B-1139 at 6; also XVIII Bell System Technical Journal 292 (April, 1939). The exact sunspot number of *zero* for December, 1901 is available from the NASA archive: www.science.nasa.gov and most specifically, http://science.msfc.nasa.gov/ssl/pad/solar/greenwch/spot_num.txt

2. Aitken, Hugh G. H., *The Continuous Wave — Technology and American Radio, 1900 - 1932*, John Wiley & Sons, 1976; Princeton Univ. Press, 1985:

Amateur priority on short waves, at 512 and n. 53

Syntony and Spark — The Origins of Radio, John Wiley & Sons, 1976; Princeton Univ. Press, 1985

Dowsett, at 296 in n. 89; Baker [4] says Marconi agreed, at 71 fn.
Integrity of Marconi, at 295 at n. 86, citing [4] Baker at 71
Ionosphere and reflection, at 243
Marconi, Chapter 5 at 179ff
Propagation at its worst, at 295 in n. 86; *accord* Baker [4] at 71
Smaller wire array antennas resonate at higher frequencies, at 267
Wavelengths for 1901 test, at 269

3. Banca D'Itala, *Duemila Lire* (2,000), October, 1990. Marconi's yacht *Y.S. Elletra*, a magnetic detector and a four tower wireless station appear on the reverse. Marconi also appears on the obverse of two Italian coins.

4. Baker, W. J., *A History of the Marconi Company*, London, Methuen & Co., 1970, New York, St. Martin's Press, 1971

Integrity of Marconi, at 71
Italian Navy coherer, at 68
Propagation at its worst, at 71

But was the coherer in Newfoundland self-restoring? "Suddenly, there sounded the sharp click of the 'tapper' as it struck the coherer, showing me that something was coming" Marconi is reported to have recalled later. See Giancarlo Masini, *Marconi*, 1976, [translation in English, 1995. Marisilio Publishers, New York], at 158, quoting unsourced but apparently written "recollections" of Marconi of the events of December 12, 1901.

5. Brown (Robert R.), *A Brief History of Ionospheric Studies*, Fine Tuning's Proceedings, 1994-1995, at P6.1ff; see also Ian Poole, *Radio Waves and the Ionosphere*, *QST* Magazine (November, 1999) at 62.

6. Bucher, Elmer E., *Practical Wireless Telegraphy*, Wireless Press, 1917

Decrement §169 in Part XI Practical Radio Measurements, at 200
"Double hump" graph of wavelengths, at §182 at 219
Marconi engineer, title page, at [i]

7. Clark (David) and John Bryant, *Additional Notes on Tropical Band Propagation*, Fine Tuning's *Proceedings*, 1991, at P4.1ff

8. Connelly, (Mark; WA1ION), *The Newfoundland 1991 Medium Wave DXpedition*, Fine Tuning's *Proceedings*, 1992-1993, at F32.1ff

9. DX EDGE™ copyright Xantek, Inc. 1981 using the Miller Cylindrical Projection and a different sliding terminator overlay for each month of the year

10. [Editors], How Far on What K-C [kilocycle, kHz]? *Short Wave Craft*, July, 1932, 160. This graph exactly predicts Marconi's 1902 night distance of 2,000 some odd miles, assuming a frequency of 800 kHz and comparable sensitivities in receivers

11. France Telecom, *Télécarte 50*, Guglielmo *Marconi* (1874-1937), *Les Grandes Figures Des Telecommunications*, which goes on to say, in French, that Marconi "... primed the birth of wireless telegraphy [*la TSF*] by copying his first signals in 1896 [and that] in 1901, he sent the first radiotelegram between England and the New World"

12. Gilette (artist), painting of Marconi Telegraph Station and Poldhu Hotel..., Tuck's Post Card No. 7740, circa 1912

13. Lee (Manning DeV.) (artist), drawing of kite lofting, in Joseph Cottler, *Marconi*, Calif. State Department of Education, 1956, at 28

14. Marconi. Guglielmo, Looking Back Over Thirty Years of Radio. *Radio Broadcast*, November, 1926 at 28

700 and 2200 miles on *S.S. Philadelphia*, at 29 (see also LXX Proceedings of the Royal Society, June 12, 1902)

Kemp's calendar, at 29

Marconi's earliest theory of propagation may be found, curiously, in a 1901 story by Rudyard Kipling titled "Wireless" in *Mrs. Bathurst and Other Stories* (ed. Lisa Lewis, in The World's Classics, Oxford, 1991 at p. 23). Marconi had visited Kipling at his home in 1899 and explained how signals penetrated the ether. Kipling opens his story with dialogue starting "It's a funny thing, this Marconi business, isn't it?" Later, he quotes the wireless operator: "Grand, isn't it? That's the Power — our unknown Power — kicking and fighting to get loose," said young Mr. Cashell. "There she goes — kick — kick — kick into space..." I am indebted to Professor Thomas Gavin for his insight and initiative in making this material available to me.

15. Marconi, Guglielmo, *Results obtained over very long distances by Shortwave Directional Wireless Telegraphy more generally referred to as The Beam System* — paper read at the Royal Society of Arts on the 2nd July, 1924 by Senator Guglielmo Marconi... Reprint from the Journal of the Royal Society of the Arts [privately, presumably for the Marconi Company]

Altitude of the sun, at 6 (seasonal), 8 (daily)

Parabolic reflectors, at 4, Fig. 3

It was Marconi's deep conviction that the explorer of a new technology should always reach beyond the limits suggested by the "experts" of the day, and not permit such expertise to constrain experiment or ambition.

16. McNichol, Donald, *Radio's Conquest of Space*, Arno Press reprint, 1974 of Murray Hill Books, 1946

Poldhu circular antenna, illustrated at 138

Kite antenna, illustrated by an unidentified artist, attributed to Radio Corporation of America, at 140.

17. Newfoundland [Postal Authority], 1937 green nine-cent postage stamp of Cabot Tower on Signal Hill, noting: "First Trans-Atlantic Wireless Signal Received [in] 1901"

18. Noack, (F.), How Sun Affects S-W [Short Wave] Reception, *Short Wave Craft*, December, 1932, 400 at 507

19. Reynolds, Pam, *Guglielmo Marconi*, The Marconi Company, 1984.

Jury rigged fan antenna, at 9, item 21(photo); Baker [4] says 50 wires, at 66, Fig. 6.2 but the photo suggests fewer

Marconi's calendar, at 10, item 22

S.S. Philadelphia 1902 tests, at 10, items 23, 24

20. Robinson, Capt. S.S., Capt. D. W. Todd, and Cmdr. S.C. Hooper, *Robinson's Manual of Radio Telegraphy and Telephony* ..., Annapolis, U.S. Naval Institute, 1919

Graphs of double hump wavelength emissions, at 242 see Fig. 135, and at 250 see Fig. 139

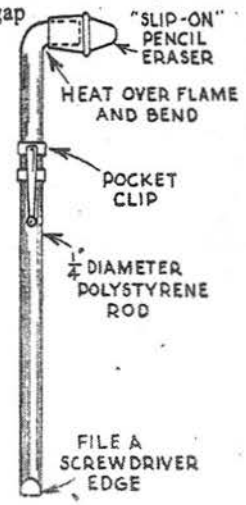
Humps of differing wavelengths, at 238

Shorter wavelength for second hump, at 238

Tuning for sharp peaks, at 239ff

21. United States Postal Service, six-cent multicolor postage stamp of the 1973 series (of four) denominated "Progress in Electronics," designed by Walter and Naiad Einsel, illustrating a Marconi induction coil and an early spherical spark gap

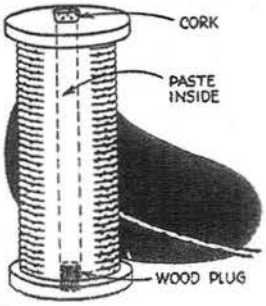
[END]



Tube-Tapper

• A combination tube-tapper and ultra-high frequency alignment tool can be made easily by any radio man. Take a 7 in. length of ¼ in. dia. polystyrene rod; heat one end over a flame; make a 1 in. right-angle bend, and dip it in cold water. Cement a slip on pencil eraser onto bent end of rod. File screwdriver edge on other end of rod. Slip and tighten pocket pencil clip on, and your tool is finished. —ARTHUR TRAUFFER.

Soldering Flux in a Spool



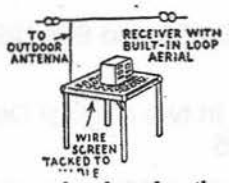
• Soldering flux, in paste form, can be kept inside of the hole in the spool on which the wire solder is wound. Tightly close one end of the spool with a wooden plug and insert a small cork in the other end. Time and space can be saved by this arrangement, and the flux and solder wire are always together.

105 North Street
Coral Grove, O.

JACK BRYANT

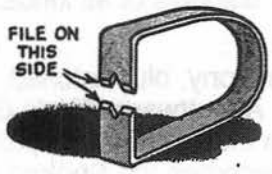
CHRS Membership Directory,
CHRS Repair Directory,
and CHRS Classified sections
omitted from the on-line issue.

Wire Screen Serves as Signal-Booster for Loop



• To increase signal pick-up when a portable receiver is being used in a steel building, connect a regular outdoor antenna to some large insulated metal surface in the room, such as to a copper screen placed under the rug, or to a piece of screen tacked under the table on which the receiver is most often used.

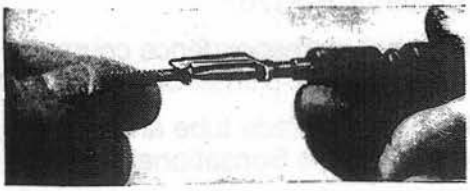
Handy Wire Peeler



• A piece of spring steel or an old hacksaw blade with the teeth filed off, measuring 7" long by ½" in width, makes a handy wire peeler. Cut a "V" in each end ¼" long and file on one side only of the "V" notch, tapering it like a wood chisel. Emery cloth all burrs and bend the spring steel or hacksaw blade into a horseshoe shape. When wire is to be peeled, slight pressure will cause the jaws to cut through the insulation, and by giving the peeler a half turn, the insulation is cut and the wire bared.—BARNEY M. JENSEN.

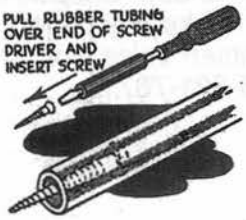
Pencil Clip Secures Screw to Driver

• A screw-holding screw driver is easily made by adding an ordinary metal pencil clip to the driver, as shown, so that it will hold the head of the screw while it is being placed



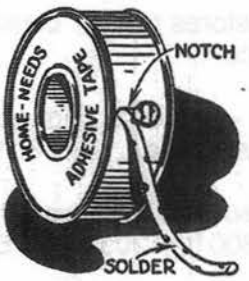
in position for driving. It will probably be necessary to bend the arms of the clip with pliers so that it will grip the smaller driver shaft. Pull clip back out of way when not in use.—K. M.

A Tube Will Hold Screws



• If you have difficulties inserting screws in small space, you can solve this problem by putting a piece of rubber tubing on the end of the screwdriver. The tubing will hold the screw firmly and securely in place as you work the screw in.

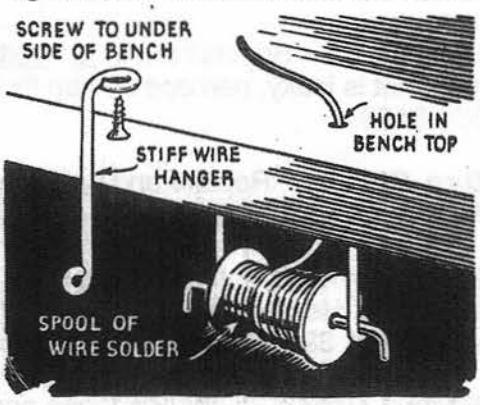
Handy Reel for Solder



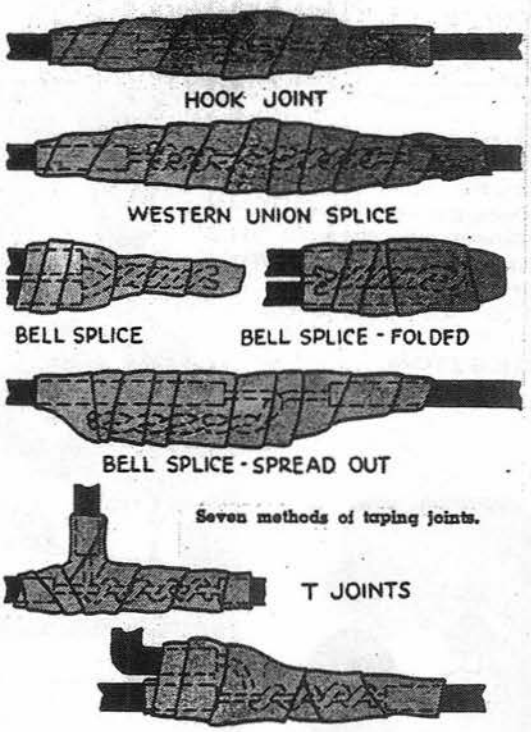
• Small household packages of solder that are not regularly supplied on a reel can be transferred onto a handy dispenser and holder by coiling them on a used adhesive tape reel as shown in the drawing. This does away with much of the direct contact with the solder and any escaped flux. Cut a hole at the side of the can for uncoiling the solder. A wedge-shaped notch at the side of the hole will lock the solder from receding back into the can.

Keeping Wire Solder Handy

• By supporting the spool of wire solder by wire hangers beneath the top of your metal working bench, and running the end through a hole



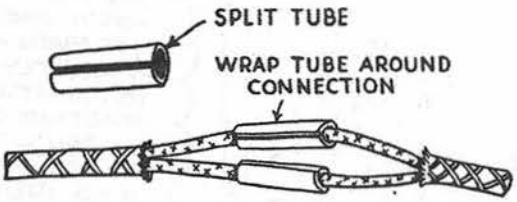
in the bench, you will have solder always within handy reach. A bend in the end of the wire will prevent its slipping through the bench.



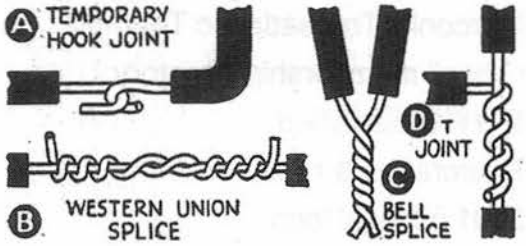
Seven methods of taping joints.

A Safe Connection

• When making a wire connection for our radio, I cut two one-inch pieces from a half-inch rubber tube. I split these and put one around



each wire at the connection point. Then I wrapped some tape over all, and it made a neat, safe job.—FRED CORNELIUS.



Four types of wire joints.

THIS IS YOUR CHRS *2001* RENEWAL FORM. PLEASE FILL IT OUT COMPLETELY, CUT AT THE DOTTED LINE, AND SEND IT BACK ALONG WITH YOUR $20 DUES, AND ANY DONATIONS. PLEASE RENEW AS SOON AS POSSIBLE. CHECK YOUR MAILING LABEL, IF YOU ARE PRE-PAID THROUGH '01,'02,'03, LIFE OR COMP, PLEASE INDICATE. PLEASE CORRECT ANY ADDRESS PROBLEMS OR CHANGE OF ADDRESS ON OR ABOUT YOUR LABEL ON THE OTHER SIDE.

CUT HERE AND MAIL TO: CHRS, P.O. BOX 31659, SAN FRANCISCO, CA 91431

---

1. My *2001* membership dues of $20 is enclosed.....[__] I am pre-paid.....[__]
2. I will volunteer time to help CHRS.....[__] or serve on the Board.....[__]
3. I am donating $_____ to the CHRS General fund.....[__] $_____ Museum fund.....[__]
4. I will help with the Presidio Restoration Project.....[__]
5. I will write an article for the CHRS Journal.....[__]
6. Cancel my ad [__] Continue my ad [__] My new ad for the next CHRSJournal:_____

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_____

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7. List me in the CHRS repair and restoration guide as follows:_____

_____

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8. Order me a New CHRS name badge: _____

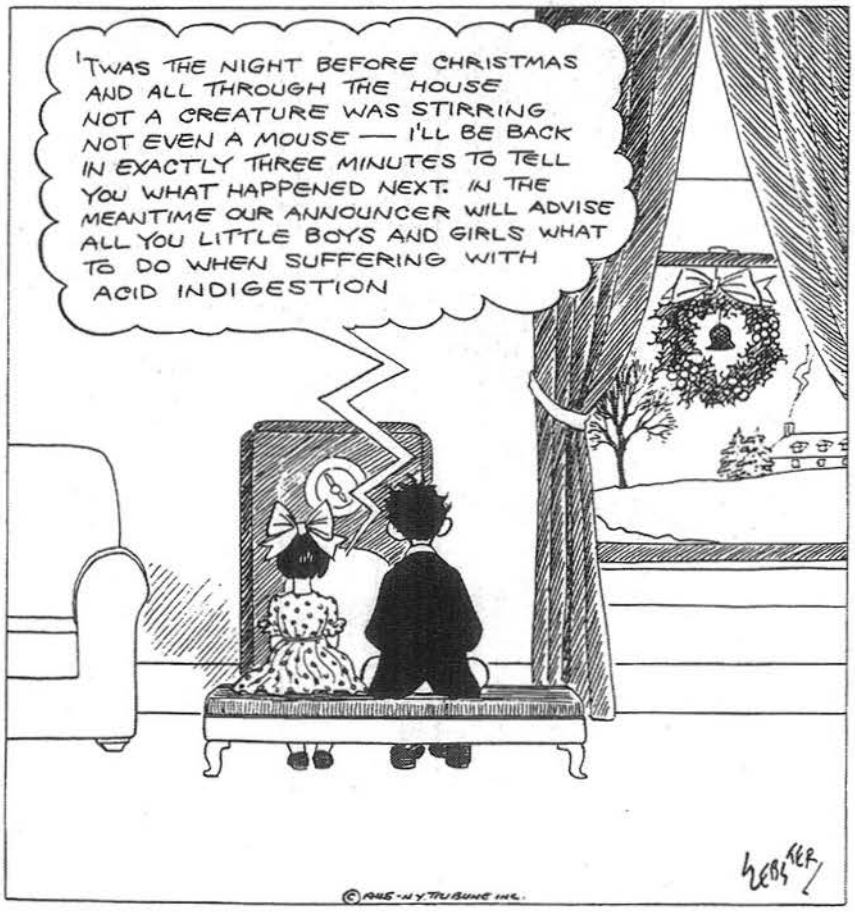
   (Please enclose $9) _____

9. I have the following suggestions, recommendations or comments for CHRS:_____

_____

_____

CONTENTS



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