RADIO BROADCAST

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How Radio Grew Up

Many Little Known Facts About Radio Development are Related—Here Is the First of a Series of Articles on This Subject Written by a Pioneer in Wireless

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REPEATEDLY during the last one hundred years, radio has been referred to as new, which has had the result of making people come to the conclusion that it must be new. This is, of course, very confusing, and is due no doubt to the fact that certain inventions and inventors have been overrated while others have been forgotten. Human love of fairy tales makes it easy for a man or a corporation with money to refer to a certain individual as the great one who has done all of the wonderful things that have been done. Money getters, too, take advantage of that love of fairy stories to fill their pockets.

Haywire, halos, and haymakers have characterized many of the early careers in radio. Inventors and would-be inventors built haywire apparatus. Promoters built press agent halos around the alleged inventors and their haywire products. Some of the hay went to develop radio and a lot of it went to whoever received the stock jobber's money. Sometimes promotors became so extravagant in the claims about an invention that the inventor himself would be found to disclaim some of the things that he was purported to have done, and to give the credit to others. Such a procedure was, of course, just what the promoters wanted, and they immediately got their press agents and after-dinner speakers on the job, in order that they might tell how modest and generous the inventor was, and thereby stud his halo with the pearls of modesty and generosity.

Homage is due to many rather than to a few. Many radio developers have received little compensation for their work in the past and they are not in a position to collect now. The public owes a debt to many people which it cannot pay. Some of those people need the money, others do not; some are dead while those still alive do not expect to realize anything on their past labors.

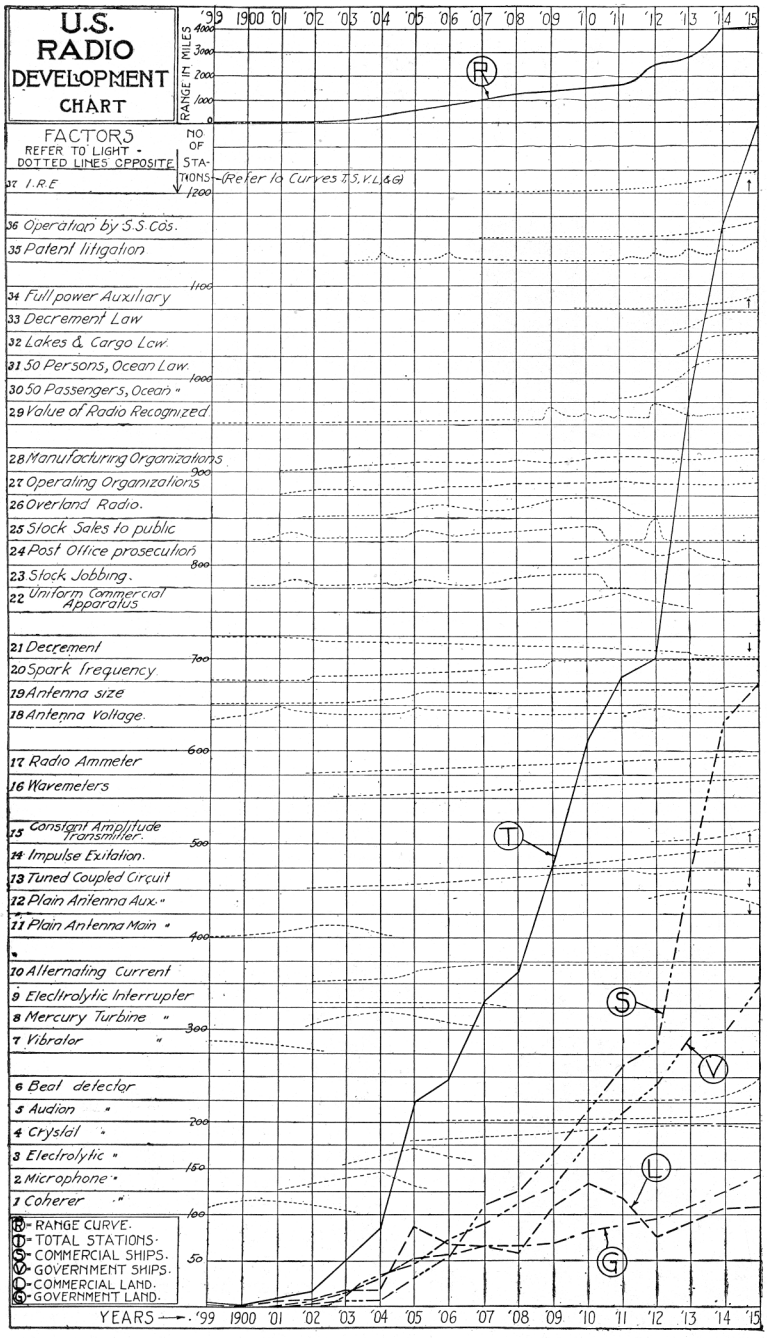
A PORTABLE SET, 1901 MODEL

Mr. Marriott operating a portable transmitting set. Note the ground plate on the floor. With an outfit about the same size as this, using vacuum tubes as the radio generating device, signals are being sent by amateurs using code, for tremendous distances. The Laboratory of RADIO BROADCAST recently communicated with the U. S. S. *Seattle* as she was leaving Tahiti in the Pacific ocean. A five-watt tube was used as a transmitter for this remarkable communication

The changes in radio development may often be traced to unexpected causes. For example, the United States Prohibition Act seems to have played a somewhat important rôle in the recent stimulation of radio broadcasting. Volstead's unintentional creation of laborious home brewing and the attendant substitution of inconvenient bootleggers for bar tenders, has apparently been an important step in the development of radio, because it suddenly has shut off from the public a very convenient means of spending their money. Now these baffled people are looking for other outlets. Broadcast receiving has supplied that demand, and its problems present a new field in which alcohol-free brains may engage.

Not only is radio history valuable as a thing of interest, as educational, and as a precedent for use in planning the future, but it is valuable in other ways. I was recently examined and cross-examined for three days about historical radio devices, for evidence in a radio suit. I believe the suit was for several millions of dollars. At any rate the amount was so interesting that two lawyers and an expert traveled across the United States and back to get my testimony.

The lawyers' questions and my answers in that testimony took up more words than I am using in this whole series of articles. The testimony was relative to only a few historical devices which had their origin from 1899 on, while I am striv-



HOW WIRELESS DEVELOPED

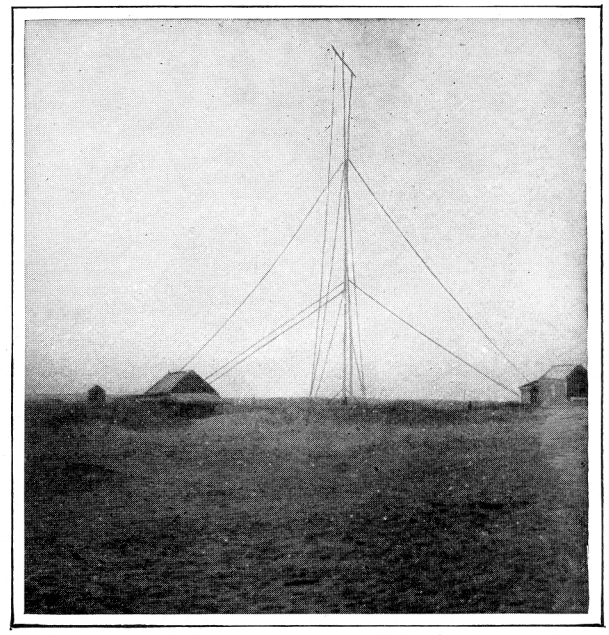
One of a number of charts presented by Mr. Marriott in a paper published in the *Proceedings of the Institute of Radio Engineers* for June, 1917, showing graphically the rise and decline of the various radio factors. For example, the electrolytic detector, No. 3 in the charts, came into use about 1902, was the leading detector about 1905 and then gave way to crystal detectors, No. 4

ing in these articles to outline the more interesting points in the development of radio since about 1790.

Starting on our outline of radio history then, we find that Galvani got a "radio kick" out of frogs' legs even before 1790; De Salva wrote a recipe for a "wireless" in 1795; Morse built a "wireless" which worked across narrow bodies of water in 1842; Maxwell wrote a theory for radio in 1867; Loomis patented a "wireless" in 1872; Hughes made and used a radio in about 1879, but he only let a few friends in on it; Professor Dolbear patented one in 1886; Hertz made a tuned radio system according to Maxwell's recipe in 1886, and that development led others in our radio of today.

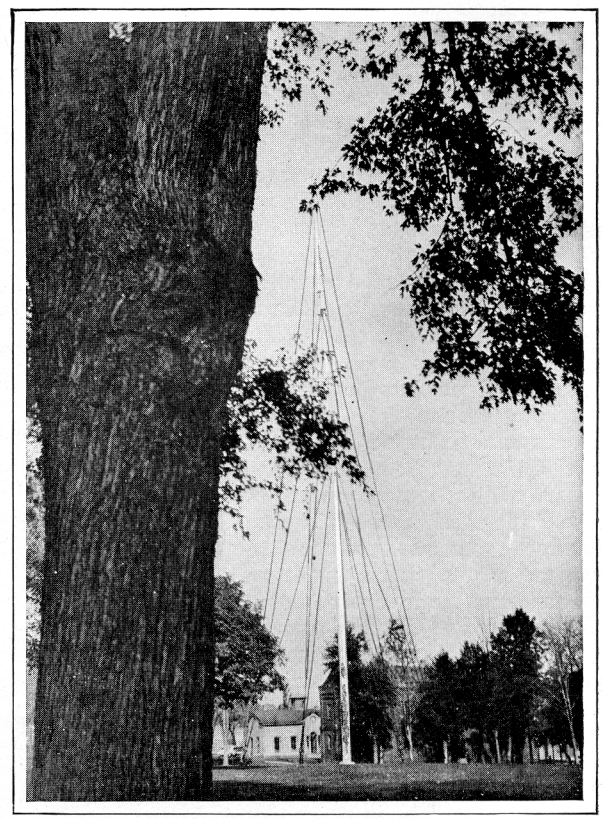
MARCONI EXPLOITS RADIO

RADIO had been thus brewing since the 18th century. By 1895 it was ready for exploitation, by which I mean that it was ready for sales engineers, exploiters, promoters, advertisers, and others. Marconi demonstrated the more or less academic radio instruments to some politicians, army men, and money getters at this time. He played the part of a demonstrator and sales engineer. A money getting company was then formed



A VERTICAL ANTENNA

About the year 1900, vertical antennas were quite popular for land stations, but as wireless became more general and the installations more elaborate, the flat top horizontal type was almost universal. It is interesting to note that now, for short wave transmissions, amateurs and others are returning to the vertical antenna



AT ANNAPOLIS

How the wireless towers looked when the picture was taken on October 25, 1902. On this day, some history was made, for, using this equipment, the Navy made its first record of about 50 miles by wireless from this equipment to a ship. Fifty miles, with the equipment known then was an extraordinary distance

which, in attempting to obtain a monopoly, set out to advertise to everybody that Marconi was the inventor and that they owned that patent on wireless which entitled them to a monopoly in America and other places. That was not, of course, true, but he did advertise wireless and to him is due the credit for having started the development of radio in many different parts of the world.

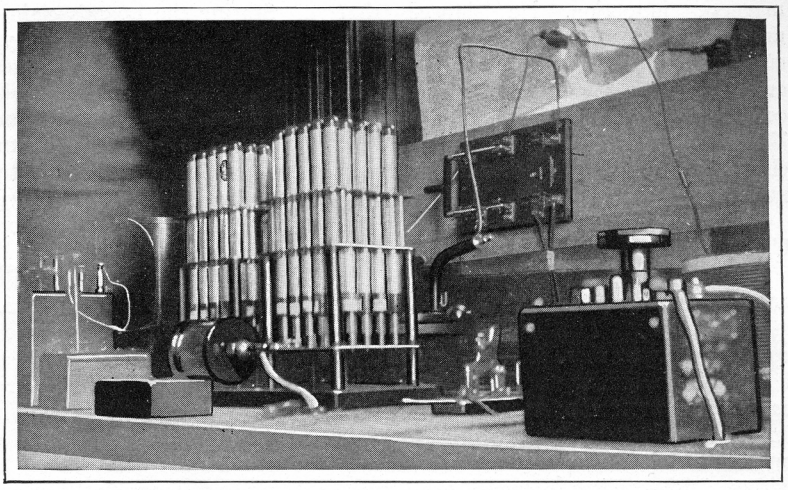
By 1900 radio had edged itself into the market as a mild public service. It continued as a tonic and stimulant for business, for military purposes, and for life saving. To obtain plenty of radio equipment for recent war purposes greater quantities of money and effort were suddenly put forth. In 1921 a radio by-product called broadcasting began to take on. Now it is a principal product, a product that sold for about $350,000,000.00 last year. That is a very brief outline of some of the more important events in the history of radio.

Luigi Galvani was an Italian anatomist and he got the kicks from frogs' legs when he put them near an electric spark. Nowadays we would call his spark maker a radio transmitter while the detached frogs' legs acted as the radio detector. Therefore he must be credited with having made a genuine radio experiment one hundred and thirty-five years ago. The distance between the spark gap and legs must have been only a few inches or, at most, a few feet, and at that time the whys and wherefores probably were not realized.

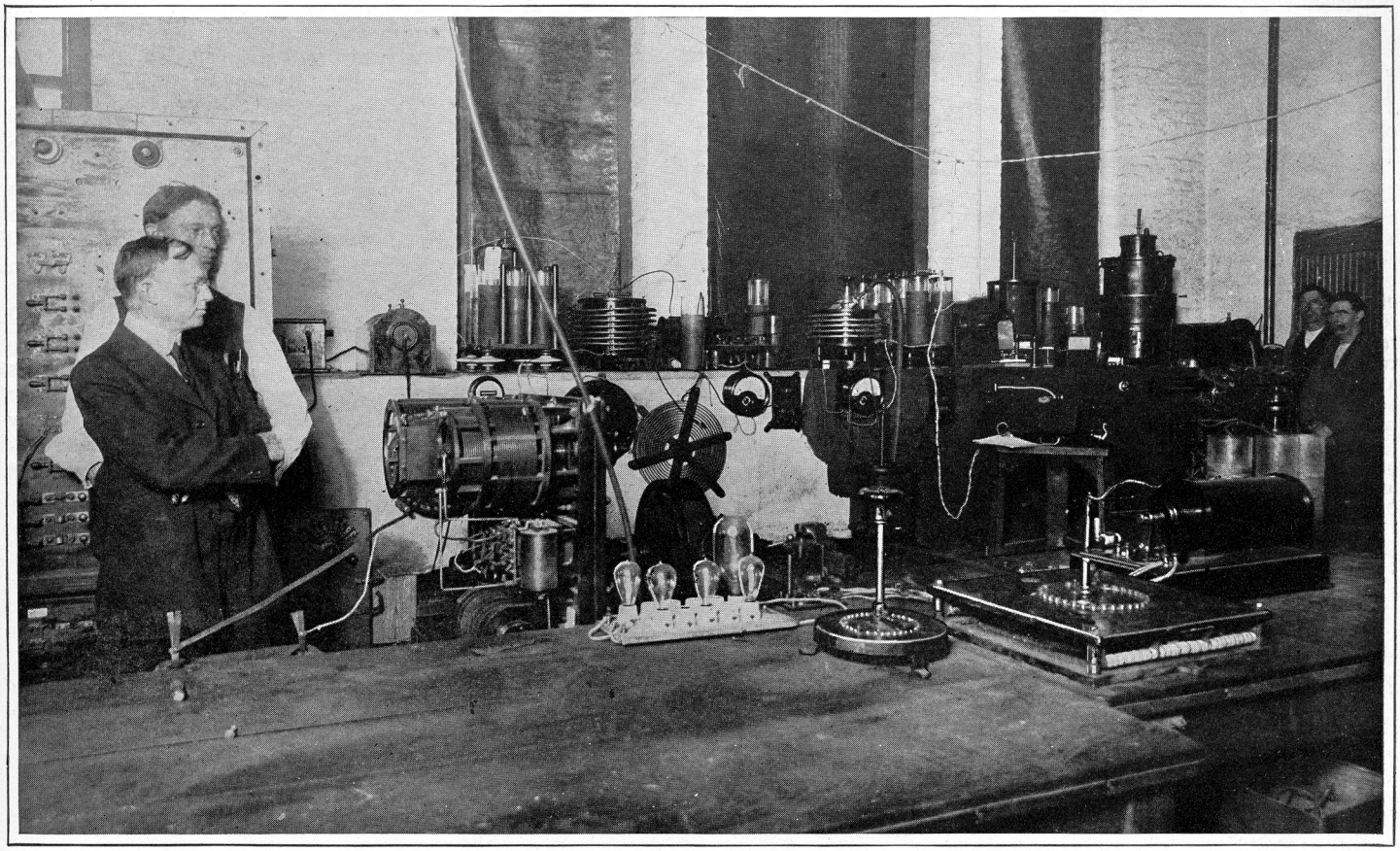
On December 16, 1795, De Salva, a Spanish physicist, read a paper before the Academy of Sciences at Barcelona in which he said: "One could, for example, arrange at Mallorca an area of earth charged with electricity, and at Alicante a similar space charged with opposite electricity, with a wire going to, and dipping into, the sea. On leading another wire from the sea shore to the electrified spot at Mallorca, the communication between the two charged surfaces would be complete, for the electric fluid would traverse the sea, which is an excellent conductor, and indicate by the spark the desired signal."

If Salva's scheme had worked as he said, it would have been wireless, but not radio. He specified for the flow of a direct current from one station to the other, rather than waves composed of combined magnetic fields and condenser fields such as are radiated from one radio station to another. However he had the idea of establishing wireless communication. Therefore the idea of wireless communication by electrical means must be at least one hundred and thirty years old.

In 1831, Faraday demonstrated electro-



INTERIOR OF THE OLD ANNAPOLIS STATION



A GALLERY OF TRANSMITTING APPARATUS

In use between 1899 and 1915 set up in the Brooklyn Navy Yard. Mr. Marriott, at the left in the photograph, was the expert witness in a case tried before a United States judge in 1915. In the foreground, to the right, is a ten-inch induction coil, with separate vibrator. This was connected directly to the antenna and was popular until about 1906. Various kinds of glass jar transmitting condensers can be seen. The inductances, of large wire, are "oscillation transformers" and coupled the oscillating circuit, consisting of spark gap and condenser, inductively to the secondary circuit which had taps leading to antenna and ground. This is a most unusual historical photograph

magnetic induction. He showed that making current start and stop in one circuit would cause currents to flow in a circuit parallel to it, although there be no connecting wires between the two circuits. That was a kind of wireless, but it is not classed as the kind of wireless we call radio.

Professor Samuel F. B. Morse, of the United States, telegraphed across narrow bodies of water in 1842, by installing a ground return transmitter circuit along one bank and a ground return receiver circuit along the other, without any wires between the sender and receiver. His, again, was not radio communication but it was wireless communication. He not only had the idea of communicating without using wires between the transmitter and receiver, but he did actually telegraph with success that way. The currents between the points at which he connected his transmitter are supposed to have wandered across the stream and through the wire that connected the two points of ground or water contact of his receiver. That was a kind of wireless that worked, and it worked more than eighty years ago.

The electromagnetic theory, which is our present accepted theory of radio wave propagation, is said to have originated with William Clerk Maxwell, a noted Scotch physicist in about 1867, and it was published shortly after that time.

LOOMIS UTILIZES STATIC FOR SENDING

JULY 30th, 1872, patent number 129,971, was issued to Mahlon Loomis, dentist, of Washington, District of Columbia. The following is quoted from the patent.

What I claim as my invention or discovery, and desire to secure by Letters Patent, is—The utilization of natural electricity from elevated points by connecting the opposite polarity of the celestial and terrestrial bodies of electricity at different points by suitable conductors, and, for telegraphic purposes, relying upon the disturbance produced in the two electro-opposite bodies (of the earth and atmosphere) by an interruption of the continuity of one of the conductors from the electrical body being indicated upon its opposite or corresponding terminus, and thus producing a circuit or communication between the two without an artificial battery or further use of wires or cable to connect the coöperating stations.

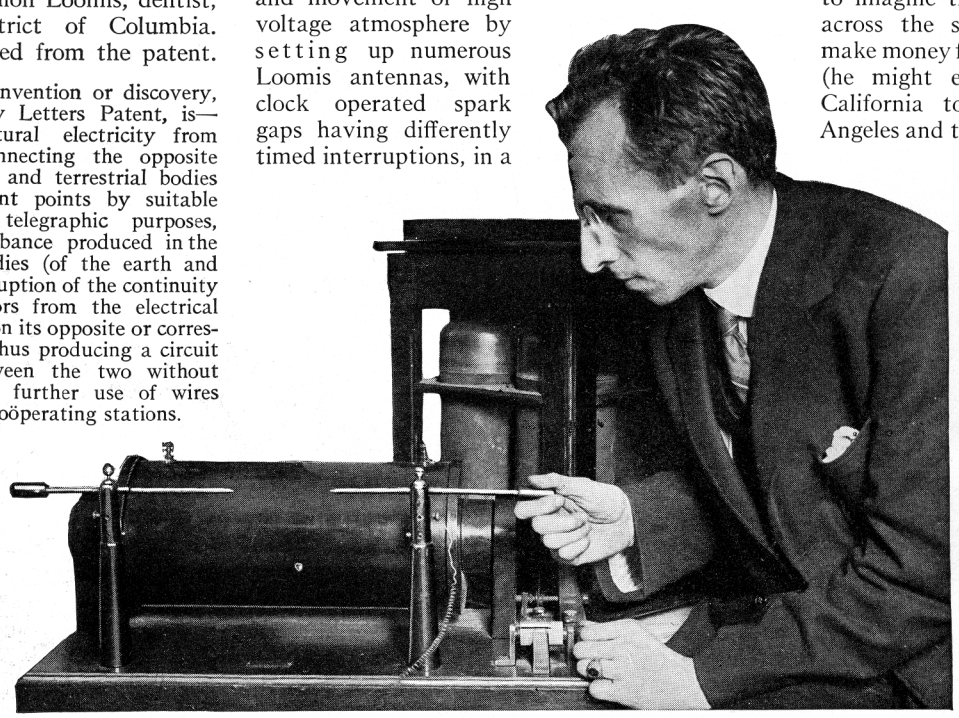
Stating the Loomis claim briefly and in present day language; if you put up an antenna where it will get atmospheric charges, and interrupt the flow of current from the antenna to ground, you can send messages. If the atmospheric voltage is high enough so that the sparks from antenna to ground will jump a gap of one inch, it would be possible to send messages more than a hundred miles to a present day receiver. However, the atmospheric voltage is not reliable for telegraphing, because conditions vary widely in different locations and at different times. Unless you use a sensitive galvanometer you might be unable to detect any voltage on your antenna, the day you read this. On the other hand, it is not a safe thing to try, carelessly, because you might get too much voltage, especially just before a rain storm.

That arrangement as described by Loomis, has worked for me many times in years past and in fact I am experimenting with such a device at present. I am using the system to find out things about the unidentified noises that interfere with radio receiving, and about fading and static. The one I am working with now is interrupted by a little copper water wheel. When the voltage is low the current only discharges from the antenna through the longest paddle of the wheel. When the voltage is high it jumps to all four. Some of us can hear it click at our receiving stations and get an idea of what is happening in the atmosphere.

An observer might record the area and movement of high voltage atmosphere by setting up numerous Loomis antennas, with clock operated spark gaps having differently timed interruptions, in a large circle around him and his receiving apparatus. Weather scientists may find this suggestion useful.

From observations made with this kind of an arrangement, it seems that some of the interference one hears on a broadcast receiver is probably due to the atmosphere charging insulated conductors to such a high voltage that the charge jumps over to earth in one spark which produces a click, or many sparks, that produce grinding, buzzing, or sizzling noises. The conductor in question might be a guy wire, fence wire, power wire, or something else. If electric power follows those pilot sparks to earth, you may hear an alternating current or commutator hum. Falling rain may contribute both voltage and moisture, causing a power circuit to leak over insulators.

I am not an inveterate story reader, but so far as I know, fiction writers have overlooked the possibilities of the Loomis antenna. All their hero or heroine needs for wireless salvation are the right weather conditions, an elevated conductor and the radio code. The villain might even grab the conductor and get a static knock-out. Loomis was away ahead of his time. His patent was not only for communicating without wires, but for taking the electricity to do it with from the atmosphere. He apparently did not reason according to the radio theory, but the idea he patented certainly works that way. He wanted to make static send messages. He probably imagined wonderful possibilities "via static," but I daresay he didn't go so far as to imagine then that the new baby across the street was destined to make money from automobiles; move (he might even fly) to Southern California to a place called Los Angeles and there buy a winter home for a fabulous sum, retire and spend his time playing Mah Jongg or working cross word puzzles, and maybe even drinking home brew while listening to Washington jazz delivered without "wires," in 1925.



"HIGH POWERED" EQUIPMENT—IN 1903

The ten-inch induction coil which was standard during the early years of wireless as the transmitter. Nothing was simpler than the circuit used. About twenty volts was supplied to the primary of the coil and some eighty or a hundred thousand volts were produced between the electrodes the operator is adjusting. Ships and shore stations alike used the coils and sharp tuning was unknown. Those were the days when no one knew exactly what wavelength he was using and didn't care. The few wavemeters in existence were objects of curiosity in almost inaccessible laboratories