THE ALEXANDERSON ALTERNATOR, A "NEAR PERFECT" SYSTEM OF W/T TRANSMISSION

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A SLIDE SEQUENCE PREPARED BY KAYE WEEDON, 1982

100 years ago, it was demonstrated by Marconi and others that it was possible to communicate over useful distances by wireless telegraphy. This was possibly the greatest advance in technology since the invention of the wheel. However the first practical systems made use of spark transmitters, and the resulting damped wave output was wasteful of spectrum space.

It was not long before the need for a better system was evident. Long before the invention of the valve made valve transmitters possible, two alternative systems of continuous wave transmission were in use. These were the Poulsen Arc transmitter, the subject of another slide sequence compiled by the late Kaye Weedon, and the Alexanderson Alternator system.

The Poulsen Arc was capable of transmitting a continuous wave (C.W.) signal which could be readily varied in frequency. It was able to do this because the arc has the property of negative resistance, in fact its operation can be compared to the tunnel diode. This, of course made sustained operation possible.

Another system had its champions. As early as 1889, the design of high frequency alternators was considered, although the purpose in mind had nothing to do with the transmission of signals. Arc lighting was in use, and when a low frequency alternator was the power source, a disagreeable hum resulted. If an alternator could be made which had an output frequency above the limits of audibility, the problem could be solved.

Professor Elihu Thomson and Nikola Tesla were probably the first to construct such alternators, and Tesla devised several forms of alternator capable of an output of 10 Amperes at a frequency as high as 12KHz. Both Thomson and Tesla built alternators in 1889, capable of 1Kw at 5KHz.

In 1903, Steinmetz built a 1Kw, 10KHz alternator which was used by Fessenden in experiments with wireless telephony, and in 1904 he placed an order with the General Electric Company (U.S.A.) to design and build an alternator capable of operating at a frequency of 100KHz. G E handed the order to E F W Alexanderson to design.

Alexanderson tested special Swedish iron strips 1.5 mills thick in strong magnetic fields, and found the iron capable of satisfactory operation at 100 KHz, so he designed the alternator with an iron core. However Fessenden rejected the design and insisted on the use of a wooden core as he was sure that iron would melt in a strong magnetic field at 100KHz.

By mid-1906 General Electric had built an alternator with a wooden core as specified, and Fessenden used it for his tests from Brant Rock, Mass. on Christmas Eve, 1906. He succeeded in broadcasting both speech and music, and the transmission was heard as far away as Norfolk, Virginia. However Dr. Alexanderson did not give up his idea of using an iron cored armature, and was able to obtain authority from G.E. to build a model alternator to his own design. When this machine was demonstrated to Fessenden he was convinced of its potential and placed an order for two 100Kw alternators using iron cores.

By 1915 a 50Kw, 50 KHz experimental alternator was being tested and Dr. Alexanderson was able to modulate it with voice, using a DeForest Audion valve to control a magnetic amplifier. Dr. Alexanderson was also responsible for the design of a multiple tuned antenna for use with the alternator.

By 1917 the 50 Kw alternator was ready to be tested in the American Marconi station at New Brunswick, N.J. but by this time America had entered the war and all radio stations were taken over by the U.S. government.

However the U.S. Navy became interested in the possibilities of the alternator for military purposes and tests proceeded under the supervision of the Navy. These tests were very successful, with better reception in Europe than any other American station at that time. The success of these tests resulted in the design of a 200 Kw machine, and it was placed into service in the summer of 1918.

With cessation of hostilities in Europe, the Marconi Company were anxious to acquire world rights to the Alexanderson Alternator, but President Wilson wanted to keep the system in American hands. The result was the formation of the Radio Corporation of America (R.C.A.).

A total of 12 200 Kw. alternators were built and sold around the world, but only one remains. This is installed at the Grimeton Station, near Varberg, Sweden and was placed into operation just a few years ago at the request of the Antique Wireless Association of America. The slides contain many pictures of this installation.

In conclusion, it should be borne in mind that for the first couple of decades of wireless history it was believed that successful long distance transmission required low frequencies and very high power. It was not until the early 1920's that the possibilities of "short wave" communication were demonstrated, chiefly by amateur radio enthusiasts and by E T Fisk of Amalgamated Wireless of Australia Ltd. in conjunction with the Marconi Company. The purpose of the latter group was to find an alternative to the chain of Wireless stations proposed for communication between England and the colonies by the British government, and resulted in the very successful (in its time) Beam Wireless system.

The above is based on original notes of the late Kaye Weedon and was prepared for the IEE 1995 conference celebrating 100 years of radio, by Ray Kelly, Historical Radio Society of Australia, PO Box 283, Mt Waverley, Victoria 3149, Australia

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