Chapter I

A Short History of Radio

One of the most fascinating stories of history is that of radio. What could be more interesting than to hear how man, after shouting his lungs out year after year to be heard only by a few people congested in a small place, was then suddenly given an apparatus whereby he could speak softly and yet be heard throughout the world within a second of time?

Radio indeed deserves the highest honors on the scale of inventions. Yet people today have become so accustomed to its use that they fail to adhere to the thrill of the earlier scientists.

To revive this lost ecstasy nothing would be more significant than a personal appraisement; calculating the facts of history, comprehending the theories behind the mechanism, and then seeing for yourself what makes a broadcasting station "tick".

First, let us look at history. We must all agree that the first broadcast was made many years ago, when a man named Adam caused a vibrating sensation to go out of his mouth and into the receiving set of a lady called Eve -- and broadcasting indeed has been getting louder ever since.

Not much was accomplished in those early days, but in 640 B.C. a new era could have begun when a man named Thales who lived in Miletus over in Asia, found that by rubbing his hands together between a piece of amber he could cause an electric sensation that would attract straw. This was the discovery of

(sp)

static electricity! For the next two thousand years the developement seemed to go static ------ and people became content just to let it be ----- "forever amber". ← (seems out of place in a formal paper.)

Benjamin Franklin made the next big step in 1749 when through his kite experiment he proved that an electric current may be conducted through a line.

Then came Morse, Alexander Graham Bell, and Thomas Edison with strange discoveries and in 1867 a man by the name of Maxwell presented an astounding theory in which he predicted radio waves. Nine years later Hertz demonstrated rapid vibrations of electricity projected in the form of waves. Then in 1895 radio had its beginning. Gulielmo Marconi, in Bologna, Italy transmitted the first signals on a homemade apparatus.

After much work in the process of developement it was found that practical application of radio could be used in ship to ship communication. The Navy was the first to use radio, and until 1912 such communication remained known as wireless.

Then Americans changed the term to radiotelegraphic and later became satisfied with the name "radio". However, the British continue even today to use "wireless".

Our word "broadcast" also came from the Navy and it was first used as a term of "broadcasting orders".

The first voice of broadcast is subject to debate. In 1892, Stubblefield said he was successful in Kentucky. In 1906, Fessenden said his voice was transmitted in Massachusetts; but, lack of proof caused the public to be skeptical as to who really did put the first voice on the air. However, we know for certain, that De Forest put Caruso on in 1910 and made such singing talent very popular over the waves. In 1915, the transatlantic voice tests proved successful.

In 1922, the first network went on the air as two stations jointly picked up a world series game. In 1923, President Coolidge was heard in his address to Congress.

1926 was NBC's starting year with the first regular network ----24 stations, and in the following year a coast to coast hook-up made it possible for people to hear a football game. CBS came into being in 1928 and in 1930 the first Round the World broadcast was made.

Soon it was clear that all the stations would have to be regulated by a certain body of directors in order that the confusion of the air might be eliminated.

The Department of Commerce was given the first opportunity to administrate with the Secretary of Commerce presiding. The Federal Radio Commission was next. Then by request of President Roosevelt, the Federal Communications Commission,(FCC)was adopted in 1933.

Today, the FCC is in charge of all broadcasts in our country, large and small.

International agreement provided for national identification of stations by the first letter of the call name. The United States was given "K", "N", and "W" for their letters. "N" was later designated to Naval Broadcasts, "W" for the stations east of the Mississippi, and "K" for all stations west of the Mississippi. ?

The other three letters were determined by the individual stations themselves as long as they were not already used in the same sequence by another station.

Commercial broadcasting was the highlight and continues to be the highlight of radio. However, on February 19, 1936 at Brown University, George Abraham and David Borst, two freshman, decided to hook up radios in their dormitory to a line from their special phonograph apparatus so that a selection of records could be heard at the same time throughout the dorm. Through their skill and enthusiasm the Campus Carrier Current was developed and on February 19, 1940 the Intercollegiate Broadcasting System, (IBS) was created as a non-profit mutual benefit association. Abraham and Borst were placed in charge and within a single decade the organization grew to national magnitude. In 1950, there were seventy-four IBS Stations.

Chapter II

KTJO History

Doctor W.D.Bemmels, Professor of radio at Ottawa University read a <u>Saturday Evening Post</u> one summer day in 1941 and came upon an article dealing with Campus Carrier Current stations. A brain storm hit and before the Spring semester was over in 1942, Dr. Bemmels' radio class had completed ~~making~~ the apparatus. The attempt proved successful and ~~they began~~ broadcasting. The Professor of speech, Mrs. Alice Gordon Wilson, also took interest and enthusiastically ~~took a position~~ of helping to organize ~~the~~ programs.

The 1942-1943 school year found the university broadcasting one hour a week from their studio in the basement of Tauy Jones Hall. Then in 1943-1944, because of the war, Ottawa went off the air.

The Spring of 1945 brought Ottawa University back into broadcasting with a six weeks series of broadcasts, transmitting waves once a week from the second floor of Tauy Jones Hall.

In the fall semester of 1945, work began on the east side of the top floor of Tauy Jones and as a project for extra credit, Norris Haight, a student at Ottawa University spent eight weeks of the hot 1946 summer on the radio station. He worked eight hours a day, five days a week and received six hours credit for his work. Five weeks he spent building the console and three weeks on the A.M. transmitter.

In 1951, work was finished and after acquiring an F.M.

transmitter, KTJO began broadcasting on two types of waves. In 1948, the A.M. transmitter was rebuilt by David Shanan.

KTJO has many interesting things in its history. Perhaps one of the more interesting is the 1945 incident in which representatives from the FCC took a field test and found that we were much too strong. Immediately the station had to change its modulation and relieve the wires that were hooked up to the city's power lines.

Another point of interest is how the station got its name. Our station began broadcasting under the name KOU but, it wasn't long before the FCC informed us that that particular group of letters wouldn't do. So we submitted ten names to the FCC with the confidence that at least one would be accepted,---all were refused. Twenty more names were submitted. The nineteenth was "KTJO" which was accepted. The letters signify: K--west of the Mississippi, TJ--Tauy Jones, O--Ottawa.

Chapter III

Radio Theory

It does us little good if we know the history of radio and are not familiar with the fundamental principles. Hence, we should get some idea of how a broadcasting station operates. What laws are affected? How do the waves travel? What instruments are needed for effective broadcasting and how do they work?

To portray the theory of radio in full would take volumes of explanation, diagram, and mathematical figures. A technical study of radio is not only deep and complex but also in part it is misunderstood.

However, the essence of the principles and the practicality of the instruments are very easy to understand.

Let us begin with the waves. As was mentioned in the last chapter, Maxwell, in 1867 found that through his mathematical calculating it would be very reasonable to believe that light travels in waves,--electromagnetic waves. From this early theory comes our fundamental theorem of radio waves.

First of all, there is a great band of electromagnetic waves surrounding the earth and traveling at the speed of light (186,000 miles per second). To picture the speed---if one could ride around the earth on an electromagnetic wave at the equator, he would go around the globe seven times in one second. These waves, however, do not only carry the so called "radio waves" but also all of our light and color and infra-red, ultra-violet, and X-ray waves. The cause of difference in these various sets of waves is the "wave length" of each. The longer waves on our scale represent the radio waves and the shorter waves represent the X-ray waves.

These waves travel in cycles and the speed of the wave is determined in the cycle per second. Such is called frequency. In other words a station with a frequency of 660 killocycles is sending its waves out at a rate of 660,000 cycles per second and may be found at 660 on your radio dial. If you turn to 550 on your radio dial you will receive a signal coming in at a rate of 550,000 cycles per second. These waves regardless of their speed are only as powerful as their power output. That is why KTJO operating on an output of 10 watts will not go as far or be as strong as KOA which operates on an output of 50,000 watts even if the other station characteristics are the same.

At this point there may be confusion over the two speeds mentioned. It should be noted that all radio waves travel at 186,000 miles per second regardless of their frequency. The number of cycles per second that make up the frequency do not become increased or decreased by the speed of the wave but are modulated (controlled) by the electrical power that pushes them out.

Radio waves are peculiar. When they are caged up in mathematical formulas they behave like trained seals, but after they are turned loose, they are so complex that we are unable to form a satisfactory and accurate picture of them. No man has ever seen a radio wave; our instruments only record the applied characteristics of them.

However, it is quite certain that radio waves travel in all directions when leaving the station antenna and those going parallel to the earth become ground waves. Sky waves continue to go up into the atmosphere until they come to the ionisphere located from seventy to two hundred and fifty miles above. At that point they reflect off of the ionized particles made by the ultra-violet rays from the sun and strike back to the earth again at the angle of reflection. Then back to the ionisphere and down to the earth again, continuously until they fade out because of absorption.

In the meantime, ground waves are leaving the antenna and speeding along the ground. Ground waves are absorbed much quicker than sky waves as a rule because of the many absorbing materials they pass through on earth.

When these two types of waves are in phase (or working together) they produce the quality of good broadcasting, but when out of phase (or not working together) the station signal will fade.

The rest of the principles of broadcasting are more simple to understand. In the broadcasting station we have five essential mechanisms: the sound producer, the microphone, the control board, the transmitter, and the antenna.

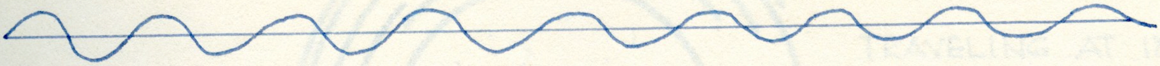
The sound producer may be "just anything that produces sound." Let's use for example, a man's voice. As he speaks, the sound goes into a particular microphone that has been constructed in a way to cause the vibrating characteristics of the sound to travel into the control board over a wire. There are three main types of microphones which all function for the same fundamental purpose.

The control board is known as the "console" to radio engineers and within it are several technical instruments. Some are made to mix the sounds, others to amplify, and others for other purposes. From this panel the 'off' and 'on' levers are controlled, along with the volume control and circuit connectors.

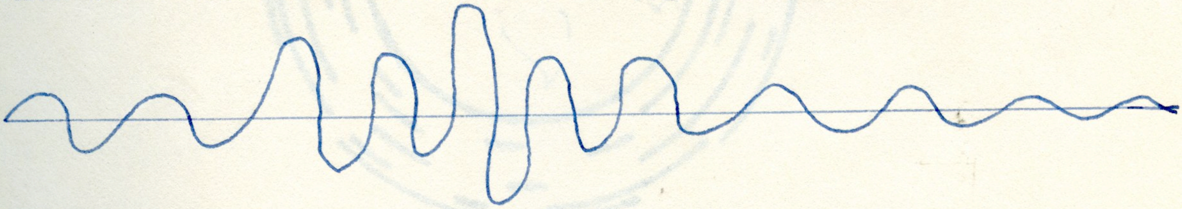
At the side of the console is a patch board, that completes the circuit and causes other microphones to be joined to the console. The particular and basic duty of the consul and patch board is to prepare the sound characteristics for their journey into the transmitter. With a switch on the console the transmitter receives its made-to-order signals.

The transmitter is a very highly technical mechanism which is made up of condensers, resisters, vacuum tubes, and many other electrical devices. One of the most interesting implements is the crystal oscillator which is responsible for ejecting the waves at the right frequency. The primary purpose of the transmitter is to transmit the sound characteristics unto the radio waves. The moment the vibrating signal is placed on the wave it is immediately sent through a wire up to the antenna and put over the air. However, the air has nothing to do with the waves, they travel independently as has been proven in vacuum experiments.

It should be noted that there are different types of transmitters and that different transmitters may transmit different waves. The two common transmitters are the A.M. (amplitude modulation) and the F.M. (frequency modulation). The waves of an amplitude modulation transmitter are designed to follow an electric line and if they could be drawn they would probably look like this:

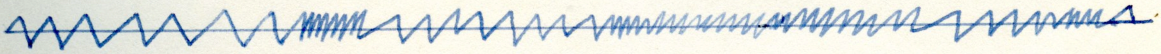


But when the sound characteristic is applied they would look like this:



Keeping the same wave-length the sound gets louder as the waves get larger, and softer as the waves get smaller.

In the F.M. transmitter the waves unaffected by sound would look like the natural A.M. waves but with the sound characteristics they would look like this:



------Keeping the same amplification but causing the wave-length to become closer when the sound is louder and shorter when the sound is softer.

You can see now more clearly why the tremendous difference in frequency. KTJO operates on a carrier frequency of 660,000 cycles per second on A.M. but on F.M. the frequency is 88.1,000,000 cycles per second.