Radio's Proving Grounds

Quiet New Jersey Countryside Now Bell Telephone Laboratories' Field Station for Radio Testing

By R. V. FINGERHUT

From dairy farm to experimental radio laboratory is the transformation that has overtaken a section of the countryside near the little town of Whippany, in northern New Jersey. Though the huge barn still stands, no longer does the bovine herd wander out each morning to graze on the hillside. And on that hillside now stand two tall structures that nature never grew. Inside the long building the whickers and grunts of placid animals have been replaced by the clicking of relays and the muffled whine of powerful generators. The posts that mark the place where stalls once stood now support a wicket fence that bears the warning sign, "Do not enter unless all power has been turned off." Instead of milk, the "farm" now turns out sound, and no farmer was ever as much concerned with the purity and quality of his milk as Whippany's engineers are with the purity and quality of their "product."

Early in 1926 a new transmitter, powered at 50 kilowatts, was nearing completion at the Philadelphia plant of the Western Electric Company. Following the design of Bell Telephone Laboratories' engineers, Western Electric craftsmen had set up racks and frames, installed coils and meters and performed the innumerable tasks necessary for the construction of the most powerful broadcasting transmitter ever manufactured on a commercial basis.

Back in New York, engineers at the Laboratories' headquarters were faced with an unusual problem. They wanted to operate the new transmitter for testing purposes, measure its signal strength, design antennas, conduct any number of exhaustive tests and experiments. But to install it at the West Street laboratories was out of the question. Fifty thousand watts of radio frequency power would raise havoc with thousands of receiving sets in New York City, besides interfering seriously with other work going on in the engineers' own building—delicate tests and measurements that demanded the utmost precision.

It was finally decided that the solution lay in using a field laboratory, away from the crowded metropolis and suitable for high powered transmission, where experiments could be carried on without interfering with radio reception. Three men were detailed to find such a place and spent two months in exploring New York's neighboring countryside before they found it at Whippany.

The selected spot was a dairy farm, owned by R. V. McEwan, operator of one of the nearby paper mills. Unused at the time, it consisted of fifty acres of grassy land bordered by miles of rolling country. A main highway passed nearby and four miles away, in Morristown, railroad connections were available, making the spot only a little over an hour

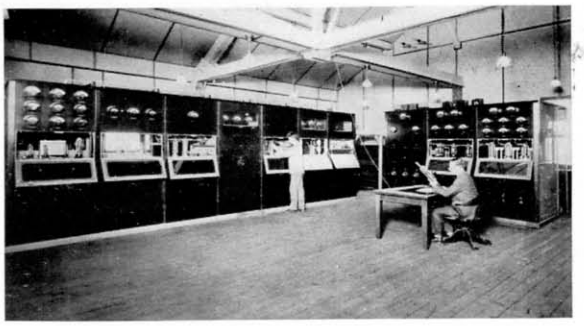
by train from the Laboratories in New York. The farm's one large building, a huge barn and two smaller ones, a pig pen and a carriage washing house, stood at the crest of a slight rise. The barn was a two-storied structure, the lower part of field stone and the upper story covered with shingles. It was a well constructed, good looking building, needing only interior remodeling to make it suit the needs of a field laboratory. That its walls were strong and solid was demonstrated later when the engineers found it took hours to drill every one of the many holes used to lead in the various power lines.

An initial force of four engineers was sent out to prepare the place for use and set up the transmitter which had been shipped to Whippany. These men were faced by a number of problems which one by one they solved by plenty of hard work and a great deal of ingenuity. For a time they ceased being engineers and became carpenters in charge of removing the stalls in the main building. Much time and elbow grease were consumed in destroying the clinging odor that betrayed the building's past history.

After this job had been finished, they became foremen of a gang of ditch diggers during the laying of the extensive ground system, a criss-cross bed of wires buried in the ground over 7,000 square yards in extent. Always willing to substitute brain power for man power, these engineers figured out a method of laying the wires underground that has since been widely adopted. They rigged up a plow with a hollow blade through which wire was threaded and fed from a reel so that when drawn by a tractor the plow would slice deeply into the soil, laying the wire along the bottom of the cut. Across the parallel rows of wire laid by this method ditches were dug and the transverse wires placed, soldered at every point where they crossed. Needless to say it was a tough and muddy job and the sale of hip boots in northern New Jersey reached a new high.

The engineers next became steeplejacks, superintending the erection of the two 250-foot antenna towers which still dominate the scene. These towers were placed well to the front so that the building would be away from the denser portion of the antenna field.

Flowers, shrubs and wooden walks give charm to the spacious surroundings at Whippany.

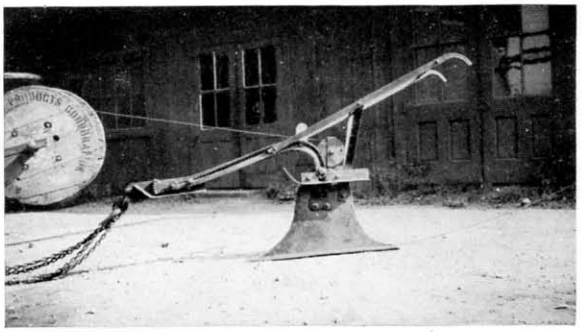


The first 50 kilowatt transmitter, installed in 1927. A comparison between it and the new model can be made by studying the photographs on pages 16 and 17.

All this time the installation of the transmitter had been going on and where cows had munched their cuds and horses buried their noses in mangers, racks were raised and panels mounted. The snicking of wire cutters and the rasp of metal against metal replaced the thud of kicking hooves and the creak of harness leather. Panel by panel, rack by rack, the transmitter grew, until the completed apparatus stood ready to send out over the air the words, "This is radio station 3XN, Whippany, New Jersey."

As soon as the installation had been completed, it was decided to use it for a demonstration of television by radio, coincident with a wired television program scheduled for April 7, 1927. A five kilowatt transmitter that had been installed in New York was moved out to Whippany and adjusted for use as the image transmitter. The 50 kilowatt transmitter was used for the speech channel. This was the first time that a television program had ever been successfully broadcast by radio and Whippany received its initial taste of newspaper headlines.

Following this spectacular work, the engineers settled down to testing and experimenting with the 50 kilowatt transmitter. Starting in May, 1927, a number of test broadcasts were made after midnight, according to commission regulations. Rabid radio fans in all parts of the country, listening in late at night, would suddenly run across a musical program at an unusual spot on their dials. So clear and loud was the signal that many thought they had picked up a local station. Sooner or later they would hear an announcer's voice saying, "This is a test broadcast from 3XN, an experimental station at Whippany, New Jersey." The engineers took turns announcing at the microphone until one night one of them grew too enthusiastic and broke into the forbidden realm of advertising by adding ". . . . , a 50 kilowatt station developed by Bell Telephone Laboratories and manufactured by the Western Electric Company." From that time on, Artie Dolan had the job of announcer



The "contraption" that was developed to lay-in the ground system. The reel is attached to the tractor that draws the plow.

and the faux pas was never repeated.

DXing was at its height at this time and mail from radio fans flooded the local post office. Thousands of letters were received asking for verifications and many were the variations applied to the spelling of "Whippany" by distant listeners unable to find this small town on their maps. At one period, despite the fact that listeners were asked not to write in, 13,000 letters were received from all over the United States and from many distant foreign countries as a result of only ten test broadcasts.

Another task that occupied Whippany's engineers was that of developing and learning a technique for antenna tuning with their powerful transmitter. In this research one set of engineers would erect an antenna and another group had to figure out a formula for its tuning. It became the great delight of the antenna-erecting group to make the task of the others as hard as possible. This friendly contest resulted in an unexpected discovery. While using all sizes and shapes of antennas a single wire, supported vertically by a balloon, was tried. This form, the original "vertical radiator," had astonishing results. The field strength measuring equipment, sent out in trucks during all tests, showed that with the vertical antenna an increase of more than 40 per cent over the then conventional types could be obtained. The outcome of this was the first vertical radiator, installed at WABC in 1928 followed by other installations in all parts of the country.

Another contribution to the art of radio came as the consequence of these experiments in that they developed and improved a technique for field strength measurement and the correlation of the data obtained for use in selecting transmitter sites. This technique has been used in selecting sites for transmitting stations all over the world.

By this time the necessity for and value of a field laboratory had been well demonstrated. The removal of higher powered radio broadcasting equipment from headquarters had eased the problem caused by the increased amount of radio energy dissipated throughout the building. The concentration of broadcasting activities had made it possible to carry on experiments and tests that could never have been conducted in New York. The success of the work at Whippany had definitely shown it to be an ideal site for the field laboratory. So it was, that although it had been established primarily for the operation of the 50 kilowatt transmitter, more and more of the radio activities were transferred to the field, and the force of engineers found their scope of work broadened.

In 1928 Whippany's engineers took to the air. At this time Bell Laboratories had completed the first of the new aviation radio telephone transmitters. Elaborate tests of the new equipment were made culminating in a number of demonstrations that attracted nation-wide newspaper headlines. In one, a representative of every metropolitan New York newspaper was taken up in the Bell Laboratories' plane, each reporter talking to his city editor from the air. In another demonstration the Graf Zeppelin was guided to its landing by a plane equipped with the new aviation equipment. In a third demonstration, a three-way conversation was held between Whippany, the Laboratories' plane and a meeting of scientists at the Massachusetts Institute of Technology. These were the first public demonstrations of plane-to-ground commercial radio telephone equipment.

The next important task of Whippany's engineers was that of testing a circuit designed to improve the operation of all types of radio equipment. This circuit has since become known to the radio world as stabilized feedback. The first broadcasting apparatus in which it was installed was a one kilowatt experimental transmitter. After thorough testing in this and other transmitters, it was installed for commercial use for the first time in the 50 kilowatt transmitter at WOR.

In 1933 William H. Doherty, stationed at Whippany, began experimenting with a circuit designed to increase the efficiency of broadcast transmitters. When perfected, it became known as the Doherty Circuit, and in 1937 was awarded the Liebman Memorial prize by the Institute of Radio Engineers. The first application of this circuit is in the new line of transmitters now being manufactured by the Western Electric Company in the five and 50 kilowatt range.

The present force of engineers, led by A. W. Kishpaugh and R. E. Coram, has just completed the installation of one of the new 50 kilowatt transmitters, replacing the old model which was sold to a commercial broadcasting station and is still doing an efficient job. The new transmitter will be used as was the old one, as a testing medium for the many improvements that result from the Laboratories' never ending research work.

It is just a little over ten years since the first 50 kilowatt transmitter was installed at Whippany. But to compare the new transmitter with the model of 1927 is like comparing one of this year's automobiles with one of a decade ago. The transmitter of today

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Edwin S. Glease, merchandise-publicity director, and Helen Whitmore discuss promotion plans for a sponsor.

Insurance Company in 1921. Promotions came fast. Before the end of the first year he was made manager of a district office. After six months he was put in charge of sales promotion in the field, covering 13 states and the District of Columbia. In 1924 he was brought back to the home office and made assistant secretary of the company working in the Industrial Division. Two years later he became a vice president in charge of the Ordinary Life Department.

By 1926 radio had boomed ahead and was ringing up sales for many firms. The company bought a half interest in a little 100 watt local station, and before the end of the year installed a new 1,000 watt transmitter. Ward was placed in charge of all radio activities. Power was increased again in 1928, the new transmitter being a Western Electric 5 KW.

By 1934 Ward had seen radio grow to amazing proportions. He realized the opportunities it offered, and so, forsaking the insurance business, bought the station, taking over the ownership and full operation on January 1, 1935. That he had become an influence in broadcasting was shown by the fact that the National Association of Broadcasters made him its president for 1934 and 1935.

It is a refreshing experience to talk to him. He is a business man and a realist. He is as aware and conscious of the "public interest" clause in his license as any broadcaster, yet he says: "Let's not kid ourselves. I am in business to make money and so is every other commercial broadcaster. That does not mean, however, that any of us disregards the public interest.

"It happens that by serving ourselves best we also serve our listeners best. We must strive constantly to develop interesting, worthwhile programs to hold our listeners, and as long as we are successful in doing this stations will be successful financially. Sponsors have come to realize this rather elementary fact of broadcasting and the very evident improvement in commercial programs is a direct result.

"One of the easiest things in the world to do is to tune out a station, and the public will do just that to any station or any program which does not fulfill the requirements of 'public interest.' This check that the public has over broadcasting is the industry's greatest governor. As long as it operates, no one should have much fear of the control of broadcasting passing into other hands.

"It is this check of public approval or disapproval which has accounted for the vast improvement in programs and station personnel. The men who did not have the vision to give the public what it wanted and needed have passed out of the picture. Today most announcers are college graduates, and the entire personnels of broadcasting stations are of the same calibre that you find in any industry."

Ward, a successful business man, a successful broadcaster, and a keen student of the industry, sees no menacing clouds on radio's horizon. Through the natural business law of the survival of the fittest those men who had no place in broadcasting have dropped out, and the industry is in the hands of men who have the vision, ability, resources and courage to continue the rapid development of broadcasting in the "public interest."

Although he looks upon television and facsimile broadcasting as tremendous future factors in the business, he sees no threat in them. "They will never replace sound broadcasting," he says. And Ward is backing his optimistic view of broadcasting by a large expansion program for WLAC. Early in 1938 he is taking over an entire floor of a large downtown office building for new studios. An application is now on file for a 50 KW license, and tests are under way for a new transmitter location.

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may transmit the same amount of power as that of 1927 but, like today's car, for that same amount of output power an enormously decreased amount of input energy is required. The 1937 transmitter has advanced in outward appearance as much as this year's streamlined car has advanced over its predecessors. And in its interior, as in the modern car, is incorporated every improvement that research engineers have developed in the past ten years.

To the proving grounds of the automobile manufacturer, with its trials and tests under all possible conditions, is attributed much of the efficiency of the modern car. The Laboratories, too, has its proving grounds—Whippany. Here must be tested every radio development of Bell Telephone Laboratories. Here must every sample of equipment prove its worth. Every engineer in the radio industry knows that after the words, "Developed by Bell Telephone Laboratories," there follows the unwritten assurance, "Tested and approved at Whippany." Whippany, the proving grounds of radio!