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# Television AND Pocket Radios

## PROMISED BY LATEST SHORT-WAVE TESTS

Workmen installing a lightning arrester to protect the antennas of a television station in the Empire State Building, New York City. Left, a modern television receiver with sight and sound circuits housed in a single cabinet

A FEW years hence, you may have a private radio wave length, just as you now have your own telephone number!

That is one of the spectacular developments recently predicted by David Sarnoff, president of the Radio Corporation of America. Exploration in the wilderness of ultra-high frequencies, he believes, will provide millions of new channels for private broadcasting.

Then the dream of midget stations—vest-pocket transmitters and receivers no larger than watches—may be realized. Already, successful tests along this line have been reported both here and abroad. From Rome, Italy, comes word of a featherweight radiotelephone with which pedestrians and motorists can converse with friends while walking or riding down the street. Again, at the Democratic convention at Philadelphia, Pa., a microwave transmitter, hardly larger than a shoe box, attracted wide attention. It broadcast speeches from the floor of the hall to a larger transmitter which put them on the air in a national hook-up.

One of the outstanding developments of recent months has been the advances in the realm of communication. Curious new terms: "coaxial cables," "Christmas-tree antennas," "shoe-button tubes," "television snowstorms," form the milestones of this advance. Behind each of these additions to the vocabulary of the radio engineer lies a record of research and achievement.

Only the other day, another page was added to this record. Zigzag wires on top of a New York skyscraper sent off ultra-high-frequency waves which were picked up by a "turnstile" antenna in Philadelphia. In bridging that 100-mile gap, the waves opened up dramatic possibilities for the future.

The Morse code may become as obsolete as a prairie schooner! Written letters may leap through thin air with the speed

By EDWIN TEALE


A FAR HORIZON FOR TELEVISION

This drawing shows why television transmitting stations are located on tall buildings to give maximum sending range

# NEW MARVELS OF COMMUNICATION TAKE FORM IN THE LABORATORIES OF THE WIZARDS OF ELECTRICITY

**SENDING FACSIMILES BY ULTRA-SHORT WAVES**

An operator preparing to send a message over the circuit that transmits pictures and drawings between New York and Philadelphia. The diagram at the right was sent through the air by this method. At the left are the antennas at the New York end of the new experimental circuit

of light and be received in the handwriting of the person who sent them! Newspapers may be printed in your own home, going to press by radio!

Impulses reaching the Philadelphia antenna operate a secret mechanism in which a spiral bar moves swiftly over a sheet of carbon paper revolving on a drum, and leaves behind a perfect reproduction of a picture turning on a similar drum in a New York broadcasting studio.

Letters, pictures, newspapers, maps, fingerprints—all can be sent through the air by the new service at a cost of so much for each square inch. Four New York newspapers are reported ready to broadcast news editions by this method. Radio experts vision as a development of the future a supernewspaper flashed to home receivers from coast to coast. Sectional news would be inserted at the local broadcasting stations. Engineers are said to have designed a receiver for home use which could be put on the market for approximately $100.

Pocket radiotelephone sets like this may soon make it easy for anyone to call up his home from the street

In addition to transmitting facsimiles of letters and pictures, the new service can send messages by telegraph or automatic typewriter. With sufficient power, it could transmit 12,000 words a minute by teletype.

One dramatic feature of the demonstration was the use of a model of Morse's original telegraph key. The same broadcast that carried pictures across the ether transmitted a message tapped out by this pioneer instrument!

While facsimile, or still-picture, transmission is not new, the New York-Philadelphia service possesses radical features which promise much. It virtually eliminates the effects of static by use of a three-meter wave length and booster stations along the way carry the broadcast to its destination at full strength.

In two American laboratories, not long ago, scientists sent even shorter radio waves racing down hollow metal tubes. At both the Massachusetts Institute of Technology and the Bell Telephone Laboratories, the waves did an amazing thing. They traveled down the pipe like a voice in a speaking tube. Instead of spreading out, they ran along the inner skin of the electromagnetic pipe, apparently immune to static.

Such wave guides may be employed for carrying radio or television broadcasts from station to station. An even more spectacular application would be their use for shooting programs directly into the air without the use of an antenna. Experiments have shown that when the end of the tube is flared out like a horn, the waves are projected into space. Such "radio guns" would enable stations to aim broadcasts in any desired direction.

During the tests at the Massachusetts Institute of Technology, radio waves only one third of an inch in length were used. They had a frequency of 2,000,000,000 cycles a second or higher. The Bell laboratories employed waves a dozen times as long, but still well within the "radio wilderness" of ultra-high frequencies.

Hundreds of experimenters in all parts of the world are now exploring the possibilities of these high-speed waves. New applications for them are popping up from week to week.

An eastern inventor, for example, has just given them the job of announcing streets and giving interesting bits of information to passengers on cars and busses. Tiny transmitters will broadcast automatically from phonograph records or films, their weak signals carrying for only half a block or so. Antennas on the moving vehicles will pick up the different broadcasts as they near the corners where the transmitters are located.

ANOTHER application for these "limited-range" stations is foreseen by the same inventor. In storms and fog, he declares, they can be used to warn airplane pilots of danger spots. When an airman picks up such a short-range signal, he will know he is close to an obstruction, just as the sound of a bell buoy warns a mariner he is nearing a reef. By placing tiny transmitters on mountain tops along commercial airlines, passenger planes could be kept from crashing into unseen peaks in fog.


THE RADIO STATION COMES TO THE SPEAKER

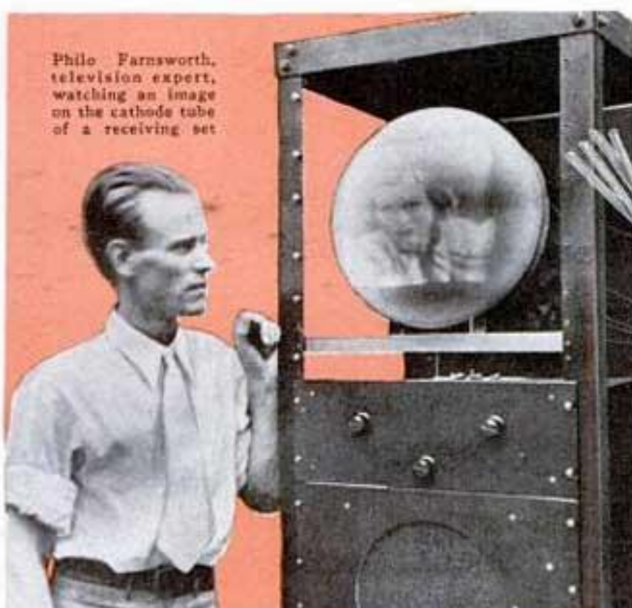
Used on the floor of the Democratic convention at Philadelphia, this portable radio transmitter picked up speeches which were rebroadcast from a larger station

Stretching sheets of radio waves into the stratosphere is another ingenious idea for detecting invisible planes in wartime. Thomas S. McCaleb, Harvard University scientist, has found that when a line of transmitters direct their signals upward, airplanes passing through the curtain of waves reflect some of them back to earth. By determining the positions of the sending and the receiving stations, he can determine the exact spot where the plane is flying. Such calculations would be of immense value in guiding the fire of anti-aircraft guns.

Another research worker at Harvard, Dr. Charles F. Brooks, director of Blue Hills Meteorological Observatory, recently set a new distance record for ultra-short radio waves. Sent from an experimental station at Cambridge, the 1¼-meter waves traveled sixty-eight miles to another station at Mt. Wachusett, Mass. Ordinarily, the ultra-short waves disappear when they have traveled twenty or thirty miles. Unlike longer radio waves, they do not bend, and when they reach the curve of the earth they fly off into space. The limit of their range is usually calculated as the horizon. Consequently, the higher their source, the farther they travel.

It is for this reason that the tip of the Empire State Building, 1,200 feet in the air, was selected as the site for the sending antenna in the $1,000,000 television "show" being put on by the Radio Corporation of America. Daily broadcasts are going out to 100 receiving sets in the homes of picked engineers. Other sets in special motor cars roll along the streets to test reception in all parts of the city. When this elaborate tryout is over, the experts will know many things about the effect of static, the reception at various distances, the location of "dead spots," and the commercial possibilities of present-day television.

THE problems connected with television, as you know, are far more complicated than those involved in the transmission of facsimile, or still pictures. In television, the image not only must be broken up into about 70,000 fragments, or elements, but it must be put together at least twenty times a second to fool the eye into seeing continuous motion. Twenty times 70,000 (Continued on page 99)



Philo Farnsworth, television expert, watching an image on the cathode tube of a receiving set

A NEW AID FOR RADIO ENGINEERS

A part of the intricate machine that winds the "coaxial" cable which can carry 200 telephone calls at once. Left, a section of the cable showing its twin copper tubes and eight wires

## NEW WONDERS PROMISED BY SHORT-WAVE RADIO

*(Continued from page 11)*

equals 1,400,000. So, 1,400,000 impulses have to be amplified, sent through the ether and picked up by a perfectly synchronized receiver while the clock is ticking once. Engineers predict that if the large-scale test now under way proves successful, television receivers can be put upon the market for approximately double the cost of a high-class radio receiver.

Images produced by the latest television sets are so clear that in street scenes it is possible to read the license numbers on passing automobiles, and in football games, the numbers on the players' sweaters. As many as thirty pictures a second have been transmitted and received in laboratory tests, thus producing steady movement without the slightest blur or flicker.

WHILE television is undergoing its $1,000,000 field test in the United States, public sight-and-sound broadcasts are starting in England on seven-meter waves from a studio in the Crystal Palace at London. So far, the programs have been rebroadcast from sound films. Receivers as far as twenty-five miles away have picked up the images in brilliant black and white. Viewing screens on these English receivers are six inches wide and eight inches long.

A few months ago, an American expert estimated that in nearly half the area of the United States static becomes so bad on stormy nights that listeners have to switch off their radios. Only near the powerful major stations which center about large cities can the programs cut through the electrical disturbances. The conquest of static stands high on the radio engineer's list of things to do.

The latest advance toward the goal is reported from New York. For more than a year, Major Edwin H. Armstrong, radio pioneer and Columbia University professor of electrical engineering, has been sending out programs on stormy nights to test a staticproof, nonfading system of radio transmission he has invented. The programs are recorded on disks at the receiving stations. Even during thunderstorms so severe that the big commercial stations were drowned out by crashing static, the Armstrong broadcasts came through without interruption. In one case, a receiver eighty-five miles away picked up the program. Through another storm, Armstrong sent a facsimile copy of the front page of a newspaper. It reached its destination without the least blurring of the print, so well was the static eliminated.

The secret of Armstrong's invention lies in introducing into the radio waves a characteristic which is not found in the natural waves of static. The receivers are designed to pick up only these "earmarked" waves and are not sensitive to static. A difficulty lies in the way of wide adoption of the Armstrong system, however. It would require scrapping present-day broadcasting and receiving equipment and replacing it with apparatus of new design.

FROM a different angle, Andrew Ring, chief engineer of the Federal Communications Commission, has been attacking the static problem. He proposes a chain of superstations, each with a power of at least 500,000 watts, to cut through static and reach the rural listener. Only one such station is now in existence, the $500,000 experimental WLW put up by Powell Crosley, Jr., at Cincinnati, O.

On the outskirts of Philadelphia, Pa., as this is written, workmen are putting the finishing touches on a 100-mile cable of revolutionary design. It will link New York and Philadelphia in a service with possibilities not only for telephone, *(Continued on page 100)*

## NEW WONDERS PROMISED BY RADIO

*(Continued from page 99)*

telegraph, radio, and teletype, but for television as well.

Developed by experts of the Bell Telephone Laboratories in New York, and named the "coaxial" cable, it has shown amazing possibilities in recent tests. It can carry 200 telephone calls simultaneously. The best that is possible with present equipment is four conversations. If used for telegraph work, the new conductor can transmit 2,000 messages at the same time. Besides this, it can accommodate a million-cycle wave band and so can be employed for piping television images from one broadcasting station to another.

Only seven eighths of an inch thick and sheathed in lead, the 100-mile cable contains twin copper tubes and eight paper-insulated wires. The tubes are filled with nitrogen gas and a central wire runs through them, supported by rubber-disk insulators.

BOTH the wire and the inside of the copper tube act as conductors, and each tube carries messages in only one direction. Specially designed booster mechanisms which function automatically are being placed at ten-mile intervals to overcome transmission losses. One sensational application of the new cable has been suggested by engineers. It may make it possible for us to see the person with whom we talk by telephone!

Contrast with that modern possibility a report from Paris, France. On the highest point in the city, the government is reconstructing an immense semaphore which stood on the eminence in the days of Napoleon. It formed a link in a communication system that was a crude predecessor of the telegraph. For hundreds of miles across France, lines of such semaphores wigwagged messages by a modification of the army flag code. In half a day, the semaphore telegraph carried news of a French victory in Alsace 250 miles to Paris. Amazement at this speed of transmission rivaled excitement over the victory.

Now, not much more than a century later, we are talking in terms of television, facsimile transmission of newspapers, superpower stations. Nor, is that all. Even more amazing advances may lie just beyond the horizon, and in a relatively short space of time we may find ourselves surrounded by marvels that now seem as impossible to us as the telephone and airplane must have seemed to people who were living less than a hundred years ago.

In addressing engineering students at Princeton University, not long ago, General James G. Harbord, chairman of the board of the Radio Corporation of America, pointed out that it is within the realm of possibility that aromas and flavors can be sent across the ether just as sounds and sights are transmitted today!

THEN, it would be possible to taste a peach or smell a rose from a place a thousand miles away. You might even take a trip around the world by proxy, seeing the sights, hearing the sounds, smelling the odors, and even tasting the fruits and dishes of far-away lands, without ever stirring from your easy chair!