SCIENTISTS OF THREE NATIONS IN RADIO RACE TO SEND VOICE RINGING AROUND THE WORLD

U. S., Germany and France Making Vast Strides on Wireless Phone

WASH. TALKS TO PARIS AND HAWAII HEARS

Arlington Engineers Use New Device to Speak to Eiffel Tower

TRANS-ATLANTIC telephony is an accomplished fact.

It was an accomplished fact more than six years ago when the soldiers of Europe still fought and died in the first half of the World War.

While blood flowed, and companies charged into ranks of grim iron death, America spoke to Paris on the telephone, and Honolulu listened in.

And the world is assured that in the near future it will be as simple a matter to call up London from America as it is for Philadelphia to get New York on the wire today.

Then, indeed, will it be literally possible for political cries of indignation, perturbation, determination, to go "ringing round the world." A statesman at his desk need only lift his telephone receiver, instruct Central, and shout!

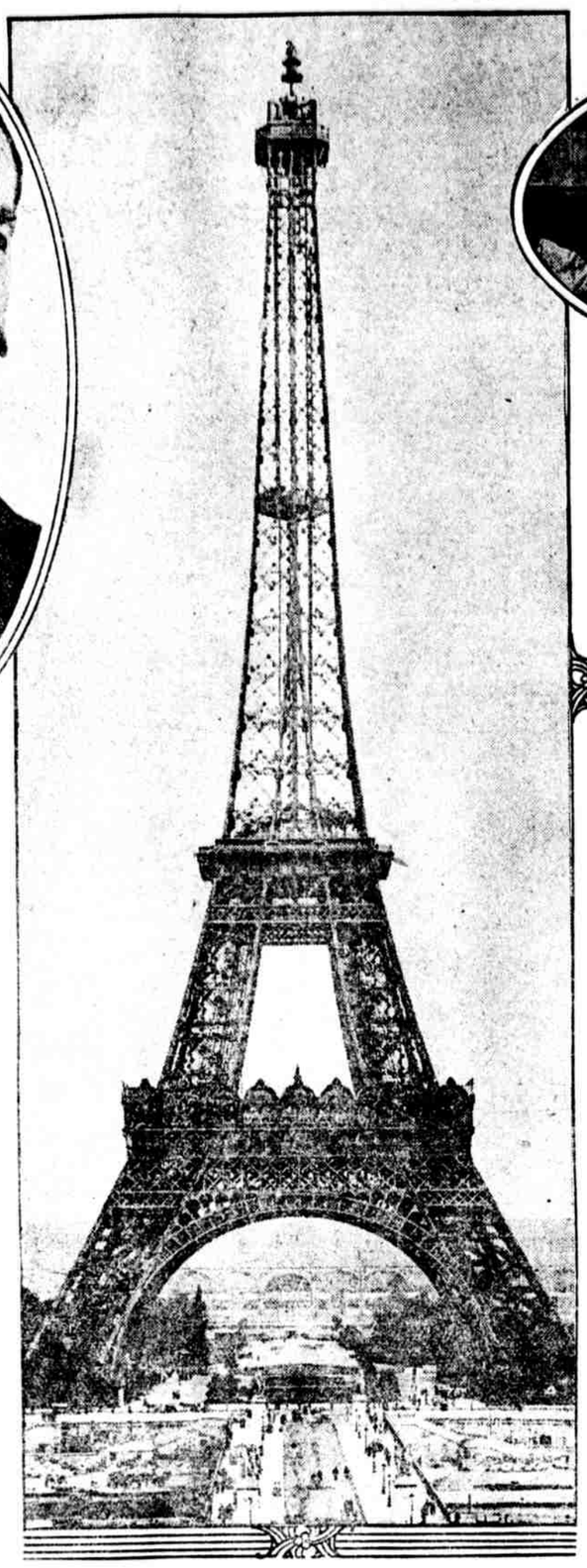
With the passage of a few years, Captain Malcolm Deepsea, in his cabin—a mid-ocean storm tearing the very paint from the hull of his "Molly-O"—will lift the receiver from his telephone and cry:

"Operator! Give me Philadelphia, Woodland 4814-W. Hello, is that you, wife? We're having a bit of weather out here, but you needn't worry. I'll give you a ring when it blows over. Good-by!"

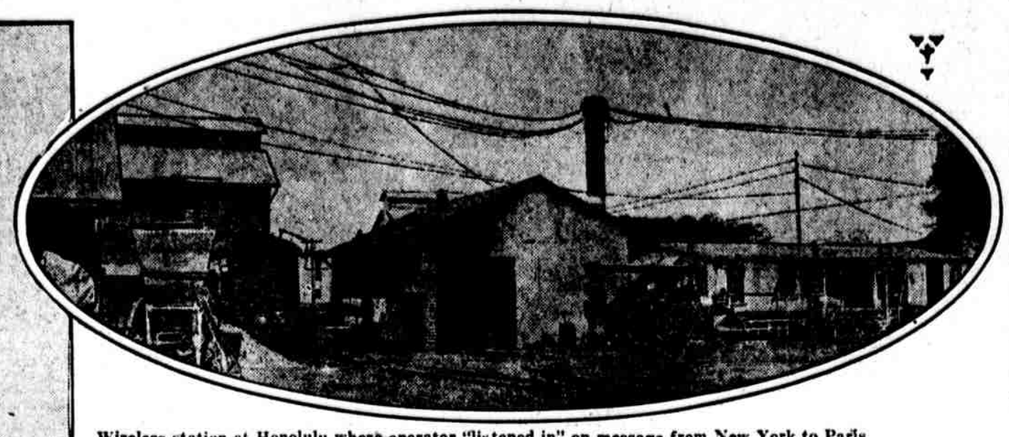
Or somebody's better half, summering in the Alps, will call up friend husband in Chicago to remind him not to forget to put the cat out nights.

Altogether, it's a gay world, rich in amazing achievements. And this newest development by science is one of the most romantic. The fact that one person can, over the telephone, talk to another thousands of miles away beggars imagination

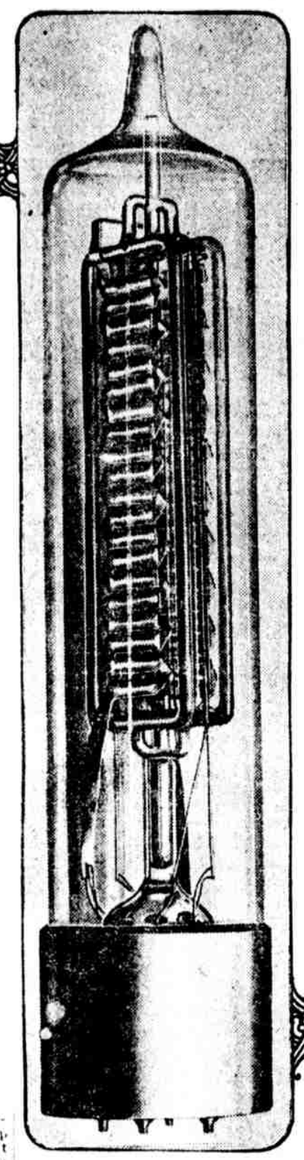
John J. Carty, who directed experiment in trans-oceanic telephony



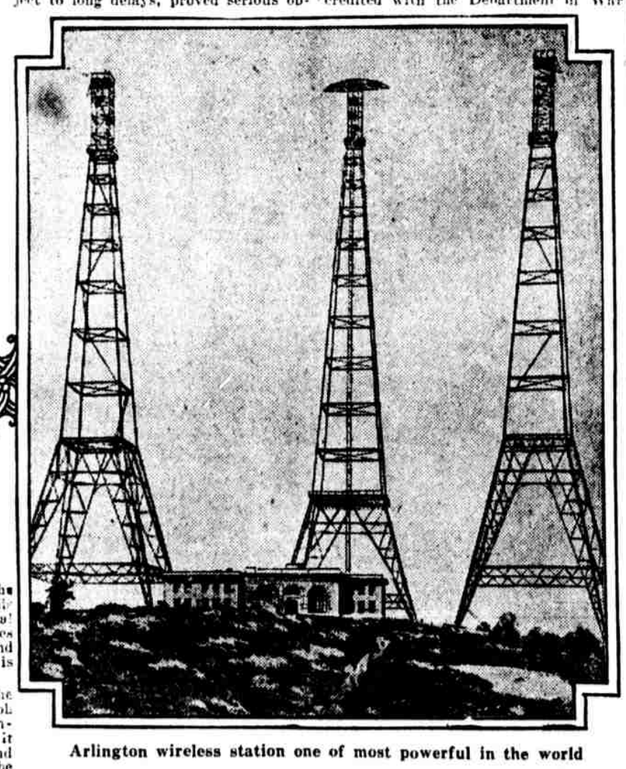
Eiffel tower which received message in Paris



Wireless station at Honolulu where operator "listened in" on message from New York to Paris



Vacuum tube, radio converter, for translation of messages



Arlington wireless station one of most powerful in the world

"Interesting," Said Grant, "But Who's Going to Use It?"

When the original model of a telephone was brought to the attention of President Grant, he is said to have remarked: "It's very interesting, but who is going to use it?"

Today gives emphatic proof that a greater portion of the world uses it, and, furthermore, promises, now that trans-Atlantic telephony is a fact, one side of the world will talk to the other side; that a man in Paris will carry on a conversation over his telephone with a man in California; that a diamond miner in South Africa may tell an Eskimo at the North Pole to go to blazes, if that is necessary.

This almost instantaneous piercing of great distances with the human voice brings all the world to our very doorsteps; makes far-off Samarkand our next door neighbor, and hauls Russia as close to us as the houses on the corner.

Experiments are being made industriously; they are being made more or less secretly; experts in the field grimly close their lips, promise nothing, but point to the year 1915 when the thing was actually done.

Experiments are being conducted in America, in Europe and South America. But it is well known in the field of telephony that for every hundred scientists searching out the great romantic problems of round-the-world telephony in this country, Europe has only about four or five.

"If we stopped this development work," says John J. Carty, directing head of the wonder workers who talked from Arlington, Washington, to the Eiffel Tower, Paris, in 1915, "we would dam up progress and we would fall into a condition as bad as there is ahead. Science is constantly advancing. Our country is growing. Business is expanding. We want to talk greater and greater distances. We must be prepared to talk to South America. We are already talking to Cuba. There is no doubt we will be talking to Europe."

But the main problem at present is one of cost. The present costs of trans-oceanic wireless telephony are very great, and before this method can be generally employed, the commercial value, as in the case of ship-to-shore telephony, must first be determined and assured. And of course a factor operating seriously against such service is the great difference in time between countries located widely apart.

Story of Radio Phone Like Romantic Fiction

The story of the evolution of the trans-oceanic telephone service reads like the wildest romantic fiction. And yet even it would not have its interest for the lay mind unless something of the problems which troubled the experts originally are understood.

In the ordinary alternating current electric light and power circuit, used to furnish light to homes and power to factories, the periodicity of the electrical current is almost universally sixty cycles per second. That is, there are sixty complete reversals of the electrical current each second.

At this low periodicity or frequency virtually all of the electrical energy is confined to the wire system and none of it is radiated into space. However, by sufficiently increasing the frequency of the current and by suitable circuit arrangements, a large proportion of the electrical energy generated may be radiated into space as electro-magnetic waves. They travel through space with the speed of light, and have frequencies varying from 15,000 to several million cycles a second.

Now it happens that for trans-oceanic telephony it would be impossible to lay cables. It would clutter up the ocean with cables, if there weren't other reasons for making wires impracticable. Consequently, to establish communication over great bodies of water communication must be made by wireless or radio.

In order to transmit a telephone message by radio, the amplitude of the high frequency waves sent out is made to vary in accordance with the variation of current produced by the voice in an ordinary telephone circuit. Do you get that?

Well, the problem of producing these high frequency electrical waves and of thus controlling them by telephone currents has been solved more or less satisfactorily by what is known as the three-electrode vacuum tube. It is this instrument which converts the electrical waves of the wire into electrical waves of the ether, out over the ocean, and back to "wire waves" when land is reached again.

During the development by the American Telephone and Telegraph Company of the vacuum tube in connection with the telephone repeater, it was found possible to make larger and more powerful tubes which could be used for radio telephony. As a result, in 1915, communication by radio telephone was made with Paris, Honolulu and San Francisco. For this distance it was necessary to keep 300 of these tubes in constant operation.

Since then research has been continued, until today the fundamentals of the art which makes possible trans-Atlantic phone communication are fairly well established. The kind of equipment necessary, however, has not been commercially produced to date except for such real uses as have been found in the field of ordinary trans-continental telephone communication.

Perhaps the story of the evolution of trans-oceanic telephone communication ought to begin with 1876, when the world witnessed the transmission of the first audible speech. That year it was made between Boston and Cambridge, two miles. In 1882 a telephone line was opened from Boston to Providence, a distance of forty-five miles; in 1884, between Boston and New York, a distance of 235 miles; in 1892, from New York to Chicago, 900 miles; in 1911, from New York to Denver, 2100 miles.

First Trans-Atlantic Telephony Is Attempted

When the American Telephone and Telegraph Company finally established a long-distance service clear across the United States to San Francisco early in 1915, attention of experts was directed out beyond the mainland and over the sea. But Chief Engineer J. J. Carty found himself not only confronted with the difficulty of the electrical problem itself, but he had a World War on his hands. Europe was a field of blood, America was neutral. All the wireless stations overseas were being busily employed by warring nations. And it was impossible for scientists to establish new stations in Europe. There remained only the possibility of convincing France, which owned the most likely tower, by means of the most astute and delicate diplomacy, to permit the Americans to use Eiffel Tower in spite of the war.

The diplomatic battle has never been properly recounted. And it is not likely to be told for some time. However, permission to use Eiffel Tower was, in the end, granted, with the understanding that it could be used only when France and her allies were not using it. And France and her allies were using it every minute.

It was arranged eventually, nonetheless, that representatives of the American company might conduct their experiments in the early morning hours for a very short period of time daily. And this was victory itself!

Mr. Carty, later a colonel in the army engineers, obtained from the Army and Navy Departments access to the tower at Arlington for a sending station. Next he fitted out three expeditions—one to Darien on the Isthmus of Panama, 2100 miles away; one to Honolulu, 4900 miles away, and one to Paris, 3800 miles away. A man had been stationed previously at the radio station, Mare Island, California.

The expeditions were equipped with receiving apparatus and other apparatus sufficient to complete communication. Lloyd Espenschied went to Honolulu. His task appeared almost insurmountable. When he reached Pearl Harbor, in Hawaii, he found that he lacked equipment, and that it was impossible to obtain it on the island. He was compelled, therefore, to adopt the cunning tactics of the Swiss Family Robinson and shipwrecked Robinson Crusoe—he had to invent paraphernalia, and he had but little time to do it in, and but little material to do it with.

Two engineers, H. E. Shreeve and A. M. Curtis, went to Paris. The limited time during which Eiffel Tower remained at the disposal of the engineers and the handicap resulting from the fact that all regular communications between the engineers abroad and those in America had to be by cable and subject to long delays, proved serious obstacles to the speedy completion of the work.

It had not been planned that Espenchied, over in Honolulu, should talk with either Paris or Arlington. He had been stationed on the other side of the Pacific as an observer. But he learned by cable the exact time when communication would be attempted between Washington and Paris. After long delay arrangements at each of the three ends had been synchronized.

Before October 21, 1915, the Arlington station had talked by telephone with the station at Panama. The success of this accomplishment heartened the experimenters, and on October 21, in the very early morning, while half of the world slept and the other half killed each other, these indomitable warriors in the realm of scientific thought waited for the test that was expected to startle a world, already startled to the point of saturation by bloodshed and atrocity.

At first it was possible to recognize the sound of the human voice. It sped from the wire at Arlington out over and across the miles of silent sea to the Eiffel Tower. The experimenters were mad with enthusiasm, but they waited, strong and stern and apparently quiet. They knew that mere sound of the voice, although a tremendous victory in itself, was not the only consummation devoutly to be wished. Like Oliver Twist, with his bowl of breakfast food, they wanted more, and they wanted it better.

Washington Gets Paris and Honolulu Listens In

And in a few moments they got it. It traveled over a trackless sea, over ships that lunged in the troughs of great seas, over the sinister German submarines curiously unmindful of the actual words translated into electricity, vaulting over their very heads; it dived into ominous black clouds banked above darkened battleships, it scurried past the ears of singing seamen, and they didn't hear a jot or tittle of it; it whirled over fields of tired soldier men, waiting to go up to meet the stolid iron German, perhaps to die; it dipped triumphantly to the Eiffel Tower aerial, and along a wire, to the ears of the waiting, trembling engineers.

"Hello, Shreeve," said Mr. Webb, at Arlington, to Mr. Shreeve, at Paris, 3800 miles away. "This is Webb talking."

Shreeve answered him. Almost instantaneously, the answer was heard.

And in Honolulu, 4900 miles from Arlington, and 8700 miles from Paris, Mr. Espenschied listened in, and heard what was said, and recognized the voices!

In a cable communication from his station at Pearl Harbor, Honolulu, he later reported that he distinctly recognized Mr. Webb talking with Paris. And he correctly reported the conversation. And he stated that the conversation could be heard three feet away from the receiver!

All this is especially remarkable, because it was necessary to use a wave length half that normally employed for long distance wireless telegraphy.

The next day, success of the experiments was made public in France. But the people in the rest of the world heard little about it. War news entirely submerged this extraordinary achievement.

Lieutenant Colonel of Engineers Ferrie, who observed the tests for the French Government, issued the following statement:

"Official statement summarizing the wireless telephonic experiments carried out between Arlington and the Eiffel Tower. The American station at Arlington was provided with a special wave generator developed by the American Telephone and Telegraph Company and the Western Electric Company, and arranged in such manner as to permit the making of wireless telephonic emissions.

"The aforesaid companies, being accredited with the Department of War by the United States Embassy at Paris, appointed one of their engineers, Mr. Shreeve, to attempt to hear these telephonic emissions at the radio telegraphic station at the Eiffel Tower by means of a receiver which is equally of their invention.

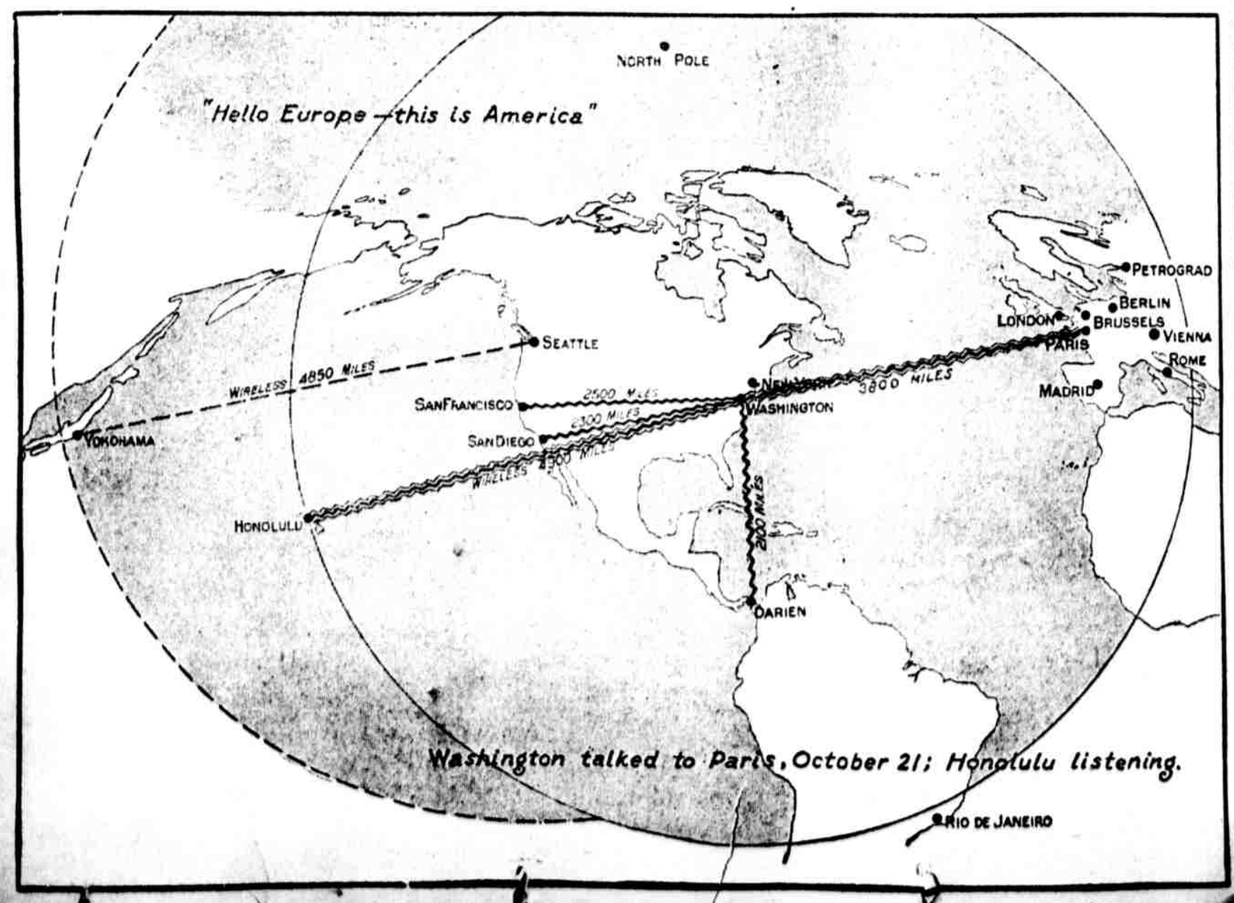
"All the experiments made have been followed in every detail by the undersigned. The first series of experiments carried out in June, 1915, gave no results, probably by reason of the electrical perturbations, naturally very intense at this season of the year. The second series, in October, 1915, has achieved great success. It has been possible to hear and understand very distinctly and repeatedly words such as one, two, three and so forth, good-by and so forth. Depending upon the intensity of the electrical perturbations which are prevalent and the condition of the atmosphere at this time, these words were heard more or less distinctly and more or less loudly. These results, although imperfect, are extremely interesting, and there is every reason to believe that they will be improved upon."

Three Nations in Race to Perfect Radio Phone

At present there is a race among engineers of this country, France and Germany in the perfection of this service. All three countries are working along the same general lines. And they all are concentrating on the improvement of the vacuum tubes.

Tests are being conducted at the gigantic radio station at Stony Point, L. I., with great secrecy. This station is made up of twelve towers bearing antennae that stretch approximately two miles. It is understood that no effort is being made at Stony Point to transmit the human voice. Experiments are concerned entirely with the radiation of carrier waves.

Previous to the trans-oceanic partire, part-wireless telephonic communication the feat had been accomplished over a shorter distance. A distance of 250 miles was pierced between an experimental tower erected at Montauk, L. I., and a small tower borrowed from private owners at Wilmington, Del.



Perfection of Phone Expected to Bring Nearer Brotherhood of Man

POSSIBILITIES THRILL THE IMAGINATION

Invention May Lead to Much Desired Chat With Planet Mars

Later communication was successfully made between the Montauk tower and an experimental tower at St. Simon's Island, Ga. In September, 1915, persons in New York spoke with an observer at Mare Island, San Francisco. Officials of the telephone company, seated in a New York office, picked up the receiver of an ordinary Bell phone and talked with Mr. Carty, at the Mare Island Navy Yard. The route was by wire from New York to Washington, by wireless to Mare Island.

Questions and answers were given and returned almost instantly. The voices were distinct and recognizable.

"The process," said Bancroft Gherardi, one of the engineers of the company, "is very delicate and abstruse. It is one which would be almost impossible for the lay mind to understand. I doubt whether I could prepare an explanation comprehensible to the unscientific mind.

"The system consists of four sets of important special apparatus over which have been spent months of work and years of thought."

Two of these sets are used at either end of the wireless space. And the electrical waves transmitted through the air by the apparatus are of the same nature as those transmitted over the wire by the ordinary telephone.

Mr. Gherardi has pointed out three great limitations to this service. It applies to wireless telegraphy as well as to wireless telephony:

"First. Atmospheric conditions—the so-called 'static'. A wireless aerial is a structure which catches all these disturbances.

"Second. The interference of other stations. This can be obviated by tuning the instruments, but is still a serious problem.

"Third. The lack of secrecy. In sending a wireless telephone message you are electrically shouting it out to the whole world."

Recently, at the International Communications Conference in New York conversation was exchanged between Catalina, an island in the Pacific Ocean, and the steamship Gloucester in the Atlantic Ocean. Speech was transmitted by radio telephone from the Gloucester through the New Jersey station at Deal Beach, and thence by wire across the continent to Los Angeles and thence by radio telephone to Catalina.

More recently the overland wire service from Key West to Los Angeles was joined with the new submarine cable to Cuba, and with the radio telephone to Catalina, with the result that speech was transmitted between an island in the Atlantic and an island in the Pacific.

Liner in Mid-Ocean Talks to Folk Ashore

Last March representatives of the press were invited to a demonstration by the American Telephone and Telegraph Company, at its Long Lines Building, New York. Direct communication was made with Deal Beach, and each guest was given a telephone receiver. They listened in on conversations with a ship on the Atlantic, and talked with friends on board the ship.

The test, it has been stated, showed notably that two-way radio communication could be established over the same wave circuit, and that it is quite feasible to connect the radio with the regular nationwide wire system. In other words, it is possible for anybody with a phone in his house to talk at once with friends in the middle of the Atlantic.

Later in the demonstration, Captain William Rind, of the vessel America, in mid-ocean, was connected with H. B. Thayer, in his country home at New Canaan, Conn. Captain Rind was 370 miles at sea. Mr. Thayer, president of the company, used an ordinary telephone line, connected with a small exchange. The two men could hear each other as distinctly as if they were in adjoining houses. Mr. Thayer asked what sort of weather the captain was having and he replied "stormy!" He said the weather was picking up and that he planned to "land at Ambrose at 4 o'clock Monday." After a little more pleasant conversation they said "Good night!" The representatives of the press listened in throughout this discussion.

At Philadelphia in March before a large audience in the Academy of Music, J. J. Carty directed the first demonstration of two-wire transmission across the continent over a two-wire circuit.

General Carty—he holds that office in the officers' reserve corps—connected the Academy of Music with the trans-continental circuit to San Francisco. Later after a violin solo had been played in San Francisco, and the players had heard the applause coming from Philadelphia, a circuit was set up in the offices of the PUBLIC LEDGER. John J. Spurgeon, editor, without leaving his desk, addressed the audience, and read news dispatches to be printed in the paper next day.

The new invention offers thrilling suggestions. It will supplement and extend wire communication to places where it is impossible to string wires. Its use will wed great expanses of water, deserts, the icy northern lands, the ends of Africa, with the commodious offices of great cities.

It will facilitate the business of the world, and speed—who knows?—at long last the very much desired brotherhood of the world, making all nations the closest and most intimate of neighbors.

Indeed some day, we may lift the receiver in the telephone booth at the corner drug store, and for once have the satisfaction of telling great god Mars, on his cold, grim planet millions of miles away, just where he ought to get off!