

RADIO BROADCAST

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Broadcasting Complete American Programs to All England

How KDKA Programs on Only 94 Meters Were Heard in England Even
Over Lowly Crystal Sets. What Broadcast Repeating May Mean

By W. W. RODGERS

INTERNATIONAL broadcasting, three months ago only an imaginative theory, is now an actual fact, due to the great progress made in relaying or repeating broadcasts, by means of high frequency waves.

Short waves or high frequency broadcasts—both terms have the same meaning—have opened up a new field in broadcasting. The first test completed at the very start of the New Year open up possibilities that promise extremely rapid developments in 1924.

The first complete international repeating of concerts was accomplished by the Westinghouse Electric and Manufacturing Company coöperating with the Metropolitan-Vickers Electric Company at Manchester, England. There is a kind of unusual justice that KDKA, one of the pioneer broadcasting stations should be the first radio station to transmit concerts to England on a thoroughly accurate basis.

Radio moves so swiftly these days that events tread upon the very heels of one another. The transatlantic tests, sponsored by RADIO BROADCAST, the *Wireless World and Radio Review* (London) and the British Broadcasting Company used the old method of transmitting

programs. These had hardly been completed to the satisfaction of the world; when this new scientific feat was accomplished and the latter was so much more satisfactory that there was hardly a comparison between the old method and this new method started by the Westinghouse Company. The old method of transatlantic reception, as all readers of RADIO BROADCAST know, is the same as receiving the concerts in the United States. The station trying to reach England sends out advance notices and then on a prearranged night sends its concert. Those on the other side, know the hour the concert will be broadcasted and listen patiently for the signals. Sometimes on favorable nights, the operator equipped with an extremely sensitive receiver will hear fragments of the concert, but he is never certain to get the signals. The drawback to this method is, of course, the fact that only a small minority of the people living in a country can hear these transatlantic signals because it is only the small minority who own high-priced, very sensitive receiving apparatus. The great mass of the people depend upon the one—or two—tube sets—the English call them “valves”—for the reception of the concerts.

No reception is certain by this method. The listener must be ruled by the god of static, and the good or bad genii of "conditions." It is at best a haphazard arrangement.

But now comes the perfection of the short wave, or high frequency broadcasts. The first announcement of the use of high frequency or very short wavelengths came late last year when Station KFKX, the first radio repeating station in the world, was opened at Hastings, Nebraska. This station is near the exact geographical center of the United States for the purpose of repeating the broadcasts of KDKA, at East Pittsburgh, Pa. It was built to bring the concerts of KDKA to the people of the entire country. The normal range of KDKA was greatly increased because of the repeating station, and the people on the West Coast, who heretofore, had not heard that station, except on very sensitive multi-tube sets, began to pick up Pittsburgh with average receivers.

The same principle as used in rebroadcasting from KFKX at Hastings was used in the repeating of concerts in England. The same waves were used as were sent to KFKX, in fact the same transmitter broadcasting its very short waves to the Hastings, Nebraska station simultaneously carried the concert to England for repeating.

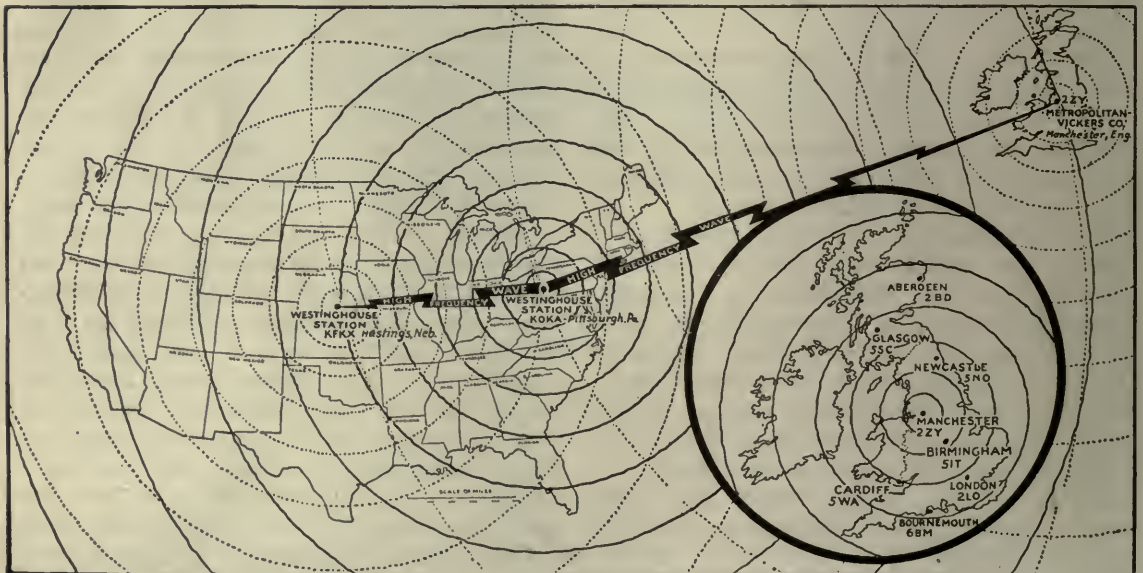
All this development in short wave application was accomplished in the last two years'

experimenting with these short waves by Frank Conrad, assistant chief engineer of the Westinghouse Company. He had found in his experimenting that the short waves go farther with the same power than do the longer waves and had also made the revolutionary discovery that the short wavelengths were not affected by daylight in nearly the same degree as are the ordinary waves now used in broadcasting. Interference from other stations, of course, at that frequency, did not exist.

Thus, since a medium by means of which broadcasting could be carried on at great distances without interference was at the engineer's command, no barrier opposed international broadcasting. But the proper co-operation from the other side of the Atlantic involved many problems, which though not apparent to the public, took nearly a year to perfect. International broadcasting, brought to a climax with the New Year, really started early in 1922, yet so quietly were the developments made that, at the time of the trans-Atlantic tests last November, few in the broadcast world had even hinted at the possibilities of the repeating station.

HOW THE PLANS WERE QUIETLY MADE

IN THE summer of 1922, Mr. A. P. M. Fleming, manager of the research department of the Metropolitan-Vickers Electrical



HOW KDKA'S 94 METER WAVE TRAVELS

KFKX at Hastings, Nebraska, and the stations of the British Broadcasting Company rebroadcast the short waves with the regular transmitter so that any one with a simple receiver can pick the signals up

Company, visited the engineering department of the Westinghouse Company. During this visit, he talked with Mr. Conrad, Mr. Davis, and others of the officials interested in broadcasting and was told of the short wave tests and how this new medium promised great developments in the radio field. It was in a talk with Mr. Davis that the idea for this international broadcasting was started.

Mr. Fleming told Mr. Davis of the broadcast situation in England at the time and though the possibilities were there, the thought seemed literally and metaphorically a very ethereal subject because while the United States had been very thoroughly "sold" to radio broadcasting, in England the furore was just starting. The public had not caught the enthusiasm. Many of the English newspapers were even severely critical of the future of broadcasting.

Despite the uncertain broadcasting situation in England, the research department of the Metropolitan-Vickers research laboratories were at the time working on the radio problem and had high hopes for radio broadcasting in England. As a matter of fact, scarcely had Mr. Fleming returned when the radio storm broke and swept over England in the same manner it had swept the United States.

During the later months of organization, the British Broadcasting Company was formed, an organization which has a monopoly on broadcasting in England. The company is an association of manufacturers operating broadcasting stations. Those comprising the association of



MR. FRANK CONRAD

Assistant chief engineer of the Westinghouse Company, who was largely responsible for the success of the short wave broadcasting

broadcast stations include the following—2LO, London, 363 meters; 6BM, Bournemouth, 385 meters; 5WA, Cardiff, 353 meters; 5SC, Glasgow, 415 meters; 5IT, Birmingham, 423 meters; 5 NO, Newcastle, 400 meters; 2AC, Manchester, 370 meters; and 2BD, Aberdeen, 495 meters. These stations besides operating independently of each other are also linked by land wire so that in the event of an important happening in one section of the country, the stations can be linked together. Simultaneous broadcasting from all eight stations occurred in RADIO BROADCAST'S test of last November.

This was the situation when the "Metro-Vick" Company began testing with East Pittsburgh on short wavelengths. After leaving America, Mr. Fleming had not been forgotten by the Pittsburgh broadcast officials and they were constantly in correspondence with him regarding the progress of developments with the high frequencies. After the success of the short wave tests in the United States, the English Company installed a private high frequency receiver in its plant at Manchester, England to test with the broadcasts of KDKA and particularly with the broadcasts sent to KFKX.

After many weeks' testing and frequent changes in the design of various units in the high frequency receiver, the results showed a stable reception and one that could easily be



MR. H. P. DAVIS

Vice-President of the Westinghouse Company, before the microphone at KDKA where he sent New Year greetings to England at 7 P.M. on December 31, 1923. It was just midnight in England



"THIS IS 2LO, LONDON"

And Captain E. P. Eckersley, chief engineer of the British Broadcasting Company with a wavemeter and long wavelength pipe testing their radiated wave. 2 LO was one of the stations to rebroadcast KDKA's short wave program

placed on the air in England whenever desirable. So the Metropolitan-Vickers Company sent the program out through "Merrie" England and the European continent for the first time, December 29, 1923. The other seven British broadcasting stations were linked in by land phone with the result that all of them were broadcasting KDKA's concerts, a feat never before accomplished.

Of course, this wasn't the first time KDKA had been heard in England. As a matter of fact, KDKA has been receiving hundreds of letters from all parts of the world, telling of the reception of its concerts on its regular wavelength, but the receivers of these broadcast signals did it with multi-tube sets and then the reception at most was greatly dependent upon weather conditions and was quite haphazard. However, here was an actuality that gave every one in the ordinary broadcast range of the English stations, (which, by the way, are

limited by law to an output of three kilowatts and which usually operate much below that figure), an opportunity to listen-in.

Knowing from the cables that passed back and forth between England and the American company that the proper time had come to exchange international greetings, arrangements were made to repeat KDKA's concerts throughout England through the Metropolitan-Vickers pick-up with Mr. H. P. Davis of the Westinghouse Company sending the greetings. Mr. Davis gave his New Year's greeting from the East Pittsburgh Studio of KDKA at seven o'clock, Eastern Standard Time Monday evening, December 31, 1923. Because of the difference in time—five hours—this was exactly midnight in Great Britain and Mr. Davis's speech was the first greeting received in the Old World from the New, for the coming year. Mr. Davis said:

"To the people of Great Britain in this New Year's Eve, I send greetings from America and express to you the wish of every American—that Great Britain and her European neighbors may enjoy a prosperous, peaceful, and progressive New Year.

"That the means of communication have been greatly advanced during the past year is fitly shown by the fact that I am able to speak directly to you, across an intervening ocean. This achievement will ultimately result in making known to you America's daily events and your every day happenings known to us.

"A year ago such an achievement seemed beyond belief. With such advancement in the radio art an established fact, no man dares predict what developments will take place before another New Year.

"It is a wonderful thing for the world—this achievement which enables the peoples of one continent to "listen in" on the activities of the peoples of another continent—for the friendship of nations is founded on closer understanding among the various peoples and in no way can different nations better understand each other and become more closely in touch with each other than by improved means of rapid and accurate communication.

"It is also fitting that Westinghouse Station KDKA, the pioneer broadcasting station of the world, should be the first station to develop a means for the repeating of its programs to you, the peoples of other continents, for it was here, and by this station, from which I am now

sending this message, that radio broadcasting was first undertaken. This feat is only another progressive step in the development of this great utility.

"On behalf of the people of America, it is my great privilege, therefore, for the first time in history, by means of the spoken word, to speak directly to you the wish for a happy and prosperous New Year."

The announcer at the time Mr. Davis spoke was an Englishman, chosen because of the fact that his decided English accent would be an added touch to the broadcasting. This announcer was Mr. Sidney Nightingale, who prefaced the speaker's remarks.

An aftermath of Mr. Nightingale's announcing came the next day in a message from his mother, Mrs. J. R. Nightingale of Manchester, England. This lady listened to her son's announcing 3,900 miles away. It is safe to say that a mother, any mother for that matter, after hearing her son's voice coming so far would feel quite proud, but she was particularly proud that her son's voice should be the first that came over from America to be repeated by these British stations.

So, just a year after a speculative talk in the offices of Mr. Davis at East Pittsburgh, the theory of the future had become the established fact and international broadcasting had become a scientific accomplishment.

For this rebroadcasting, KDKA transmits to England on 94 meters (3,200 kilocycles), the same frequency or wavelength at which it transmits to Hastings, Nebraska. The wavelengths of the English stations have been listed earlier in this article and are not important except as being a definite link between the 94 meters of KDKA and the broadcast listener of the Old World.

The antenna at East Pittsburgh used for this repeating radio transmission is not more than thirty-five feet long. This is much smaller than the antenna required for ordinary broadcasting. There are only thirty-five feet between flat top and counterpoise. The antenna and counterpoise consist of two small cages.

One of the difficulties of short wave broadcasting is that every precaution must be taken to prevent any outside influences, such as vibration, that would change the frequency. The vibration of the ground or the swinging of the antenna would serve to throw the set off its frequency. To guard against the possibility of swinging, the East Pittsburgh short wave antenna, including the flat top and counterpoise, are stretched between cross arms rigidly attached to the tower instead of the more common swinging spreaders.

The lead-in from the antenna to the counterpoise consists of copper tubing rigidly mounted on long high voltage porcelain insulators on the poles. The various inductances on the set are wound on rigid forms. Copper tubing is used to make all the connections.

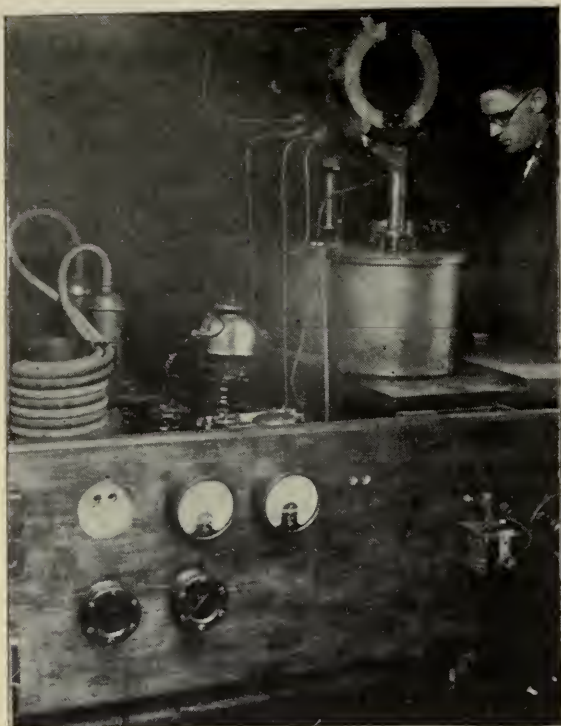
The short wave set at East Pittsburgh is located on the top of a nine-story building and is subjected to the usual jars. But the set is therefore suspended on a system of springs, and vibrations of the building cannot affect the operation of the set.

The transmitting set at East Pittsburgh con-



THIS ANTENNA RADIATES ON 94 METERS

And is only 35 feet long. Note that the spreaders are tightly fixed to the masts, in order to prevent any swinging of the wires and consequent slight variation in the radiated wave. This is the antenna used in sending to England and to KFKX, the "repeater" broadcasting station at Hastings, Nebraska



THE 94 METER TRANSMITTER

In use at KDKA to send programs to Hastings, Nebraska. The transmitter is supported on heavy springs so local jars will not change the wavelength adjustment

sists of three panels: the rectifier panel, the modulator panel, and the oscillator panel. The rectifier converts the high voltage A. C. current, obtained by stepping up the ordinary plant current supply to high voltage D. C. for the plate circuit. The modulator with its accessories impresses the voice frequency on his high voltage D.C. current before it goes to the oscillator. Finally the oscillator converts the high voltage D.C. currents into radio frequency, in which form it is delivered to the antenna.

Although this article tells, primarily of repeating of concerts in England, that all the while that the very short waves of 3,200 kc. are

going across the ocean to be received in Great Britain, similar waves are going out to Hastings, Nebraska, where they are being repeated through Station KFKX. Therefore, when KDKA goes into operation, with the repeating equipment in England and at Hastings, Nebraska, the station is covering nearly half of the world.

Not only is this an enormous scientific and engineering achievement but it is also a great step forward toward better international relations. By means of this amazing means of communication, the human touch is possible over thousands of leagues of ocean and it must prove a thing of inestimable good, bringing as it does whole continents into personal communication, which is bound to result in that better understanding so vitally necessary for any lasting peace.

C. W. Horn, superintendent of radio operations of the Westinghouse Company, a man who is very close to the broadcast situation, sees something significant in the English repeating. According to Mr. Horn it sounds the death knell of those stations who either can't or won't put on the air the best of programs. The pace that is being set is very swift and, Mr. Horn thinks, those who can't maintain it will fall by the wayside.

Significantly, the repeating of these English concerts brings to mind the remarks of Mr. Davis, one year and a half ago, relative to the broadcast situation. At that time he said that the only way to obtain the greatest possible good out of radio was to have a few modern powerful and efficient transmitting sets located in such manner as to serve various districts. Within these districts there would be located repeating stations which would repeat efficiently the concerts broadcasted by the central station. Developments of the last few months seem to indicate that this may be the ultimate in broadcasting and with events moving so swiftly, the new year may give the answer.

