If American industrial history proves anything, it proves that invention has created many more new jobs than have been taken away by technological improvements or labor-saving devices.

Radio, for example, is purely a child of invention. To-day the radio industry, which practically did not exist twenty years ago, provides direct employment for 400,000 persons. Their annual wages reach an estimated total of half a billion dollars. Indirectly, radio provides employment for many thousands more.

Radio has now added sight to the service of sound. Television is here. It might more accurately be called "radiovision." It promises to add a brilliant new chapter to the annals of American economic development, and ultimately to provide new channels of employment for workmen and white-collar men, artists and writers, technicians and scientists.

The United States was created by pioneers. It was made great by other pioneers. As long as the pioneering spirit lives, America will go forward.

Dr. Frank Conrad is an illustrious example of this pioneering spirit. Difficult problems, that were a stop signal to others, were to him only a green light. Of him it may truly be said, that:

> He didn't know it couldn't be done,
> so he did it.

Mr. President, I have the great privilege to present to you, for the high honor of the Gold Medal of the American Institute of the City of New York, one of America's true pioneers; a man respected and admired throughout the electrical and radio industries, a benefactor of humanity and my friend—Dr. Frank Conrad.

DAVID SARNOFF,
President of the Radio Corporation of America

THE STORY OF SHORT WAVES

MR. CHAIRMAN and ladies and gentlemen, I deeply appreciate the honor extended by the American Institute of the City of New York in awarding me the institute's medal. I am particularly gratified that the award was determined in part by work in the development of radio broadcasting.

Radio broadcasting may justly be classed among the developments which have done most to produce our present civilization. The important ones, as I see them and in the order in which they came into the world, are printing, the railroad, the telephone, the automobile and the radio. Each of these developments has moulded the lives of people and changed the destinies of nations by facilitating the interchange of goods or ideas.

In the forefront of these agencies for the extension of civilized thought and action is radio broadcasting, a development so recent that even to-day it is no older than the average college sophomore. Ultimately, it should be a mighty weapon for peace, but paradoxically, it was literally born of the last World War. One of the factors which made it possible for science to have ready nearly all the tools required for this entirely new art was that war.

Before the struggle began, radio was considered as a possible rival of the telephone or telegraph wire, and its apparent field of greatest use was in communication from ship-to-shore, vessel to vessel or with isolated spots. The desirability of communication between ships for even limited distances served as an impetus to the development of devices which would thus enable a ship in distress to call for help. The apparatus as developed before the war period effectively served this purpose, although it would not make possible the use to which radio is put to-day. The military necessities of war time not only furnished the incentive for a further development of radio, but, what was even more important, it furnished the necessary financial support of this work.

At the close of the war, we found ourselves in possession of the radio products of many research agencies but with no apparent use to which to put these products. The tools were there, but so far as the world could see, there was no new work for them to perform. In my own case it was undoubtedly the natural fascination of working with a new tool that induced me to continue my research and experimentation.

To-day we all know that radio has come far and fast since those war days. Broadcasting—and particularly short-wave broadcasting—is developing so rapidly that it is hardly safe to make predictions as to its future, lest the prophecies become matter-of-fact realities before they appear in print.

However, with a background of more than 20 years' relationship with radio, I am convinced that if radio broadcasting is to continue to expand, and I have no doubt that it is, then the short wave-lengths offer the only road to that expansion. Two developments in the use of short-wave bands for a wider dissemination of entertainment and culture appear to be imminent at this time: first, a network of short-wave broadcasting stations; second, within a matter of ever-shortening time the ultra-short wave bands will be carrying television.

These forecasts are conservative, even "tame," compared with a few made by the late H. P. Davis, vice-president of the Westinghouse Electric and Manufacturing Company, a few months after the first scheduled commercial broadcast was made over station KDKA in 1920. Mr. Davis said:

The importance of reaching such tremendous numbers of people, with practically no effort, offers great possibilities for advertising and the distribution of news and important facts, and in reality introduces a "universal speaking service." It is not unreasonable to predict that the time will come when almost every home will include in its furnishings some sort of loudspeaking radio-receiving instrument, which can be put into operation at will, permitting the householder to be in more or less constant touch with the outside world through these broadcasting agencies.

And where will it end? What are the limitations? Who dares to predict? Relays will permit one station to pass its message on to another, and we may easily expect to hear in an outlying farm in Maine some great artist singing into a microphone many thousand miles away.

All these things were visions 20 years ago; to-day they are dreams made real by radio. And for all practical entertainment purposes, channels assigned to commercial broadcasting have proved adequate until to-day. Now these longer wave bands have reached their saturation point; there is virtually no more room in them to carry additional broadcast loads. Consequently, the short-wave bands are receiving more and more attention. There is ample room on these bands for expansion of broadcasting. What is more, these short waves are the long distance carriers of radio.

We began to realize this fact as early as 1922. We felt even then that there were wonderful possibilities which were being overlooked in the then unused and rather despised short-wave bands—bands considerably lower than those then in use for broadcasting and for communication. I arranged to carry on experimental short-wave tests from my home transmitter to an amateur station in Boston. The accident of selecting a collaborator as far from Pittsburgh as Boston was a happy one, because it automatically eliminated the so-called skip zone obstacle.

In the fall of 1923 Westinghouse located a re-broadcasting station in Hastings, Nebraska, the start of the well-known KFKX. At this point short-wave transmissions from KDKA were nightly received and re-broadcast on the station's assigned wave-lengths. But strangely enough, even while this re-broadcasting service was being carried out, radio men in general were convinced that the short-wave signals died out after traveling a relatively few miles. They did not know —and this is one of the things we demonstrated in our Pittsburgh-Boston tests—that this phenomenon is due to the skip zone near the transmitter and that the short-wave signals again appear at distances beyond the skip zone.

At a conference of associated radio companies held in London, England, in the early 1920's, delegates, in discussing a proposed radio link with South America, raised some questions as to short waves ever being of any value in radio. So one night I invited a number of the delegates to my room, where I unpacked a short-wave receiver I had taken with me from Pittsburgh. Tying a wire to a curtain rod for an aerial, I "tuned in" on our station 8XK at Pittsburgh and the Pittsburgh announcer launched a prearranged program. He spoke a few words and then relayed by telegraph code extracts from a Pittsburgh newspaper. Dave Sarnoff was in our room, and he deciphered the coded broadcast. The delegates were hearing not only their first transatlantic short-wave transmission, but also the greatest number of words sent over the ocean by radio up to that time.

On New Year's Eve in 1923, through previous arrangement, we transmitted a short-wave program from Pittsburgh to Great Britain. This program was re-broadcast to British listeners through a station operated by the Metropolitan Vickers Company at Manchester, England, and was the first internationally broadcast program as well as the first to be rebroadcast.

On December 12, 1924, KDKA's short-wave program was received and re-transmitted in Johannesburg, South Africa, and a few weeks later we transmitted a program to Australia. This transmission marked the ultimate in distance transmission since it was sent halfway round the world.

Then to the far north went these short waves, carrying messages and entertainment to the Royal Canadian Mounted Police; radio had begun its mission of carrying good-will to all the world.

Since those rather crude beginnings, the technique of short-wave broadcasting has advanced daily. To-day every nation in Europe displays a keen appreciation of the importance of short-wave transmission in inter-country mass communication. The short wave knows no borders and passes freely from one country to the other. Some nations are using this method to spread their particular ideologies and their pet brands of war propaganda, it is true; but the day will come when short waves will find their rightful use as bonds of international understanding and appreciation.

England links the vast British Empire with such a short-wave bond. The United States has for a number of years been making its South American neighbors better acquainted with it by means of short-wave broadcasts.

And while we are prophesying, who knows but that the day may come when the short wave will bring forth a new and better understanding between the great nations of the earth.

FRANK CONRAD,
Assistant Chief Engineer of the Westinghouse Electric and Manufacturing Company