

RADIO CORPORATION OF AMERICA

PART I—THE YEARS TO 1938

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**Article written in 1938*

RADIO—A NEW COMMUNICATIONS SERVICE

At the close of the war the only company in a position to handle commercial transatlantic radio communications was the Marconi Wireless Telegraph Company of America, although the stations which it had operated before the war were in the hands of the Government who had taken over all such stations for wartime purposes. This company was an offshoot of the British Marconi Co. and was largely owned by English interests.

At this time the best known means of long distance transmission was the Alexanderson high frequency alternator, the patents on which were owned by the General Electric Company. Negotiations between General Electric and the American Marconi Company, which had started several years previous, but had been interrupted by the war were resumed in 1919 for the purpose of transferring patent rights as well as alternators to the Marconi Company which was anxious to expand its transatlantic services.

Certain high officials of the Government learned of these negotiations and were unwilling to see a growing communications service under foreign control, particularly since the transatlantic cables were in the hands of foreign, though friendly, nations. Consequently they suggested to the General Electric Company that negotiations be suspended until after discussion with the Navy Department. This was in April 1919 and it is interesting to note that the letter to the General Electric Company was written by Mr. Franklin D. Roosevelt, then Acting Secretary of the Navy.

FORMATION OF RCA

As a result of conferences with the Navy a plan was developed for forming a new American company to take

over the assets of the American Marconi Company. So, on October 17, 1919, the Radio Corporation of America was incorporated, and on November 20, 1919 the entire business of the Marconi Company was taken over.

GE held a substantial interest in the new company, and immediate arrangements were made between RCA and GE to cross-license each other to use the radio patents of the GE Company and the patents RCA had just acquired from Marconi. Work was started at once on new high power alternator stations in California, Massachusetts and Hawaii.

But another patent deadlock soon appeared particularly with respect to vacuum tubes. The possibilities of long distance shortwave communications were unknown at this time. In fact, wavelengths under 200 meters were relegated to the supposedly unimportant use of amateurs. But, tube transmitters were needed for medium power services and, of course, tube receivers were essential.

Strong patents on vacuum tubes were held by both GE and the Western Electric Company, but neither could make effective use of its own patents without infringement of the other's. Again the Navy lent a hand and persuaded the GE Company and AT&T Company to come to an understanding "For the good of the public." This was in January 1920.

TRANSOCEANIC SERVICE BEGINS

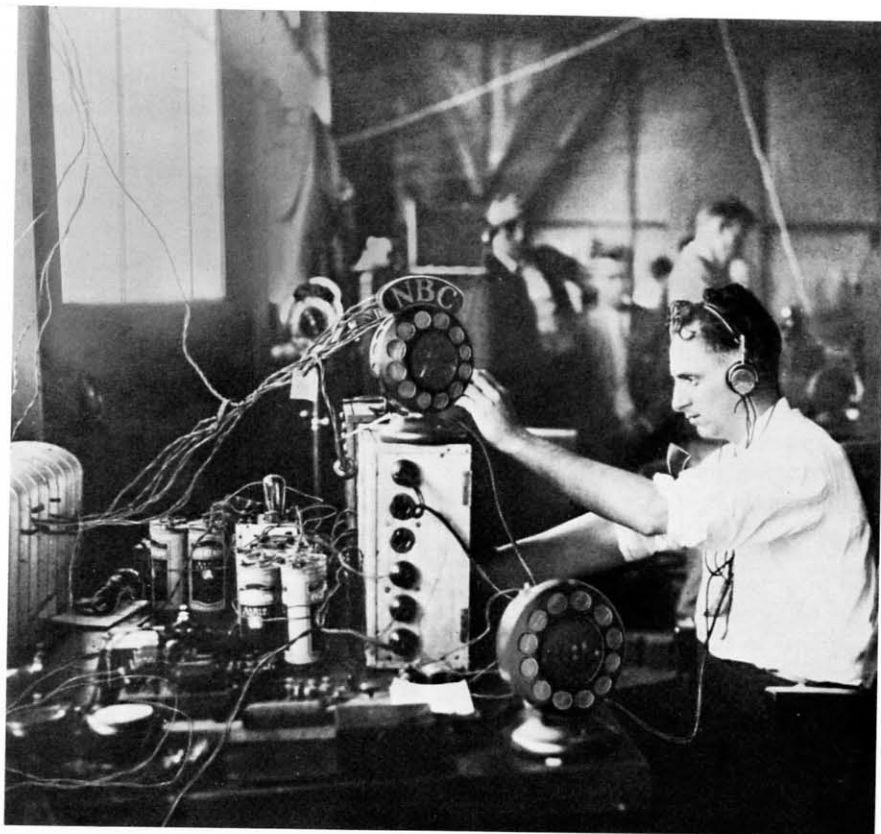
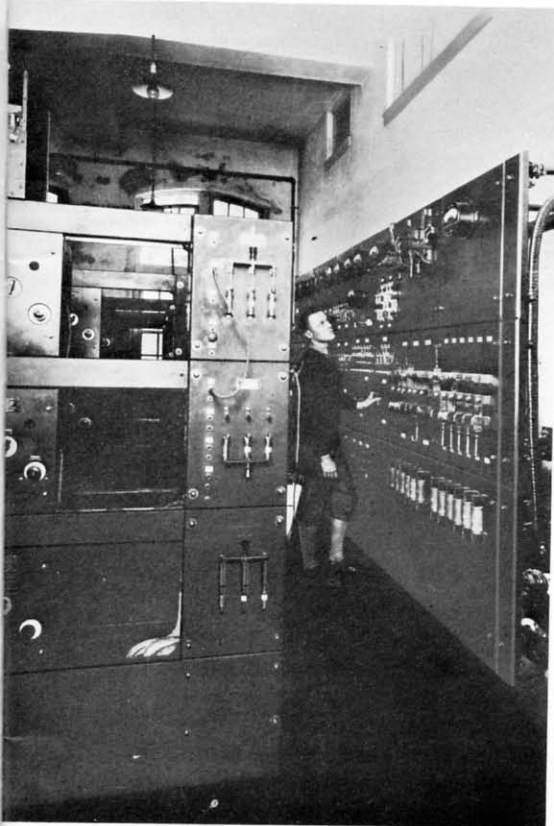
In February 1920, the stations which had been taken over from the Marconi Company by the Government during the war were turned back to the new RCA, and a foreign communications service were inaugurated. One of the principal stations was in New Brunswick, N. J., and the long-wave antenna there has no doubt been seen by a great many of you. During that year,



J. C. Warner

IT WOULD BE misleading for me to imply that anything approaching a complete history of the Radio Corporation of America could be covered in the brief time which we can spend together. While the company is only a little over 18 years old several volumes would be required to do a really thorough job. However, I shall try to review some of the high points in the history of the company, and to cite the progressive changes in organization and their relation to the progress of the company in radio and allied fields.

It has often been said that "the story of the Radio Corporation of America outlines the larger story of the radio era," i.e. the era of radio broadcasting. Peculiarly enough the company was not organized with radio broadcasting in mind, although it is significant that the man whose name is so closely associated with the history of RCA and who has for many years been its active head, had clearly visualized the possibilities of radio broadcasting service and even "electric tuning" long before broadcasting made its first appearance. I refer, of course, to Mr. David Sarnoff.



Two scenes of early communications and broadcasting activities.

foreign service was established with England, Germany, France, Norway, Japan and Hawaii.

In July 1920 an agreement was reached between RCA, GE, and AT&T which permitted RCA to proceed with the use of all radio patents of these companies.

BEGINNING OF BROADCASTING

During the first year of the RCA attention was directed almost exclusively on communications, but in 1921 the first rumblings of what soon was to become a broadcasting boom began to be heard. A number of experimenters had been playing with the idea of transmitting phonograph music over somewhat crude telephone transmitters.

WESTINGHOUSE JOINS RADIO GROUP

Westinghouse had done a certain amount of radio experimentation in its laboratories, and shortly after the formation of RCA began to consider going into the radio field. A subsidiary company was set up known as The International Radio Telegraph Company which had acquired a large

group of Fessenden patents from the old National Electric Signaling Company. Consideration was given to going into the communications business, but difficulties were encountered in that the important European stations were all tied in with the stations of the Marconi Co. now held by RCA.

To strengthen their position Westinghouse acquired a group of Armstrong and Pupin patents, among which was the Armstrong "feed-back" patent later to become quite famous. Finally, in 1921, a cross-license agreement was made between RCA, GE and Westinghouse, and Westinghouse now became a member of the radio group.

BROADCASTING BEGINS

Meanwhile, strenuous efforts were being made to get broadcasting started. The pioneer licensed station of the United States, and of the world, was KDKA, of the Westinghouse Company, in Pittsburgh, licensed by the Department of Commerce on October 27, 1920. This station broadcast election returns in November of that year. RCA first entered this field on July 2, 1921, when a one-day broad-

cast was made from a temporary station at Hoboken, N. J., on the occasion of the Dempsey-Carpentier fight. Soon after, RCA opened station WDY at Roselle Park, N. J., which continued for some months, when it was shut down on account of interference with station WJZ of the Westinghouse Company in nearby Newark. RCA then went in as halfpartner with Westinghouse in the management of WJZ. Broadcasting was really on its way.

WIRELESS SPECIALTY COMPANY

Another corporate element entered the picture in 1921, the Wireless Specialty Apparatus Company. This was a Massachusetts concern largely occupied in making apparatus for the Tropical Radio Company, which in turn was a subsidiary of the United Fruit Company, and which operated coast and ship service for the large United Fruit fleet. GE bought into Wireless Specialty, and again made license arrangements which cleared up a few more of the patent obstacles to RCA's progress.

A FORMATIVE PERIOD

These first two years cover what might be called the formative period of RCA. It was a period during which all of the important American companies which could play a part in the development of the radio field of that time were brought into a workable relationship.

It was a fortunate coincidence that the end of this two year period came just at the threshold of the development of the new broadcasting industry. In fact it is a fair statement that without the removal of the many previous obstacles, broadcasting itself would never have developed on a national scale in such a short time.

RCA ENTERS MERCHANDISING FIELD

Just prior to the start of broadcasting RCA had given thought to furnishing apparatus to radio amateurs both for reception and transmission. As broadcasting appeared, the line of amateur apparatus was expanded as quickly as possible to include home broadcast receiving equipment, and RCA now entered the merchandising field with GE and Westinghouse as manufacturers

son with the present. For that reason I shall digress for a few moments to describe some of the things which were offered for sale. The catalogue was entitled "Radio Enters the Home," and since in this period every man had to be his own serviceman all the accessories imaginable were included as well as many parts for the experimenter to make his own set.

The cheapest receiver listed was a steel box containing a single-circuit tuner and crystal. This sold for \$25.50 with headphones, antenna equipment and "full instructions." More elaborate crystal sets were available at \$32.50 and \$47.50. The cheapest tube set was the one-tube "Aeriola Senior" made by Westinghouse—it used a WD-11 tube in a regenerative circuit and sold for \$75.90 with batteries and antenna, and for \$65.00 without the accessories. This was a very popular set in its day and it is quite likely that a few of them are still in use.

GE supplied a set made in steel boxes. The two units comprised a tuning system in one box and a three-tube

were four ballast tubes to avoid use of a filament rheostat. No emphasis was placed on the number of tubes since the practice of stressing this had not yet appeared. This set sold for \$401 with all accessories

The only loudspeaker shown was similar to a brass automobile horn with a telephone receiver on the end—which sold for \$30.00. It is interesting to note that a phonograph attachment was available at \$18.00 which consisted of a telephone receiver element to be attached to the tone arm of the phonograph so as to get the equivalent of a loudspeaker. There were two models—one for Victrolas and the other for Graphonolas.

FIRST RADIO TUBES

At this time RCA sold four types of receiving tubes. Two were made by Westinghouse and two by GE. The Westinghouse tubes were designed and manufactured in East Pittsburgh and the GE tubes were designed in their Research Laboratory at Schenectady and manufactured in two of the GE lamp factories, one at Nela Park,



First RCA laboratory (1919) was located at Riverhead, Long Island



Broadcast stations in the formative years were crude by present standards



Early recording sessions were waxed without electronic processing methods

(Wireless Specialty also furnished a small amount of apparatus for a time). As later developed, this arrangement had many disadvantages but remember that at the time it was probably the only way in which the RCA could get started. It was, so to speak, a condition of RCA's birth.

In 1922, RCA got out a catalogue of radio equipment which well illustrates the conditions of that day in compari-

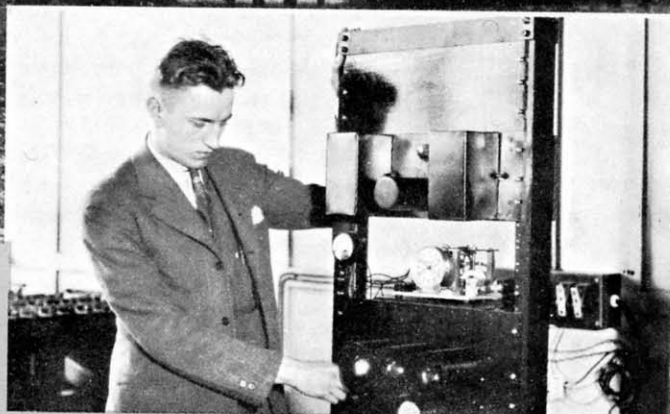
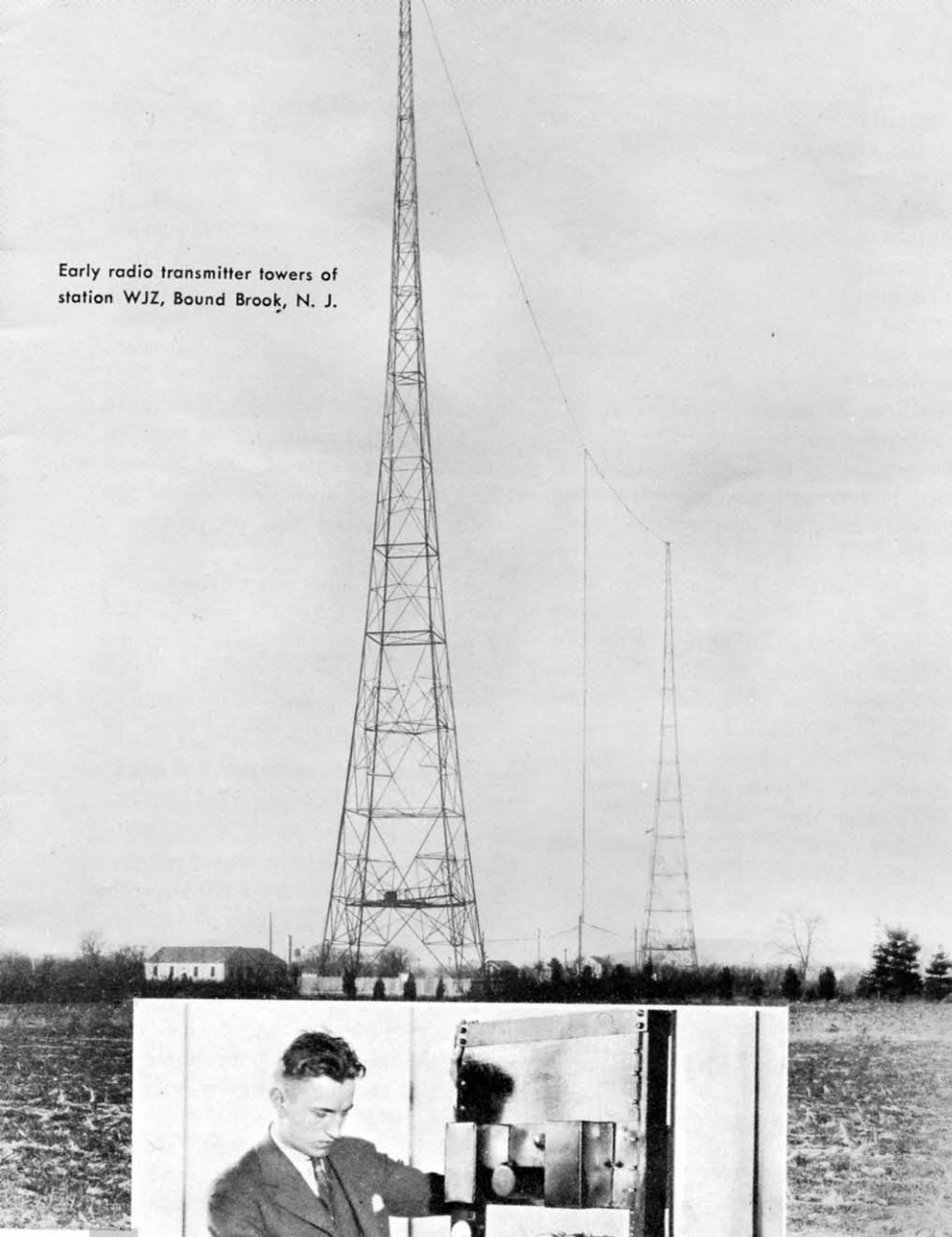
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The most elaborate set was the "Aeriola Grand" made by Westinghouse. This had four tubes, a regenerative detector and, in addition, there

were four ballast tubes to avoid use of a filament rheostat. No emphasis was placed on the number of tubes since the practice of stressing this had not yet appeared. This set sold for \$401 with all accessories

The only loudspeaker shown was similar to a brass automobile horn with a telephone receiver on the end—which sold for \$30.00. It is interesting to note that a phonograph attachment was available at \$18.00 which consisted of a telephone receiver element to be attached to the tone arm of the phonograph so as to get the equivalent of a loudspeaker. There were two models—one for Victrolas and the other for Graphonolas.

Early radio transmitter towers of station WJZ, Bound Brook, N. J.



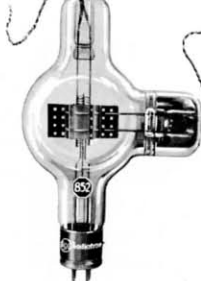
Lester J. Wolf, currently in DEP Radar Projects at the Moorestown plant, is shown with a developmental quartz crystal frequency standard at Westinghouse, 1928-29.



Original studio and operating room, station WBZ, Springfield, Mass., in 1921. Horace R. Dyson, Staff Engineer in DEP Technical Administration, is the operator in the background.



WD-11 Detector Amplifier—1920



852 Transmitting triode—1927

scale he entered into an arrangement with RCA in 1920 which gave him the right to sell tubes under his own name. They were the same as RCA tubes but had different type numbers.

RCA PROGRESSES IN ALL FIELDS

The years 1923, 1924 and 1925 brought numerous advances in the RCA fields. To mention only a few—in 1923 two broadcasting stations were opened by RCA in New York and one in Washington. In 1925 the first WJZ transmitter was installed at Bound Brook, N. J. Short-waves came into use for long distance communications, first to supplement the high power long-wave transmitters, and later to take over practically all of the long distance service. Trans-oceanic communications were extended to additional European and South American countries. The first superheterodyne receiver was brought out in 1924. In 1925 a receiver was sold with accessories permitting it to be operated from alternating current. In the same year the electrodynamic loud speaker was brought out. Apparatus was developed for recording and reproducing records electrically. Improvements were made in tubes greatly reducing the power consumption.

In 1925, RCA furnished certain components to the Victor Talking Machine Company which were built into a radio-phonograph combination employing a single speaker. This is significant as the first step in very important later developments.

RCA ONLY A SELLING AGENCY

Remember, that during this period and for several years after, in the merchandising field RCA itself was only a selling agency. The manufacturing was done entirely by the electric companies. Receivers were made at Schenectady by GE and at East Pittsburgh by Westinghouse. Receiving tubes were engineered at East Pittsburgh and Schenectady, and were made in GE lamp factories at Cleve-



UX-222 Sharp-Cutoff Tetrode—1927



247 Power Pentode 1931

land, Harrison, and later at Newark—also in Westinghouse factories, at East Pittsburgh, Bloomfield, N. J., and later at Indianapolis (in what is now our Indianapolis Plant).

It must already be evident that the problems of coordination began to be tremendous. RCA first utilized the electrical laboratory of the City College of New York, which was in charge of Dr. Alfred N. Goldsmith, to test new models of apparatus. This was quickly outgrown and the Technical and Test Department of RCA was established in its own building at the edge of Van Cortlandt Park in New York. Here samples of apparatus were submitted independently by GE and Westinghouse, tested and reported back to the manufacturing companies, with approval or suggested changes.

It soon became necessary for RCA to have the same apparatus regardless of which company made it. In the case of tubes it was particularly essential to have uniform designs from all factories so they could be interchangeable in any receiver. Of course, this was long before the time tubes were shipped in sets.

EFFORTS ON COORDINATION

In an attempt to accomplish this necessary coordination, "design" or "standardization" committees were set up separately for receivers and tubes, comprising representatives of GE and Westinghouse. The tube committee which started in 1924 perhaps best serves to illustrate the unwieldiness of such an arrangement, which I will describe in some detail.

This committee was known as the Radiotron Standardization Committee. It was made up of representatives from East Pittsburgh, Cleveland, Schenectady, Bloomfield, and Harrison—two and sometimes three from each. It met once a month around the circle and attempted to arrive at agreements on tube designs, ratings, characteristics, and even some production problems. It had no direct rep-

resentation from the receiver divisions so the coordination with them was supposedly handled by the East Pittsburgh and Schenectady tube representatives, and the ideas and needs of the receiver engineers carried to the tube meetings. The main committee carried with it a train of sub-committees and coordination groups intended to handle specific technical items. Needless to say this kind of an arrangement was in many ways unsatisfactory, yet it is difficult to visualize any better method under the then existing company relationships.

The "Design" committee on receivers operated in much the same way as the tube committee, but with some advantage in having only two groups involved. It finally became necessary to set up an additional receiver coordination committee which included RCA representation. One of their first subjects of discussion in 1927 was the "Radiola 16," and another model which became the "Radiola 17," which was the first real a-c receiver using a-c tubes.

The loss of time inherent in the inter-company committee method of coordination was a major handicap to progress in engineering, manufacturing, and sales, but it remained until new major changes in organization came to pass, as we shall see later.

FORMATION OF NATIONAL BROADCASTING COMPANY

Going back to 1924, the AT&T was actively developing the use of wire lines for furnishing programs to broadcast stations and they set up WEAf as the source of these programs. In 1926 RCA and its associates took steps to integrate a complete broadcasting service and formed the National Broadcasting Company. This was a recognition by RCA officials that this new service had the possibilities of an important industry and that a specialized organization was necessary to develop programs, to install new stations and to maintain a satisfactory continuous service to their own as well as other stations.

The new company acquired station WEAf from the AT&T, and also took over the stations owned by RCA and thereby created the real beginning of the network broadcasting industry.

RCA LICENSES OTHER RADIO COMPANIES

In 1927, a major step was taken in a new direction, the licensing of other manufacturers under RCA patents. It was inevitable that the demand for broadcast receivers would lead other companies into the business, and a large number had by this time become established. The granting of licenses to these companies strengthened their position, but at the same time gave RCA a rightful return for its huge investment in patents obtained through the research and engineering of the radio group and also by purchases from other inventors.

At first the superheterodyne patents were not included in the licenses. Also it was not until two years later that tube licenses were granted, although a number of lamp and other manufacturers were actively making tubes.

RADIOMARINE COMPANY FORMED

Late in 1927, the ship-to-shore telegraph business of the RCA, which had been growing steadily, was segregated into a new subsidiary company—the Radiomarine Corporation of America.

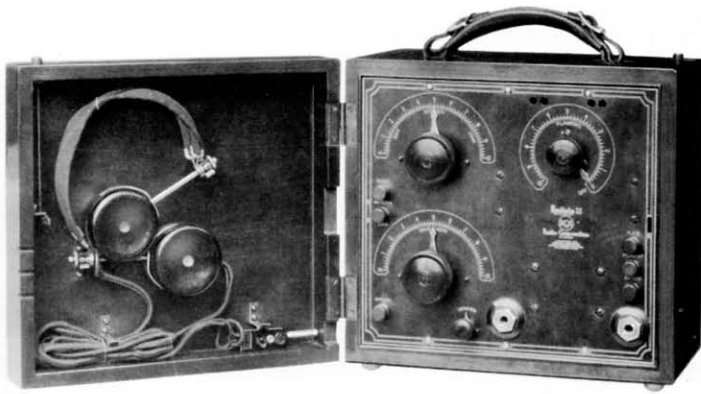
RCA PHOTOPHONE ORGANIZED

In 1928 a new offshoot of the radio business appeared. For several years work had been going on in the GE laboratories to perfect a system of recording sound on film. This was now ready for commercial exploitation in the motion picture industry and RCA Photophone Company was organized to handle this business.

RCA PURCHASES VICTOR COMPANY

1929 was a year of far-reaching changes in the organization of the RCA group which constituted the first major step towards integration of the company into a self-contained, self-controlled radio business.

I have mentioned already some of the handicaps inherent in the arrangements whereby RCA did the selling while the other companies manufactured. This method was wholly inadequate to meet the quick moves of the independent competitor. Furthermore, the electric companies naturally wanted to make a profit and so did RCA. This seriously handicapped the coordination of sales and production which is so essential to the success of an entire operation. RCA needed its own manufacturing facilities.



The "Radiola II", an early radio marketed by RCA at the start of the '20's. The word "Radiola" was coined by Dr. Alfred N. Goldsmith in a note to General Sarnoff supporting his concept of a "Radio Music Box" for home entertainment.

The Victor Talking Machine Company at Camden had been seriously affected by the growth of radio and had not been particularly successful in its attempts to enter the radio field. In order to obtain manufacturing facilities RCA purchased the Victor Company including the manufacturing plant, what was left of the phonograph business, and the Victor dog trademark. Arrangements were also made whereby RCA took over tube manufacturing from GE and Westinghouse. RCA acquired the entire Edison Lamp Works property of the GE at Harrison, and also the Westinghouse factory at Indianapolis, and at the end of the year the RCA Victor Company and the RCA Radiotron Company were organized.

RCA COMMUNICATIONS FORMED

In this same year the RCA Communications Company was formed to take over all of the business in trans-oceanic communications.

CONSOLIDATED RESEARCH, ENGINEERING, MANUFACTURING AND SALES

In 1930 RCA completed the consolidation in the RCA Victor and Radiotron companies of all facilities of research, engineering, manufacturing, and sales

of RCA products which now for the first time included phonographs and records. Somewhat later, in 1932, the Photophone business also was taken over by the RCA Victor Company.

Licenses were now being granted to tube manufacturers and the super-heterodyne patents were included in the set licenses. Agreements had also been made with a number of foreign radio manufacturers giving RCA rights under their patents and in some cases access to their laboratories.

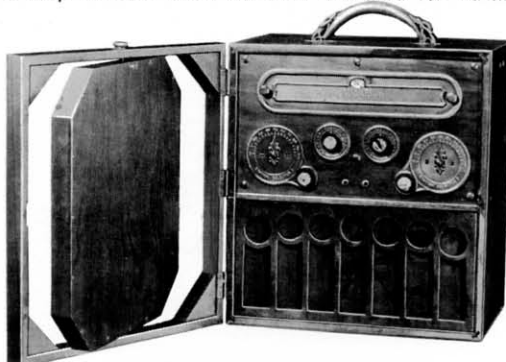
CUNNINGHAM COMPANY BOUGHT

In 1931 the E. T. Cunningham Company was taken over by RCA and consolidated with the RCA Radiotron Company, giving RCA rights to the use of the Cunningham brand and bringing Mr. Cunningham into the RCA organization.

ELECTRIC COMPANIES WITHDRAW

The second and final step toward an independent RCA took place in 1932. In 1930 the Government had brought suit against RCA attacking certain exclusive features of the inter-company agreements, and as the result of a consent decree all the stock interest of GE and Westinghouse in RCA was disposed of by those companies. AT&T

The "Radiola 26", an early superheterodyne portable receiver. The lid contained a rotatable loop antenna which was also dial-tuned for maximum sensitivity.



had disposed of its stock interest in RCA some years before. Modified cross-license patent agreements were entered into with the approval of the Attorney General and the sanction of the Court. RCA now became a completely self-contained organization with wholly owned subsidiary companies operating a broadcasting business, a communications business, a marine radio business, a radio school, and a manufacturing and merchandising business.

DE FOREST COMPANY PURCHASED

In 1934 the tube business was augmented by the purchase of certain patents from the defunct De Forest Radio Company. This brought about the beginning of transmitting tube manufacturing by RCA Radiotron.

RCA VICTOR AND RCA RADIOTRON MERGE

In 1935, the manufacturing and merchandising business was further consolidated by the merger of the RCA Radiotron and RCA Victor Companies which now became the RCA Mfg. Co.

IMPORTANCE OF DIVERSIFICATION

Before concluding I want to emphasize one phase of the history of RCA which so far I have mentioned only indirectly, yet which stands out with clearness and significance in the whole course of the 18 years of RCA's life. I refer to product diversification. A study of the history of RCA is well worth while if it does no more than demonstrate the value of diversification, and its paramount importance to us in looking toward the future.

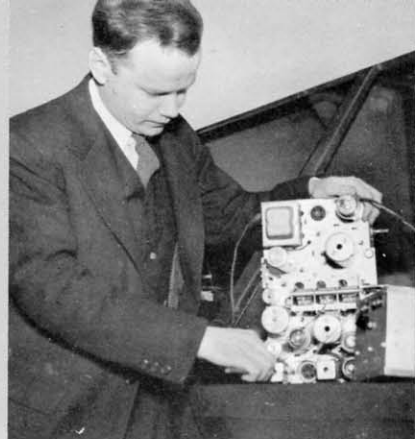
The corporate history is a sort of family tree in which certain elements contributed at the start, but which were later separated from the new growth. I shall use another horticultural analogy to illustrate product diversification.

Certain varieties of trees are responsive to wide differences of training. Two plants may sprout from the ground exactly alike, side by side. One of them may be trained to grow perfectly straight with a central trunk and beautiful symmetry. The other may be trained into a large bush-like growth with many branches.

Two companies may also start in



John B. Coleman inspecting a transmitter in Camden, ca. 1936. Mr. Coleman is presently Manager of BMEWS project.



Dr. Elmer W. Engstrom working on a radio receiver in a Camden research laboratory in 1934



Clarence A. Gunther is shown making receiver tests in a Camden laboratory, ca. 1935. Mr. Gunther is now Chief Defense Engineer, DEP

the same way from small beginnings. One may be concerned with a single product or a narrow field while the other grows many branches, large and small. We may have a great admiration for the tall straight tree, but if a storm comes along and breaks off the top it may be years before it recovers its original form. The same storm has little effect on the other tree. It may pass over without harm or even if a few branches are broken they may be trimmed off without showing.

The one-product company may do admirably in times of prosperity and we may envy its simple operation. But if it meets with changing conditions or times of depression the "one product" may no longer be in demand and the company has nowhere to turn.

Suppose that back in 1921 RCA had said "No, we aren't interested in radio entertainment, we are in the commercial communications business." Again

suppose RCA had looked at talking pictures and said "No, we aren't interested, we are in the radio business." Again, after acquiring the Victor Company suppose RCA Victor had said "We will let the phonograph business die. It doesn't amount to much and we want to sell radio receivers." There are several obvious answers to these suppositions, but the uppermost in our minds probably is that if these things had happened most of us wouldn't have our jobs.

PUBLIC SERVICE IS PARAMOUNT

The strength of a company is in a large measure proportional to its service to the public. The RCA has grown as it has extended its fields of public service. It will continue to grow just so long as it utilizes its variety of resources to give the public new or better services, or new or better products.

It should never be forgotten that a

by-product often becomes a main product. Again, the limitations of a product or service today may turn into advantages of tomorrow. The often alleged lack of secrecy in radio communication was once talked of as a handicap, but broadcasting, as its name implies, made good use of this so called handicap.

RESEARCH INSURES PROGRESS

Research has played a major part in the evolution of the RCA and must continue to do so. I use the term not alone in a technical sense but broadly—research in sales methods, in advertising, in relations with the public, in better understanding and organization of our personnel, as well as in engineering and manufacturing of our products.

Research provides the new food which the tree needs when the old is exhausted or no longer suitable. The tree must grow or it will die and a company must go ahead or back. It never stands still. RCA has made good use of its resources to expand its fields of activity. But it is a safe prediction that if we live up to our opportunities we will some day look back at 1938 and see that we have now only started to scratch the surface. Facsimile is barely started. Television is still ahead of us. Commercial Sound applications are getting under way. A multitude of ultra-high frequency applications are certain. And outside the radio or entertainment fields the field of electronic devices is in its early infancy.

I hope that this brief story of the RCA has served to show something of how far we have come but more important, how much farther we can go in the future.



The "Radiola 17"—the first a-c radio. The receiver contained six tubes plus rectifier and operated on a tuned radio-frequency principle