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RADIO AGE

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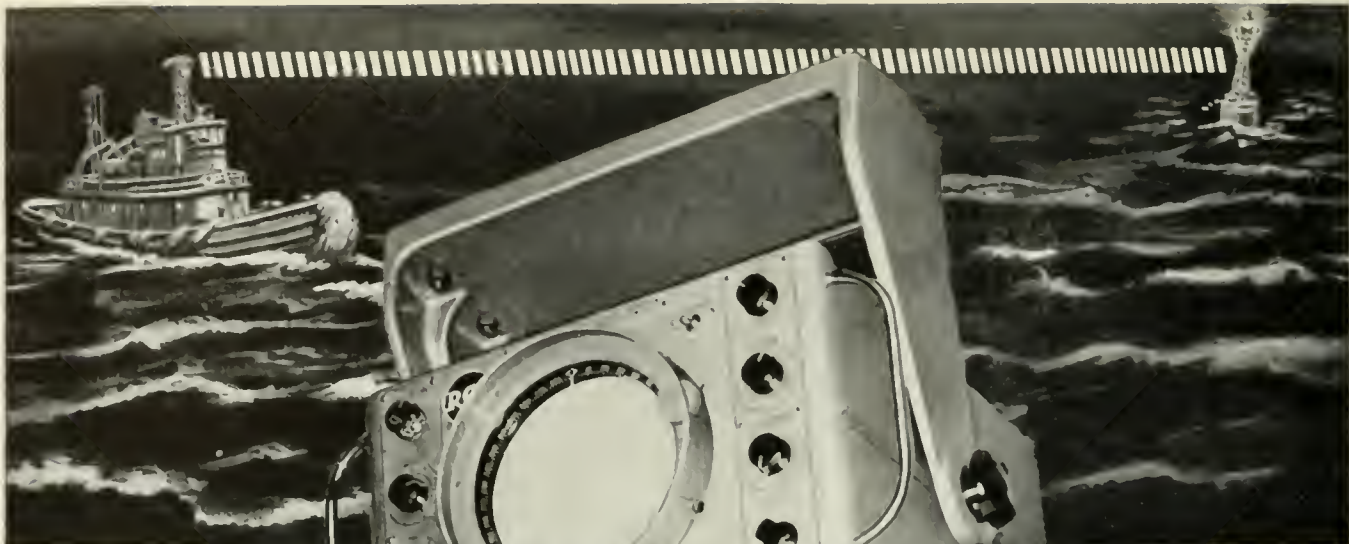


TOSCANINI



APRIL

1950



The **NEW**

RADIOMARINE® 3.2 cm RADAR...

for work boats, fishing craft and small vessels

Now, mariners aboard small craft also can enjoy the advantages of radar. This new, low-cost Radiomarine Model CR-103 offers all the advantages of modern radar. Use it for pilotage... for position finding... as an anti-collision aid... for detecting storms.

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Engineered and constructed to fit the small space limitations of tugs, harbor craft, trawlers, fishing craft, ferries and yachts, the CR-103 has these outstanding features:

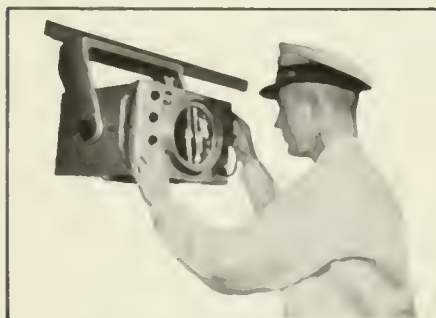
Clear images on a 7-inch scope. Operating ranges of 1, 3, 8 and 20 miles, with a close-in range of 75 yards from the antenna.

50-inch diameter low wind resistance antenna, weighs only 150 lbs.

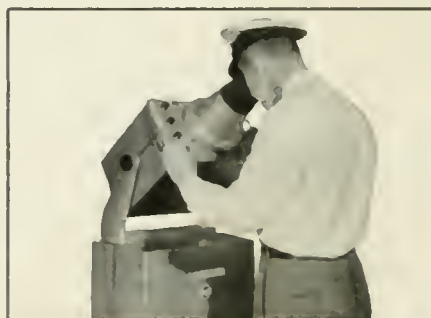
Operates from 24, 32, 115, 230 volts D. C. or 115/230 volts, 60 cycles.

Backed by Radiomarine's world-wide Service.

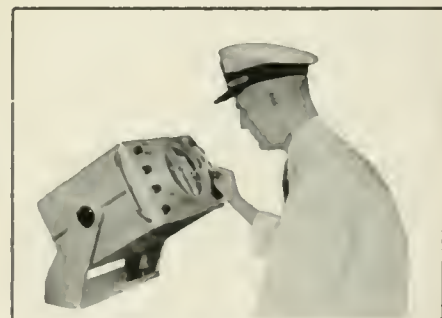
Radiomarine CR-103 Radar will enable small vessels to operate on schedule, regardless of weather, in harbor, at sea or inland waters. Investigate its possibilities for safety and economy for your craft. Write for complete information.



Mounted from the overhead



Mounted on Transmitter/Receiver Cabinet



Mounted on a table or shelf

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RADIO AGE

RESEARCH • MANUFACTURING • COMMUNICATIONS • BROADCASTING • TELEVISION



COVER

Toscanini and the NBC Symphony Orchestra are making their first nationwide tour during which the 73-year-old maestro and his 106 musicians will give concerts in 20 cities.

VOLUME 9 NUMBER 3

APRIL 1950

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Radio Age is published quarterly by the Department of Information,
Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y.



FESTOONS OF RCA'S "CONES OF SILENCE" FORM ONE OF THE ACOUSTICS EXHIBITS IN THE HAYDEN GALLERY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

New Color Television Tube Seen Bringing Color Programs to the Home

Sarnoff Acclaims New Development as Miracle of Science and Declares it a Key to a Practical Color Television System for Home Reception. He Sees Future of All-Electronic Color Television Assured for the Public

A COLOR television picture tube, long recognized by scientists as vital for the complete development of a practical, simplified color television receiver, was demonstrated by the Radio Corporation of America in Washington, D.C., on March 29.

Performance of the electronic color tube in this first public demonstration, revealed beyond doubt that the scientists and engineers of RCA have succeeded in discovering and developing the only link that up to now had been missing in color television for the home. As a result, another major advance has been made in the RCA all-electronic, high-definition, fully compatible color television system.

The new picture tube, or kinescope, was shown in two direct-view types. The color picture is viewed directly on the face of the tube the same as black-and-white pictures are seen on the majority of the 5,000,000 television sets already in use. The high-definition color pictures are reproduced all-electronically. The receiver is unencumbered by any mechanical parts or revolving disks. Thus, there is no flicker, no color break-up and no whir of a disk such as characterizes any system utilizing a mechanical scanning disk.

Sarnoff Evaluates Color Tube

Praising the scientists and engineers of RCA who developed the full-color tube, Brig. General David Sarnoff, Chairman of the Board of RCA, acclaimed the development as miraculous, both from a scientific and artistic standpoint.*

* Reprints of General Sarnoff's contemporaneous statement to newsmen at the press conference and demonstration of RCA color tube in Washington, D.C., March 29, may be obtained from the Department of Information, 30 Rockefeller Plaza, New York 20, N.Y.

"Measured in comparison with every major development in radio and television over the past fifty years," said General Sarnoff, "this color tube will take its place in the annals of television as a revolutionary and epoch-making invention. When historians at the close of the 20th Century evaluate the most important scientific developments, I will predict that this tube will be among the great inventions of the second half of this Century. As the master key to practical color television, it is an outstanding development of our time.

"We are on the threshold of a new era in television—the era of color," said General Sarnoff. "We can see ahead to the commercial development of practical and simplified color receivers. Our generation is assured of clear and natural color television programs. Generations yet to come will see around the world in color because this tube, which will go down in history as

the father of future color television picture tubes, is the key to greater achievements destined to come.

Scientists Congratulated

"I congratulate the scientists, research men and engineers of RCA whose skills have achieved this great success," continued General Sarnoff. "They have made a tremendous contribution to the art and industry, and have greatly intensified television's effectiveness not only in entertainment, but in education. By learning to harness electrons to 'paint' with perfection in natural colors, these men of science and engineering have added to the preeminence of the United States in television.

"As Dr. V. K. Zworykin's invention of the iconoscope and development of the kinescope revealed to experimenters in the Twenties that the old mechanical scanning disk was a crude and impractical device for the sending and receiving of

RCA COLOR TELEVISION RECEIVERS ARE THE SAME AS THE COMPANY'S STANDARD TABLE-MODEL BLACK-AND-WHITE SETS IN SIZE AND APPEARANCE.



black-and-white television pictures, so this color tube reveals the superiority of electronics in color television," said General Sarnoff. "The mechanical scanning disk in television now belongs to the Ages. As an expedient, it merely gave laboratory technicians something to play with while the proponents of electronics applied the modern and practical methods to develop an all-electronic, high-definition, completely compatible system of color television for the American public."

Emphasizing the feature of compatibility as an engineering triumph, engineers explained that those who already own television sets, or contemplate purchase, need have no fear of obsolescence. Neither has the broadcaster any cause to fear obsolescence of his transmitter or loss of his black-and-white audience should he also broadcast color programs. Because of its compatibility, the engineers explained that the RCA color system operates at both the transmitter and receiver in complete harmony with the existing black-and-white system.

In fact, so close is its relationship with the present system that both color and monochrome are capable of existing, or operating, on the same channels, same transmitters and same receivers, except, of course, that present sets reproduce the color programs in monochrome. To see the programs in color, the present television receiver in the home can be adapted to use the new color tube, or a new receiver designed to operate with the color tube can be used.

Compatibility Illustrated

During the demonstration, the significant feature of compatibility of the RCA color system was impressively illustrated. A standard black-and-white receiver was placed between two sets equipped with the color tube. While they reproduced the color program in color, the black-and-white set reproduced the same program at the same time in black and white.

Thus, those present at the demonstration not only saw the show in color, but any one of the thousands of television set owners in the Washington area also could see it



HAROLD B. LAW, E. W. HEROLD AND RUSSELL LAW, RESEARCH SCIENTISTS OF RCA LABORATORIES, DISCUSS THE TECHNICAL FEATURES OF THE NEW RCA COLOR TELEVISION TUBE.

in black-and-white without modification of their sets and without having to change any adjustments or turn any knobs.

The engineers pointed out that such a result was impossible with a mechanical disk system, which lacks compatibility with existing receivers.

Prior to the demonstration, it was disclosed that members of the Federal Communications Commission and its engineering staff previously had been given the first — and unofficial — demonstration of the new color receivers in operation in a Washington studio of the National Broadcasting Company which had been converted into a temporary "laboratory". It was there, also, that the public demonstration was held. The programs were telecast from NBC's station WNBW, at the Wardman Park Hotel, where the television transmitter, studio and antenna are located.

The color receivers in the demonstration, in size and outward appearance, are the same as the standard RCA table-model television sets. The face of the tube appears to the observer exactly the same as in a black-and-white receiver, except that the picture is in natural colors. When color television is available for the home, the engineers declare that every tint will be clearly and faithfully

reproduced. Even the texture of the skin and delicate petals of a flower will be vividly seen true to life.

Describes Color Tubes

Dr. C. B. Jolliffe, Executive Vice President in Charge of RCA Laboratories, explained that while the general appearance of the receivers was the same as present black-and-white sets, there were modifications of circuits and additional radio tubes inside the cabinets to help the color tube perform its function.

Revealing that the RCA scientists are expanding their research to explore every possibility for further advances, Dr. Jolliffe pointed out that the two color receivers in the demonstration used different types of color picture tubes. One employed a single electron gun to "paint" the pictures. The other used three electron guns, each of which had an electron beam geared magnetically to actuate each of the three primary colors on the face of the tube and blend them true to the original scene being telecast.

"Already these two types of tubes have provided us with a vast store of new knowledge," said Dr. Jolliffe. "As is the case with the majority of inventions in the beginning, these tubes are hand-made. The next step will be to produce them commercially by mass production methods. As the human eye is

a delicate and wondrous organ of sight, so are television picture tubes. In fact, it is interesting to know that on the faces of these color picture tubes there are 351,000 color dots, and we expect to increase that number to improve the resolution for the most critical eye."

Calling attention to some of the major technical advances in the new color kinescopes, Dr. Elmer W. Engstrom, Vice President in Charge of Research, RCA Laboratories, explained that the elements that performed the color magic were built into standard metal-cone tubes. He pointed out that, while the pictures measured 9 x 12 inches on the face of the tube, still larger pictures can be achieved, in fact, the larger the tube, the easier it is to build them for high resolution.

Explains Tube's Performance

He said that the images are made to appear on the face of the tube by pencil-like beams of electrons that activate fluorescent materials representative of the three primary colors—red, green and blue. Although the trio of beams all operate simultaneously down the narrow glass neck of the same picture tube, they are ingeniously controlled so that their actions are masked from interfering with the operation of each other.

"The main difference between the two types of color tubes shown today," said Dr. Engstrom, "is that one is equipped with a single electron gun to generate the electron beam, and the other employs three guns. A duo-feature is that both tubes will reproduce color pictures when color signals are broadcast, or they will reproduce the pictures in black-and-white if the signals are in monochrome. The advantages to the owner of such a flexible receiver are obvious — he can see color broadcasts, or if the transmitter is broadcasting black-and-white pictures, the color tube will also see them that way with excellent clarity and sharp contrast.

"The electron guns which 'fire' narrow beams of electrons at the fluorescent-coated face of the tube are controlled by the video signals as intercepted by the receiving antenna," continued Dr. Engstrom. "The video signals contain the nec-

essary information regarding the color detail of the object or scene being televised. As a simple illustration, if a rose is being televised, the video signal will carry the red information as well as the green of the stem and leaves. At the receiver, the red electron beam will handle only the red, and the green beam will be influenced only by its color. With split-second precision the two beams will 'paint' the flower true to the original on the face of the tube, blending the 'fluorescent paints' in perfect harmony.

Coated With Color Phosphors

"To accomplish this," said Dr. Engstrom, "the face of each tube is coated on the inside with multiplicity of dots of color phosphors. These dots are arranged in triangular groups of three—one red, one green, and one blue. The total number of dots presently used on each tube face is 351,000 or 117,000 for each color. Behind the tube-face is a metal masking screen containing 117,000 holes of approximately the same size as the dots of color phosphor. The holes are so placed that they overlap equally each red, green, and blue dot of a triangular group.

"As the electron gun, or guns, scans the face of the tube, electrons pass through the masking screen and activate the color phosphor dots, causing them to give off visible light. When a video signal representing red passes through the electron gun, a red dot is activated. Green and blue dots are activated as signals representing those colors arrive. The amount of light in color given off by each dot varies in exact accordance with the information supplied from the video signals taken from the air. This action occurs so rapidly that the light from the activated color dots blends into the natural colors of the original scene."

Dr. Engstrom added that, in the RCA color television system, the tri-color tube operates on a standard of 525-line definition—the same as black-and-white television. This means, he explained, that images are built up with 525 lines of detail, resulting in a high level of clarity and sharpness.

Asked whether there was any one man responsible for the tube's

invention, Dr. Engstrom said that the development was the result of great teamwork among scientists, research men and engineers, all of whom marshalled their special skills and knowledge to solve the problem. Experts in the science of electronics, specialists in electron tube design, in broadcasting, in receiving sets, in fluorescent materials, electron guns and engineering, in fact, all phases of television, contributed to the achievement. Dr. Engstrom described it as "an outstanding example of what can be accomplished in the complex and ever-widening science of electronics in which no one man could possibly find all the answers to a problem." As a result, he said, the color tubes were developed by a corp of scientists and development engineers on the staffs of RCA Laboratories at Princeton, N. J., and at the RCA tube plants at Harrison, N. J., and Lancaster, Pa.

Sarnoff Pointed Way to Success

"I would like to point out, however," said Dr. Engstrom, "that, while no one individual invented the color tube, or developed the RCA color system, this is an appropriate occasion to reveal that the several hundred of us who contributed to the accomplishment were spurred on by the enthusiastic leadership and vision of General Sarnoff. When things looked dark at times, as we faced impasses, it was his support and encouragement that drove us onward. One of the dramatic stories yet to be told is that of his drive and determination that a color system and a color tube be developed on an all-electronic basis, fully compatible with the present television system to avoid any loss to the public through obsolescence. Without his indefatigable leadership and faith in our ability, we would not have reached this goal at least for many years to come. He saw what was needed, and applying wartime techniques, directed us at forced draft. Such tactics are not always productive of speed in achievement when applied to creative effort dependent for success on new knowledge and new scientific principles. But General Sarnoff has taught us that the

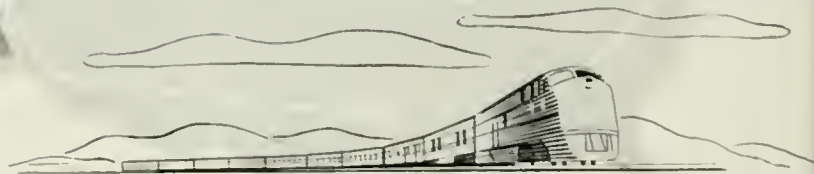
(Continued on page 21)



ON A COAST-TO-COAST TOUR, MAESTRO TOSCANINI WILL CONDUCT THE NBC SYMPHONY ORCHESTRA IN 19 CITIES.

SCHEDULE OF CONCERTS BY TOSCANINI AND THE NBC SYMPHONY

April 14 New York	May 9 Portland
April 17 Baltimore	May 10 Seattle
April 19 Richmond	May 13 Denver
April 22 Atlanta	May 15 St. Louis
April 25 New Orleans	May 17 Chicago
April 27 Houston	May 19 Detroit
April 29 Austin	May 21 Cleveland
May 1 Dallas	May 23 Pittsburgh
May 3-5 Pasadena	May 25 Washington
May 7 San Francisco	May 27 Philadelphia



Toscanini on Nationwide Tour

Noted Maestro and NBC Symphony Orchestra Left April 17 for Concerts in 19 Cities from Coast-to-Coast

ENTRAINING on one of the most extensive musical grand tours of all time, Arturo Toscanini and the NBC Symphony Orchestra left New York on April 17 on a transcontinental journey that will cover more than 8,000 miles during which concerts will be presented in 19 cities. None of the concerts will be broadcast.

The six-weeks trip which will be under the auspices of the RCA Victor Division of the Radio Corporation of America, has been planned in observance of the musical achievements made in America during the past 50 years. The opening concert was held in Carnegie Hall, New York, on April 14 and the final one will be on May 27 in Philadelphia.

In announcing the tour, Frank M. Folsom, RCA president said:

"The RCA Victor Division of Radio Corporation of America welcomes the opportunity to make pos-

sible this first coast-to-coast tour of Maestro Toscanini and the NBC Symphony, which today, thirteen years after its founding, is recognized as one of the greatest orchestras in the world.

"This Corporation, which has pioneered in bringing out great music to millions of music lovers through phonograph records, radio and television, is particularly happy to arrange for Maestro Toscanini and his men to visit cities where they have never been seen or heard in live concert.

"This tour serves as fitting recognition of the musical achievements of our country during the first fifty years of the Twentieth Century, a period during which the United States attained world leadership in the art of making great music and bringing it into the American home. This nation-wide tour by Maestro Toscanini underscores this accomplishment. It is also an impressive

portent for the second half of the century and our future musical culture, which will continue to develop and expand through the media of live concerts, records, radio broadcasts and television."

The Toscanini Tour Special is a veritable "hotel on wheels" accommodating 125 persons. Twelve cars, including a private car for the Maestro make up the caravan.

Toscanini's private car houses not only bedroom, bath and lounging facilities, but also a complete kitchen and an observation platform. Every effort has been made to give the 83-year-old conductor complete comfort on the 8,593-mile trip.

No less effort has been put into making the quarters of the 106 musicians and score of additional personnel comfortable. The best sleeping accommodations plus lounging and dining cars have been provided. Extra lounge and dining cars will be added to the 12-car train along the route of the trip.

The \$250,000 worth of valuable musical instruments will be transported in special baggage cars.

(Continued on page 32)

4800 FIRMS SPEED PRODUCTION

*Majority of RCA Suppliers Are Small Businesses Spread Over the Nation,
Contributing Goods and Services in the Amount of \$125,000,000*



By Vincent de P. Goubeau

*Vice President in charge of Materials,
RCA Victor Division.*

THE electronics industry which has expanded ten times in the last two decades is like a magic wand weaving a pattern of industrial interdependence among thousands of small and large businesses.

Growing faster than any other industry and receiving tremendous impetus from television, the electronics industry has stimulated business and strengthened the nation's economy as much as any new development since the birth of the automotive industry.

Every day more and more small, independent businesses rise out of the dreams of enterprising Americans to share in the success, in the profits of this fast growing industry. There are thousands of these independent business firms, each adding its share, some in a small way, some in large and impressive proportions, to the success of an enterprise which has received universal acceptance by the American public.

Rapidly approaching a \$2 billion-a-year enterprise, television gives us a good picture of how one business affects and depends upon others. At the end of 1946 there were six television receiver manufacturers—today there are 105. In 1946 there were 6,500 television sets produced—this year it is estimated that over 4,000,000 will be

produced. One clear result of the expansion of this industry is the increased volume of business for vendors and suppliers of raw materials, components and parts to television manufacturers.

Television Employment Increasing

It is estimated that there are more than 500,000 people directly engaged in the television industry. This number is growing every day. Add the thousands of others in the mills, shops, stores, factories and offices supplying raw materials, parts and services for this industry and one has a picture of American interdependence that is of a tremendous economic scope.

To bring this point home, we need only consider the contributions of RCA in the spectacular growth of the electronics industry and of television in particular. RCA's achievements have been made possible in a large measure by the support and cooperation of

independent suppliers furnishing RCA with necessary materials, parts and services. The self-contained efforts of RCA or any similar company alone could not have harvested the magnificent accomplishments in electronics which we are all aware of today.

The scope of relationship between RCA Victor, the manufacturing Division of Radio Corporation of America, and its suppliers is graphically illustrated by the fact that last year 4,800 firms supplied RCA Victor with goods and services in the amount of \$125,000,000. These 4,800 independent businesses represent a cross-section of American enterprise. About four-fifths of them have less than 500 employees; almost half have less than a hundred.

Many of these businesses were born out of the requirements of television alone. Others have their roots in earlier radio and electronic developments. Through many years of loyal and friendly associations



79% OF RCA SUPPLIERS ARE 'SMALL BUSINESS' FIRMS



A LARGE AND CONSTANT SUPPLY OF PLASTIC MATERIAL IS REQUIRED IN THE PRODUCTION OF PHONOGRAPH RECORDS.

between them and RCA, an interdependence has grown into a relationship which is far beyond the cold, matter-of-fact business dealings of buyer and seller. Each takes pride in the achievements of the other.

Scores of these small businesses have been helped by RCA and similar firms, receiving assistance in organization and production problems and in engineering know-how, and some, through hard work, efficiency and quality performances, have grown from small beginnings to become leaders in their chosen field, graduating into the "big leagues" of industry. Indeed, RCA Victor itself is one of these graduates. Fifty years ago its predecessor was only a 17-foot machine shop in Camden, New Jersey.

Scattered in 42 States

Scattered as they are in 42 states, RCA Victor's suppliers, large and small, are solid community assets throughout the entire nation. They offer employment opportunities which might not have existed were it not for their rela-



THE MANUFACTURE OF CABINETS FOR TELEVISION AND RADIO SETS CONSUMES HUGE QUANTITIES OF CHOICE LUMBER SELECTED FROM MANY KINDS OF TIMBER.

MANY SUPPLIERS PROVIDE THE COMPONENTS THAT GO INTO THE ASSEMBLY OF KINESCOPE PICTURE TUBES FOR TV RECEIVERS.



tionship with RCA Victor and similar companies. They contribute to the steady growth and prosperity of many communities.

Maintaining production, servicing and distribution schedules at RCA Victor depends upon a continuous flow of services and materials in quantities of astronomical proportions. Thousands of outside suppliers are depended upon to keep the wheels rolling in RCA Victor's four product departments — Home Instrument, Engineering Products, Tube and Record.

Raw materials and component

parts must flow from all corners of the nation into the three Home Instrument assembly plants at Indianapolis and Bloomington, Indiana and Camden, New Jersey and into the Company's two cabinet plants at Pulaski, Virginia and Monticello, Indiana. A few examples of annual requirements of these plants are 20,000 feet of wire and cable, 57,000,000 capacitors, and 3,000 carloads of cabinets.

Another large business of RCA Victor is that of the Tube Department whose plants at Marion and Indianapolis, Indiana; Lancaster,

Pennsylvania and Harrison, New Jersey, require tremendous stock-piles of materials from hundreds of independent businesses. As one example, these plants use three car-loads of glass bulbs for radio and television tube production every working day—more than a million pounds of glass a month.

Requires Material in Steady Flow

RCA Victor's phonograph and record production also requires a steady flow of materials into two major plants at Canonsburg, Pennsylvania and at Indianapolis, Indiana. Record label paper is used at the rate of 40,000 pounds a month and resin, compounds and packing materials are needed in equally huge proportions to keep the shelves of the nation's record dealers stocked with the favorite tunes of music lovers.

In the Engineering Products Department, a wide variety of raw materials, components and parts, is utilized reflecting the diversity of products manufactured by this Department for government an' com-



THIS "SMALL BUSINESS" MACHINE SHOP WAS THE PREDECESSOR OF THE FAR-FLUNG RCA VICTOR ORGANIZATION OF TODAY.

mercial uses. Items furnished to this Department range from tiny test gauges of delicate, watch-like precision to 30,000 pounds of steel and other material used in making a 175-foot super-gain antenna for a television station.

These few examples of essential requirements which RCA Victor

obtains from the outside give some indication of the mutual dependence of RCA Victor and its 4,800 suppliers. This relationship of mutual dependence, which is frequently taken for granted in our country, is typical of American business enterprise. It is an essential ingredient of its success.

SOME OF THE HUNDREDS OF PARTS AND SUB-ASSEMBLIES THAT GO INTO THE MAKING OF A 12½-INCH TELEVISION RECEIVER.



[RADIO AGE 9]



No

First "Satellite" TV Station

New Station at Bridgeport, Conn., is Being Used By NBC to Study Effectiveness of Microwaves in Providing Metropolitan Video Program Service to Outlying Communities



By Raymond F. Guy

Manager, Radio and Allocations Engineering, National Broadcasting Company.

AMERICA'S first custom-built ultra-high-frequency television station to be licensed by the Federal Communications Commission for the specific purpose of studying the availability of microwaves in providing full-scale video program service is now in regular operation on a hilltop near Bridgeport, Connecticut. The station equipment was designed by the Radio Corporation of America and was installed and is operated by the National Broadcasting Company under the call letters of KC2XAK.

Intended to function solely as a "satellite" station, KC2XAK does not originate programs but picks up video signals telecast by WNBC, New York, and retransmits them on the frequencies of 529-535 mc. Results of field tests now being conducted are expected to be an important factor in determining the feasibility of opening the uhf band from 475 to 890 megacycles for the extension of commercial television program service to cover the entire country.

Bordering Long Island Sound approximately 55 miles from New York City, Bridgeport was chosen for the site of the experiment for two reasons. First the city is on the fringe of the area served by New York television stations and therefore is not adequately served by metropolitan transmitters. Sec-

ondly, this particular Connecticut community is situated on rolling or hilly country which provides an opportunity to study the effects of this type of terrain on the transmission and reception of uhf waves. An estimated population of 350,000 would be reached by the station's signals. A site for the station and tower was selected on Success Hill, 200 feet above sea-level and slightly more than two miles northeast of the center of Bridgeport.

Once preliminary details had been settled, the project moved ahead rapidly. The transmitter

building was completed on November 15, 1949, and 35 days later the 40-foot, specially-designed slot antenna was in place atop the 210-foot tower. Regular program operations began on December 29.

Program material for the satellite operation is picked up direct from Empire State tower by a six-foot parabolic antenna attached to the tower's 180-foot level. The signals are led downward to receiving equipment in the transmitter building, processed there and then retransmitted on the station's assigned uhf frequency. The com-



ENGINEER TUNES SLOT-TYPE ANTENNA BEFORE IT IS LIFTED TO TOP OF 210-FOOT TOWER OF BRIDGEPORT STATION.



PARABOLIC RECEIVING ANTENNA BEING TESTED BEFORE INSTALLATION ON THE STATION'S TOWER.

[RADIO AGE II]

A WINDING ROAD CLIMBS UPHILL THE TRANSMITTER BUILDING AND TOWER OF RCA-NBC'S NEW EXPERIMENTAL UHF TELEVISION STATION ON SUCCESS HILL, NEAR BRIDGEPORT, CONN.

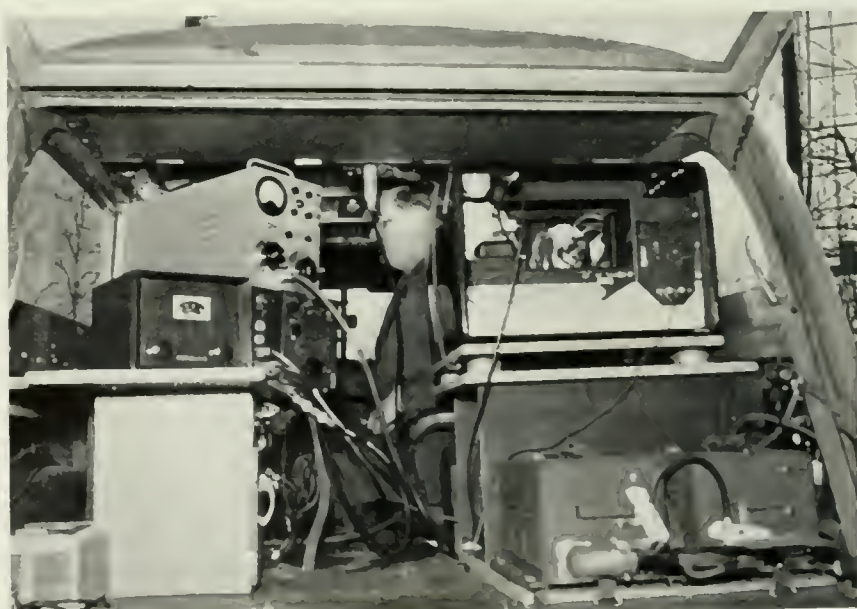


"BOW-TIE" ANTENNA (IN CIRCLE) IS ONE OF SEVERAL TYPES OF UHF RECEIVING ANTENNAS UNDERGOING TESTS IN THE BRIDGEPORT AREA.

combination of transmitter output and a high-gain antenna radiate the picture signals with a power of approximately 14,000 watts.

Special uhf tuners and converters were designed for installation in 100 homes and check-points throughout KC2XAK's service area. These instruments are located at distances in excess of 30 miles from the transmitter. Observers at these points make frequent reports of the quality of reception to the station where the data are recorded on a chart representing the service area. In addition, a station wagon, carrying sensitive measuring instruments, roams the surrounding countryside recording the strength of signals at varying distances from Success Hill. Several types of receiving antennas are being tried out to determine the one most suitable for conditions that are likely to be encountered in similar typical communities throughout the country.

Despite the numerous investigations of uhf propagation that have been carried out during past years, many more exact studies are to be continued at Bridgeport. In particular, engineers need more data



EXTERIOR AND INTERIOR VIEWS OF THE STATION WAGON WHICH IS BEING USED THROUGHOUT THE NORMAL SERVICE AREA OF THE BRIDGEPORT UHF "SATELLITE" TO MEASURE THE STRENGTH OF THE TRANSMITTED SIGNALS AT DIFFERENT DISTANCES FROM SUCCESS HILL.

on the effect on reception of intervening buildings and hills. Because of the lack of satisfactory means for measuring the strength of TV signals in locations where hills lie between the receiving antenna and the station, NBC is proposing to utilize a helium-filled balloon carry-

ing a small antenna and a detecting device which is connected to measuring instruments at ground level. The information to be obtained will provide a pattern showing the travel of waves in the vertical plane.

Engineers also want to know
(Continued on page 24)



CONTAINING FOUR MINIATURE TUBES AND ALL BATTERIES, THE RECEIVER IS SMALL ENOUGH TO FIT EASILY INTO A POCKET OR MILADY'S HANDRAG. BELOW: COMPARISON OF PREVIOUS "PERSONAL" RADIO AND THE LATEST MODEL.

Very Much in Very Little

Research Develops World's Smallest Superheterodyne Radio Receiver with Highly Efficient Loud-Speaker

RESEARCH in acoustics, conducted by engineers at RCA Laboratories, Princeton, N. J., has resulted in the development of a pocket-size laboratory model superheterodyne radio receiver smaller than any previously designed with a loudspeaker. Dimensions of the complete instrument are $5\frac{1}{8}$ inches by 3 inches by $1\frac{5}{8}$ inches, and the total weight, including batteries is only three pounds.

In addition to a more efficient loudspeaker and horn system, smaller components and better positioning of the loop antenna were combined to give improved performance in a set one-third the size and half the weight of receivers now available, according to Dr. Harry F. Olson, Director of the Acoustical Research Laboratory.

"To develop a set of this size with performance equal—or in this case, superior—to larger portable radios, meant that an increase in loudspeaker efficiency had to be achieved to compensate for the reduction in power output," Dr. Olson

explained. "The most significant step in this direction was realized by using the movable lid of the receiver case as a horn for the loudspeaker. With this single innovation the set's performance was increased four-fold over existing models."

When the lid of the case is raised, a tapered horn approximately five by three by one and a half inches is formed, he continued. This provides much more effective amplification than any horn which could be incorporated in the case and wastes no space when it is closed.

"The speaker itself is only the diameter of a silver dollar, but, by using better materials in the magnet itself and in the surrounding structure, higher flux density in the air gap is achieved," Dr. Olson said. "This improves the loudspeaker's efficiency by two to one."

The electrical input to the speaker of the new receiver is only one-sixth that produced in current models, but the eight-to-one gain in



loudspeaker overall efficiency enables the miniature set to provide better performance, it was pointed out.

The RCA development employs four sub-miniature tubes in its superheterodyne chassis—one radio frequency amplifier, one intermediate frequency amplifier, one combination audio amplifier and diode, and one power output tube. This is the first time these tubes—one-third the size of their predecessors—have been used in this type of receiver.

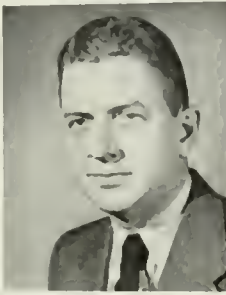
The power supply consists of two $22\frac{1}{2}$ -volt hearing aid batteries and a single $1\frac{1}{2}$ -volt flashlight cell to provide filament current.

By placing the antenna loop in the false lid of the case it is able to operate with greater efficiency than if it were in close proximity to the receiver.

[RADIO AGE 13]

Industrial Television Demonstrated

Using New Vidicon Camera Tube, the New, Simple, Compact System Extends Sight for Aid to Science, Industry and Education — Can Be Adapted for Color Pictures



By P. B. Reed

*Manager, Industrial Equipment,
RCA Engineering Products Dept.*

TELEVISION'S expansion beyond the field of entertainment has begun. Within the past few weeks, the Radio Corporation of America has presented dramatic evidence of how it can be used to extend human sight for benefits to industry, science, education, security and other non-broadcast endeavors. Behind the advance is the development by RCA Laboratories of the smallest and simplest television equipment ever devised.

This system, first revealed to the public at the 1950 Convention of the Institute of Radio Engineers in New York City, March 6 to 9, was demonstrated the following week for the New York City Department of Correction to show its effectiveness in prison security.

The demonstration, presented in the City Prison of Manhattan, revealed the usefulness of RCA's experimental industrial television system for observing prisoners during relaxation and exercise periods, as well as at work.

For the demonstration, RCA utilized three television camera chains operating in a closed circuit with monitors in the warden's office. One of the monitors was connected to a camera covering the fourth floor tier of prison cells and showed the guard patrolling the catwalk

while prisoners took their morning relaxation and exercise.

Another camera chain, linked to the prison laundry, picked up prisoners at work with machines and clothing. The demonstration ended with the camera on the fourth floor monitoring prisoners as they returned to their cells.

Development of the system involved two separate phases. First came the design of the remarkably small and sensitive pickup tube known as the Vidicon. The second phase involved the engineering and designing of the camera and monitor-control unit. All of this work was under the direction of Dr. V. K. Zworykin, Vice President and Technical Consultant of RCA Laboratories. Details were described in technical papers presented at the I.R.E. Convention by Dr. Paul K. Weimer and Richard C. Webb of the Laboratories staff. Stanley V. Forgue and Robert R. Goodrich assisted Dr. Weimer in developing the Vidicon, and J. M. Morgan aided Mr. Webb in the development of the over-all system.

Future Uses of System

Future possibilities of industrial television include the monitoring of operations from a distance, especially where nearness would mean danger; the enabling of many per-

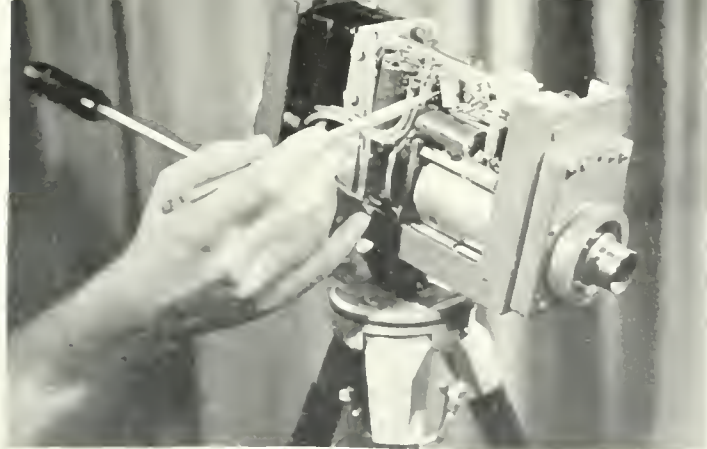
sons to view a given procedure or activity, and the supervising or coordinating of a number of operations from a central position.

Installation of the equipment in prisons, banks, and other restricted areas could prevent episodes such as the recent robbery of the Brink vaults in Boston. By television, it is possible to monitor all personnel and visitors and literally see a thief in the act. Furthermore, the equipment would be valuable for identification and verification purposes. It could scrutinize passes, security papers, and similar documents from a remote point. A number of restricted areas could be guarded by a single officer stationed at guard headquarters or some other central point.

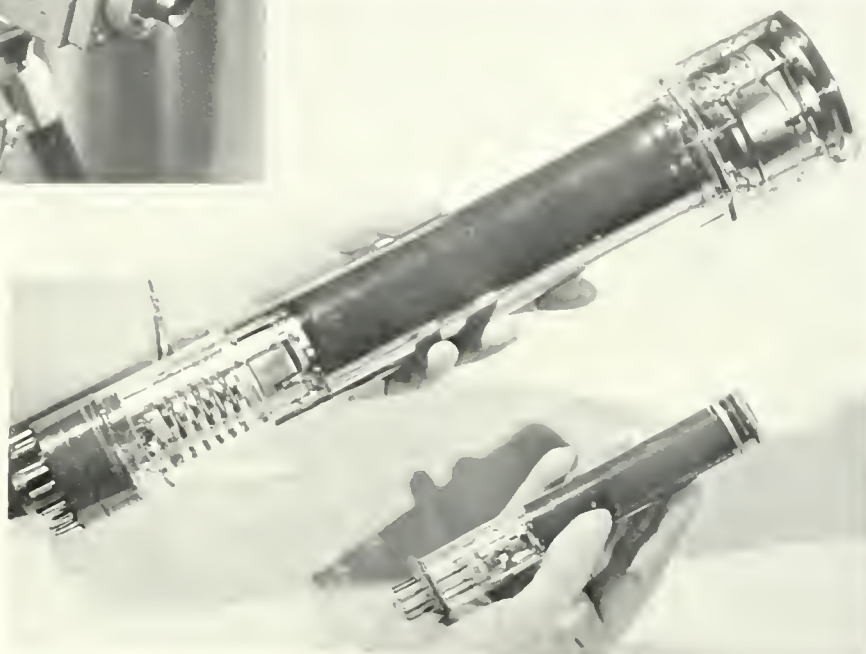
The closed circuit television system is also expected to become a powerful instrument in education, bringing great teachers into the presence of hundreds or thousands of students simultaneously. Medical students, for example, need no longer be relegated to distant seats in the amphitheatre. Instead, through the new medium, they may be brought directly to the operating table. In colleges, close-up views of experiments, demonstrations, and microscopic studies may be enlarged and projected instantaneously for convenience in teaching large

SMALLER TELEVISION CAMERAS, IDEAL FOR INDUSTRIAL AND EDUCATIONAL USES, ARE MADE POSSIBLE BY A DIMINUTIVE PICKUP TUBE CALLED THE VIDICON.





LEFT: INTERIOR OF SMALL CAMERA SHOWING THE VIDICON TUBE AT THE LOWER RIGHT CORNER OF THE CASE. BELOW: A COMPARISON OF THE RELATIVE SIZES OF THE STANDARD IMAGE ORTHICON CAMERA TUBE AND THE NEWLY DEVELOPED VIDICON.



groups of students. The armed forces are experimenting with a television hook-up between classrooms to make more effective use of topnotch instructors for mass training of personnel.

The new RCA television chain may become the expendable eye that can watch dangerous industrial and scientific processes where it would be unsafe for a human observer. The progress of multiple, long-time tests at different places may conveniently be followed from one central point. Phenomena associated with nuclear reactions can now be observed from a safe position. Diverse operations may be studied directly in a central office. Enlargement of subjects on the television screen also reduces eye fatigue and promotes greater efficiency.

Will Facilitate Inspection

For inspecting the underside of industrial products and materials, and for exploring the interior of products such as cylinders, cannon bores, and tanks, the camera will have numerous applications. It will also facilitate inspection of the insides of oil well casings, factory chimneys, grain elevators, and many other relatively inaccessible industrial areas.

Possibilities of industrial television also include such applications as comparison of the television image with a standard, either optically or electrically, for purposes of product inspection, registration of materials with respect to each other, or location of objects on some pattern such as a map. Since visual details can be represented by wave shapes, television could pro-

vide signals that would motivate automatic controls or indicators.

Still photography may be employed to make permanent records from the screen of the monitor, while motion picture photography may be used to record high-speed data for later examination or study. The ability of television to detect infrared and ultraviolet radiations, associated with some industrial and scientific processes but invisible to the human eye, offers still further possibilities for future applications.

These various services eventually will be available in color, as well as in black and white. While surveys have indicated that black-and-white coverage will meet the requirements of most industrial users, engineers at the RCA Laboratories now are working on color equipment to fill needs that may arise.

The Vidicon tube, which measures only one inch in diameter and six inches in length, represents a departure in pickup tube design, in that it operates on the principle of

photoconductivity, while the image orthicon and other current pickup tubes in general use employ photoemissive cells. Ordinary 16mm motion picture lenses, which are comparatively reasonable in cost, work satisfactorily with the one-inch Vidicon.

The system is capable of transmitting a signal 500 feet over a coaxial cable closed circuit, giving it enormous flexibility for a wide range of industrial applications. It has a scanning frequency of 525 lines, 60 frames interlaced, and is almost compatible with standard television broadcasting techniques. Home television receivers can be adapted for use as monitors by the addition of a single tube, with accompanying resistors and capacitors, at a very modest cost.

The master control unit of the system is 24 inches long, 15 inches high, and 8½ inches wide, and weighs 58 pounds. It contains a regulated power supply, small synchronizing signal generator, a video amplifier strip, and all the scanning

(Continued on page 30)

NBC's Saturday Night Revue

YOUR SHOW OF SHOWS
FROM NEW YORK

JACK CARTER SHOW
FROM CHICAGO



Jack Carter, emcee, handles the Chicago portion of the Revue from 8.0 to 9.00 p.m. EST.



Comedion Sid Caesar and supporting cast in one of the many acts that comprise a performance of NBC's 150-minute television variety shows on Saturday nights, from 8:00 to 10:30 EST.



Marguerite Piazza, who has been featured often as an operatic soprano on the Saturday TV show.



Imogene Coca has been featured regularly in vocal satires and, with others, in comedy routines.



Bill Hayes, baritone, and the team of Nell Fisher and Jerry Ross, interpret dance novelties for the television audience.



Robert Merrill, RCA Victor recording star, has appeared on the Revue in operatic scenes.



Burgess Meredith, stage and screen star, acted as guest emcee from New York on the first two shows.



Gertrude Lawrence, noted stage actress, was featured in one of the high spots of the opening program.



Marguerite Piazza, operatic soprano, and a member of the Revue's dancing company in a ballet number.



Screen star Don Ameche, songstress Dorothy Claire and master-of-ceremonies Jack Carter in a comedy skit.



Mischa Elman, distinguished violinist, made his television debut on one of the early NBC variety programs.



Anita Alvarez, dancer, joins with Robert Merrill, tenor, in a modernized scene from "Carmen."



Comedienne Imogene Coca and Choreographer James Starbuck in a comedy skit based on the romantic fairy tale of "Cinderella."



The three Hamilton Dancers present "The Story of Dangerous Dan McGrew" as an innovation in modern ballet.



IN THE EARLY DAYS, MUSICIANS HAD TO SIT ON CROWDED TIERED BENCHES SO THAT ALL INSTRUMENTS WOULD BE IN RANGE OF THE RECORDING HORN.

THE FIRST TALKING MACHINE TO FEATURE A CONCEALED HORN WAS PRODUCED BY VICTOR TALKING MACHINE COMPANY IN 1906.

The Phonograph Comes of Age

Seventy-two years of Progress in Music Reproduction have Resulted in the Introduction of the 45-rpm System with its High-Quality Discs and Fast, Automatic Record Changer

By curious coincidence the nursery rhyme "Mary Had a Little Lamb" has been the Alpha and Omega in the evolution of the phonograph. For it was a verse to this tune which Thomas Alva Edison recited into the funnel-shaped opening of a strange-looking contraption one summer day in 1877, and seventy-two years later RCA Victor included the same melody in the first selections recorded for the introduction of its new 45-rpm system of high quality records and fast automatic reproducing instrument.

In the more than three-score-and-ten years that have elapsed since the Wizard of Menlo Park succeeded in making a machine "talk," the phonograph has passed through many evolutionary stages. Each advance was a notable one yet none has done more to further the enjoyment of the world's best music than the remarkable new combination of 15-rpm records and the fast automatic record changer introduced by RCA in 1949. But to appreciate to the fullest extent the impact of this newcomer on the field of home entertainment, a review of the history of recorded music is desirable.

Basically, Edison's original model of the "talking machine" consisted of a brass cylinder wrapped with a

sleeve of tinfoil. Mounted on each side of the cylinder were two instruments, the sound recorder and reproducer. Similar in construction, each contained a mica diaphragm connected to a short chisel-like stylus or needle. Vocal sounds introduced into the recorder caused the diaphragm to vibrate. This, in turn, forced the needle to make indentations on the tinfoil as the cylinder was rotated by a hand crank. Then by inserting the needle of the reproducer at the beginning of the grooved record and again turning the cylinder, the indentations in the tinfoil caused the stylus and diaphragm to vibrate, thus reproducing the sound.

Early Machine Only a Novelty

For a brief period, the economic value of the crude phonograph lay solely in its exhibition qualities. Many skeptics went so far as to dismiss the instrument as merely a feat of clever ventriloquism, but its inventor was not discouraged. Edison made larger and more refined models which he displayed before President Hayes, members of Congress and in cities throughout the country. However, when the coming of the electric light impelled the inventor to shift his



major efforts to this new field, others soon arrived on the scene to continue along the lines he had started.

Early in the 1880's, the Volta Laboratory, headed by Dr. Alexander Graham Bell, developed a wax cylinder on which sound grooves could be cut spirally. A reproducing machine, which Bell dubbed the graphophone, was used to play the records. Spurred by the accomplishments of his rival, Edison resumed his work in this field and devised a similar wax cylinder record as well as an instrument for reproducing the sound.

In making the recordings, both Edison and Volta adopted the "hill and dale" method, whereby the variations in sound were translated into elevations and depressions in the bottom of the record groove. Although the reproduction quality

[18 RADIO AGE]

and articulation were adequate, the volume was so low that listeners were required to use ear tubes. In appearance these early talking machines closely resembled a dictating machine and despite their acoustical deficiencies, were used as such in business offices for a limited period during the nineties.

Following close in Edison's footsteps was Emile Berliner, who patented the "gramophone" in 1887. The Berliner machine used a cylinder coated with lampblack. However, the German-born inventor's greatest contribution to the advancement of the phonograph came a short time later, while trying to solve the recording problem from a new approach.

Berliner's system featured a flat disc record with a groove that not only vibrated the stylus of the phonograph to reproduce sound but also piloted the sound box and the horn across the record. Opposing the hill-and-dale method, his record vibrated the stylus laterally by means of modulations in the side walls of the groove. Although the reproduction quality of this record was inferior to that obtained by his rivals, the volume was loud enough to eliminate the need for ear tubes. A manufacturing technique also was developed by Berliner for producing duplicate copies from a master record.

Well aware that his phonograph needed the touch of a mechanical expert, Berliner in August 1896 took his instrument to the Camden, N. J., shop of Eldridge R. Johnson, a recognized genius of machines. As a result of Johnson's success in eliminating defects in this model,

he was given a contract to produce instruments for the Berliner Gramophone Company. At the same time, Johnson continued with his own experiments and devised a spring motor with a governor which would insure a constant turntable speed. Johnson also developed a new disc type record, superior to any then on the market.

For the next few years, the flat disc record competed with the wax cylinder. When Berliner was forced out of business by his competitors, Johnson bought up many of the company's patents to supplement his own and in 1901 formed the Victor Talking Machine Company.

Critics Finally Convinced

Prior to the establishment of the Victor Company, the phonograph had not yet emerged from the toy or novelty class. One of its most common uses was as a nickelodeon in hotel lobbies, barrooms and railroad stations. But through Johnson's persistent efforts, the talking machine gradually won over its critics and gained recognition as an instrument for home entertainment.

It was about the same time that Johnson made another of his master moves. He succeeded in signing Caruso to record for Victor in this country. The great tenor's action encouraged other artists who theretofore had been reluctant to risk their reputations on the "new-fangled contraption." Victor's first catalog of Red Seal records, issued in 1901, created the impetus that aided the phonograph in becoming a dignified instrument for musical appreciation.

In those years, talking machines were sold in bicycle shops, hardware stores and sewing machines shops. Johnson, familiar with the tricks of merchandising, convinced the Lyon & Healy Company of Chicago, then the largest musical house in the world, to handle his company's phonographs and records. Opening of such important sales outlets for Victor products doomed to obsolescence the old cylinder records still being produced by Johnson's competitors.

To obtain better reproduction, larger horns came into use. However, because they finally became too heavy to rest on the record without damaging the grooves, the horn was attached to the cabinet, an arrangement that continued for only a short time. With the introduction of the Victrola phonograph in 1906, the era of the phonograph with the external horn was brought to a close. To improve the acoustical quality and appearance of the phonograph, the horn of this model was housed within the cabinet.

All recording and reproducing during the early days of the talking machine were accomplished by acoustical methods. Artists spoke or sang into a large recording horn which caused a vibrating diaphragm to actuate the recording stylus. Disadvantages of this method were numerous. For one thing, it was necessary to seat the members of a full-sized orchestra on tiered benches to bring all instruments within the limited range of the recording horn. Instruments themselves sometimes presented problems. Veterans recollect that

(Continued on page 32)

THE BERLINER GRAMAPHONE, PATENTED IN 1887, FEATURED A FLAT DISC AND A HORN, IN CONTRAST TO THE CYLINDRICAL RECORDS THEN IN COMMON USE.

THOMAS ALVA EDISON, INVENTOR OF THE "TALKING MACHINE" IS SHOWN HERE EXAMINING THE WAX CYLINDRICAL RECORD OF HIS 1907 MODEL PHONOGRAPH.



New Transmitting Tube is Powerhouse of Energy

AFTER several years of development, a transmitting power tube, believed to be the most powerful ever produced, with a continuous output of 500,000 watts and a tested input of twice that wattage, has been announced by the RCA Tube Department. Despite its enormous power input capabilities—at least four times that of any previous RCA tube—the new product, called a “super-power beam triode” is unusually compact, measuring less than 39 inches in length and weighing only 135 pounds.


Immediate applications of this super-tube are in high-power continuous wave applications and international broadcast service. In addition, the tube is expected to open the way to new developments in the high-power field hitherto considered economically unfeasible or impractical because of the banks of tubes and size of associated equipment required.

The tube can be operated with maximum ratings at frequencies throughout the “Standard Broadcast Band” and much higher. Limitations of the tube for operation at higher frequencies and at higher power have not yet been determined.

Radically new features have resulted in a structure unique in electron-tube design. The “electron heart” of the tube is an array of 48 independent unit electron-optical systems arranged cylindrically in the tube. The great power capabilities of the new tube are due largely to the successful achievement of this design, which, in effect, concentrates 48 triodes in relatively small space.

In detail, each of the independent electron-optical systems consists of a filament in a slot in the beam-forming cylinder, grid rods, and the copper anode. Electrons leaving the emitting surface of the filament are beamed between two grid rods to the anode by the focusing action of the beam-forming cylinder.

The mechanical structure embodied in the electron-optical system permits close spacing and accurate alignment of the electrodes to a degree unusual in high-power tubes.



super
power
beam
triode

DR. L. P. GARNER OF THE LANCASTER, PA., PLANT EXAMINES ONE OF THE REMARKABLE 500-KILOWATT TUBES WHICH HE AND HIS ASSOCIATES DEVELOPED.

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BRAZIL'S FIRST TELEVISION STATION WILL BE LOCATED ATOP THE STATE BANK BUILDING, HIGHEST EDIFICE IN SÃO PAULO.

Brazil to Have Television

Most Modern Equipment for Studio, Transmitter and Remote Pickups to be Ready for Use this Summer at Sao Paulo

BRAZIL'S largest radio network — Emissoras Associadas — is proceeding with its plans to introduce television in the fast-growing business center of São Paulo. Equipment for the project is being supplied by the Radio Corporation of America. The station is expected to be on the air this summer.

Arrangements for the installation of the television transmitter, as well as associated studio and mobile pickup equipment, were begun in 1948 and concluded during a recent visit to the United States by Dr. Assis Chateaubriand, Director General of the Brazilian network, according to Meade Brunet, a Vice President of RCA and Managing Director of the RCA International Division. The transmitter and antenna will be located atop the State Bank Building, highest structure in São Paulo.

"The installation," added Mr. Brunet, "will include what is known as a three-bay super-turnstile antenna, erected 520 feet above street level and capable of radiating 20 kilowatts of power. New studios

are under construction in Sumare, a São Paulo suburb. Since the city utilizes a 60-cycle power supply, it will be possible to adopt the U. S. television standard of 525 lines and 60 fields. The station will operate on 60-66 megacycles, equivalent of channel 3 in this country.

Provisions are being made for the use of RCA microwave transmitting equipment between the studio, out-

door mobile pickup units and the main transmitter.

The contract providing for the installation was arranged through RCA Victor Radio, S. A., the Brazilian associated company of RCA.

Mr. Brunet also revealed that since 1946 the Brazilian network has purchased from RCA 11 radio broadcasting transmitters, which have been erected in that country's principal cities. He said the network this year has purchased two 50-kw transmitters for installation at the strategic ports of Bahia and Porto Alegre. At the same time, a 10-kw transmitter was acquired for installation at Recife.

New Color TV Tube

(Continued from page 5)

word 'impossible' has no place in our vocabulary."

"Now, having demonstrated the practicability of the color kinescope," concluded Dr. Engstrom, "our objective is to continue its development aggressively. We are confident that we shall achieve steady improvement and refinement in design and performance for we know from experience in radio and television that the science of electronics offers unlimited opportunity for continued progress. We have lifted the opening curtain on color television, and it will be our purpose to have color tubes ready for commercial production at the earliest possible date, so that the show can go on in color—as well as in black-and-white—for the pleasure of the public."

FRANK M. FOLSOM (RIGHT), PRESIDENT OF THE RADIO CORPORATION OF AMERICA, PRESENTS THE NOTED CONDUCTOR-PIANIST JOSE ITURBI WITH A GOLD-PLATED 45-RPM RECORD OF CHOPIN'S "POLONAISE", COMMEMORATING THE MILLIONTH PRESSING OF THE RECORDING MADE BY ITURBI.



Empire State Tower to Undergo Antenna Change for Better Television Service

Present Array — the Sixth in Video History — to be Replaced by 199-Foot Column which will Support Antennas of Five Television Stations

THE pinnacle of the Empire State Building, now 1250 feet above New York's streets, soon will lift its already lofty head 199 feet farther into the clouds. The move is to be made to improve the video program service provided by television broadcasters in the metropolitan area. The National Broadcasting Company, which, since 1931, has been beaming TV signals from its perch atop the world's tallest skyscraper, recently signed an agreement with Empire State, Inc., owners of the structure, whereby it will share this exceptional location with the American Broadcasting Company, Inc. (WJZ-TV), Columbia Broadcasting System, Inc. (WCBS-TV), Allen B. DuMont Laboratories Inc. (WABD), and WPIX Incorporated. Plans are under way for construction of a tower high enough to support individual antennas for the building's new television tenants.

Centralization of TV transmitters at the Empire State Building—highest point from which television broadcasts are made on the Atlantic Seaboard—will make it possible for the antennas of most

local video receivers to be oriented to this single location. It is expected that signals of some of the newcomers not only will travel beyond their present limit of service, but will provide better images generally. The new arrangement should be especially helpful to viewers in Manhattan's more congested sections where reception now is often marred by "ghosts" and other distortions due to the location of transmitters.

Present Mast to be Dismantled

In order to make room for the new installation, the present 61-foot, 4½-ton mast will be dismantled. However, NBC's scheduled transmissions will not be affected during the change. Temporary antennas at the sides of the building will be used until the replacement is completed. At that time, WNBT will have priority for top position on the television totem pole.

Veteran engineers at WNBT regard erection of a new television antenna, with its temporary inconveniences, as a somewhat commonplace occurrence. Since NBC's pioneer station, W2XBS, took up

its abode atop the skyscraper, nineteen years ago, six different antennas have been constructed to meet the needs of the new industry. These technicians have watched television progress from mechanical systems producing peep-hole size pictures to all-electronic equipment capable of reproducing theatre-size images.

A few Company pioneers can remember the infant days, back in 1927, when RCA began work on television at its Van Cortlandt Park laboratory in New York. When the first permanent TV broadcasting license was issued for W2XBS in December, 1928, the station's equipment included a circular aluminum scanning disc with 48 holes located in a spiral near its outer edge, capable of scanning 15 complete pictures per second, feeding a transmitter of a few hundred watts output.

Later, this pioneer experimental station was moved to the RCA Photophone Building at 411 Fifth Avenue with virtually the same operating equipment, except for a 60-line rotating disc which scanned 20 pictures per second. Experiments con-

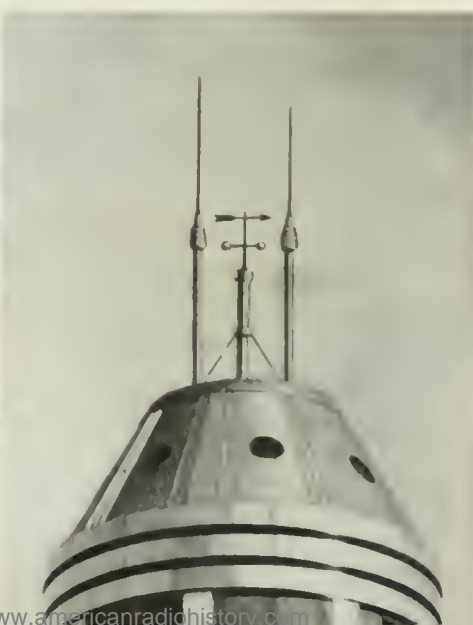
1931—THIS "DIAMOND" ANTENNA WAS INSTALLED ON THE 105TH FLOOR PARAPET OF THE EMPIRE STATE BUILDING.

1931—FIRST PERMANENT TELEVISION ANTENNAS WERE ERECTED ON TWELVE-FOOT POLES ON THE SKYSCRAPER TOWER.

1936—AN ARRANGEMENT OF POLES AND RODS SUPPORTED THE THREE TRIANGULAR ANTENNAS OF THE SECOND STRUCTURE TO BE BUILT.



[22 RADIO AGE]



ducted from this location included a demonstration of theatre-size television pictures at RKO's 58th Street Theatre.

In June, 1930, W2XBS was moved again, this time to NBC's Times Square Studio in the New Amsterdam Theatre Building. A month later NBC took over management of the RCA station, and both companies intensified their research and broadcasting experiments. A new one-kilowatt crystal-controlled transmitter replaced the original model, and late in the year an 80-line mechanical scanning system was demonstrated.

Although W2XBS was operated primarily for experiments, a definite broadcasting schedule was maintained, consisting mainly of posters, photographs and moving objects, such as Felix the Cat and Mickey Mouse revolving on a phonograph turntable.

Among the tests made by RCA-NBC in a survey of TV transmitting locations were those conducted from the roof of the General Electric building in the summer of 1931. As a result of its findings, NBC selected the Empire State Building—the highest, most difficult and most expensive location in the world—as its permanent transmitting site. By November of that year, equipment was installed which would transmit 120-line pictures scanned mechanically at 24 frames per second on a frequency of 50-56 megacycles.

The original Empire State an-



ENGINEERS ERECT THE FIRST TV ANTENNA ON THE EMPIRE STATE BUILDING, 1250 FEET ABOVE THE STREET.

tenna was mounted on two 12-foot poles. This simple construction was used by RCA-NBC for the first ultra-high-frequency television tests ever made in the world. In 1933, station W2XBS transmitted signals between New York City and Camden, N. J., comprising the first radio relay of any length in the world, the predecessor of present-day radio relay systems.

In those days, television was "just around the corner" but as it turned out, the new art still had a long way to go. During succeeding

years television research was intensified; the iconoscope, television's electronic "eye", was perfected; the all-electronic experimental system transmitting pictures based on 240 scanning lines at 24 frames per second was followed by 313 lines at 30 frames per second. To accommodate each of these improvements, it was necessary to modify transmitting equipment and receivers.

NBC began frequency modulation experiments from the Empire State station in March, 1934, and

38—THE THIRD MAST STOOD 35-
ET HIGH WITH RING-SHAPED DI-
ES AS UPPER ELEMENTS AND A
VIDEO TURNSTILE BELOW.

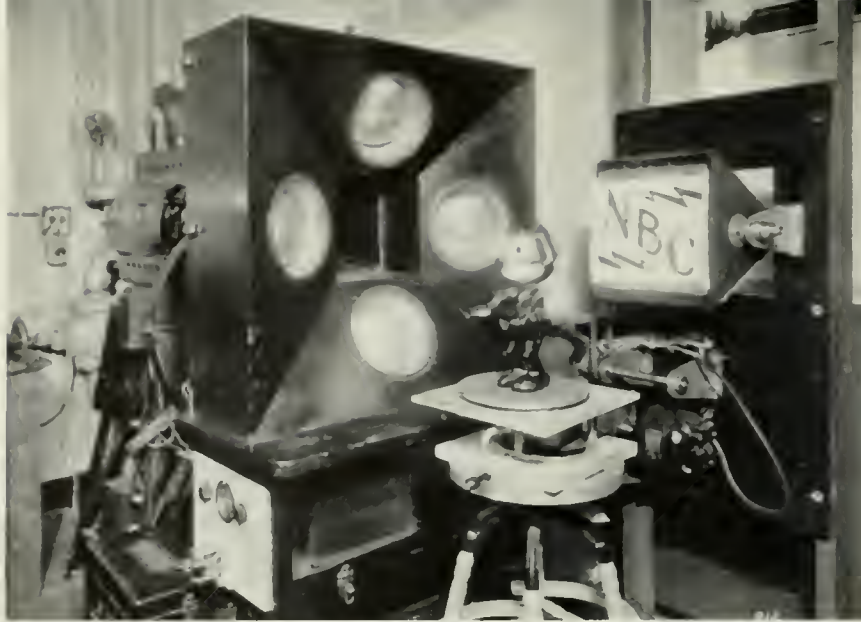


1939—THE RADIATOR PICTURED BE-
LOW WAS ONE OF THE UHF UNITS
ADDED TO THE MAIN ANTENNA
STRUCTURE FOR EXPERIMENTAL USE.



1946—THE PRESENT 61-FOOT SUPER-
TURNSTILE ANTENNA WAS ERECTED
WHEN NBC COMMENCED TELEVISION
TRANSMISSIONS ON CHANNEL 4.





A PLASTIC "FELIX THE CAT" WAS THE PRINCIPAL "PERFORMER" IN NBC'S EARLY EXPERIMENTAL TELEVISION TRANSMISSIONS FROM ITS TIMES SQUARE STUDIO.

continued the tests until space was needed for a much-extended video program.

When, in 1936, the Radio Manufacturers Association set television scanning standards at 441 lines, 30 frames per second, the Empire State video equipment again was modified to meet the new requirements. This time a triangular antenna, 37½ feet high, was erected. In the two years that this second structure was in service, television's progress was highlighted by coaxial cable transmissions, successful outdoor pickups, and improved 10-inch picture tubes.

To make further field tests in the New York metropolitan area, and to study problems involved in taking TV to higher frequencies, NBC in 1938, replaced its triangular antenna with a third installation. The new signal radiator consisted of a single mast 35 feet high carrying a ring-shaped arrangement of dipoles at the top for sound broadcasts and a video turnstile at the bottom. This antenna was capable of handling any one of six television channels in the low-frequency region.

One of the most significant dates in television history is April 30, 1939, when RCA-NBC started regular commercial TV program service, coincident with the opening of the World's Fair. Late that same year an additional transmitter was

installed at the Empire State Station to service NBC's FM station, W2XWG, which began regularly scheduled transmissions in January, 1940.

A year later the Federal Communications Commission set up definite television standards, calling for 525-line pictures at 30 frames per second. At this point the pattern of the future was taking form. On July 1, 1941, NBC received a license for full commercialization of its Empire State video station and call letters were changed to WNBT.

World War II interrupted television's progress as all research, manufacturing and broadcasting facilities were concentrated on national defense.

Industry Resumed in 1945

When hostilities came to an end in 1945 the struggling young industry resumed activities with unbelievable speed. The image orthicon camera tube, developed at RCA Laboratories, reduced lighting requirements both indoors and out; Eye-Witness Synchronization locked receivers in tune with the transmitting station; mechanical and later all-electronic color television were demonstrated; receivers began to roll off production lines, and transmitting and studio equipment was put on sale by RCA Victor.

Necessary alterations caused WNBT's first shut-down in the spring of 1946. The FCC had re-allocated television channels and WNBT was assigned to the 66-72 megacycle band in place of the 44-50 mc band which it had occupied previously. Four modern transmitters—including one each for sight and sound, one for frequency modulation and one for uhf experimental broadcasts—were installed during the interval, and a 61-foot superturnstile television antenna took its place on the building tower. After two months of silence on the air, WNBT was able to commence full-scale operations on its new Channel 4. In 1948, when completely new 5-kilowatt equipment was installed, the existing transmitters were retained as auxiliary units.

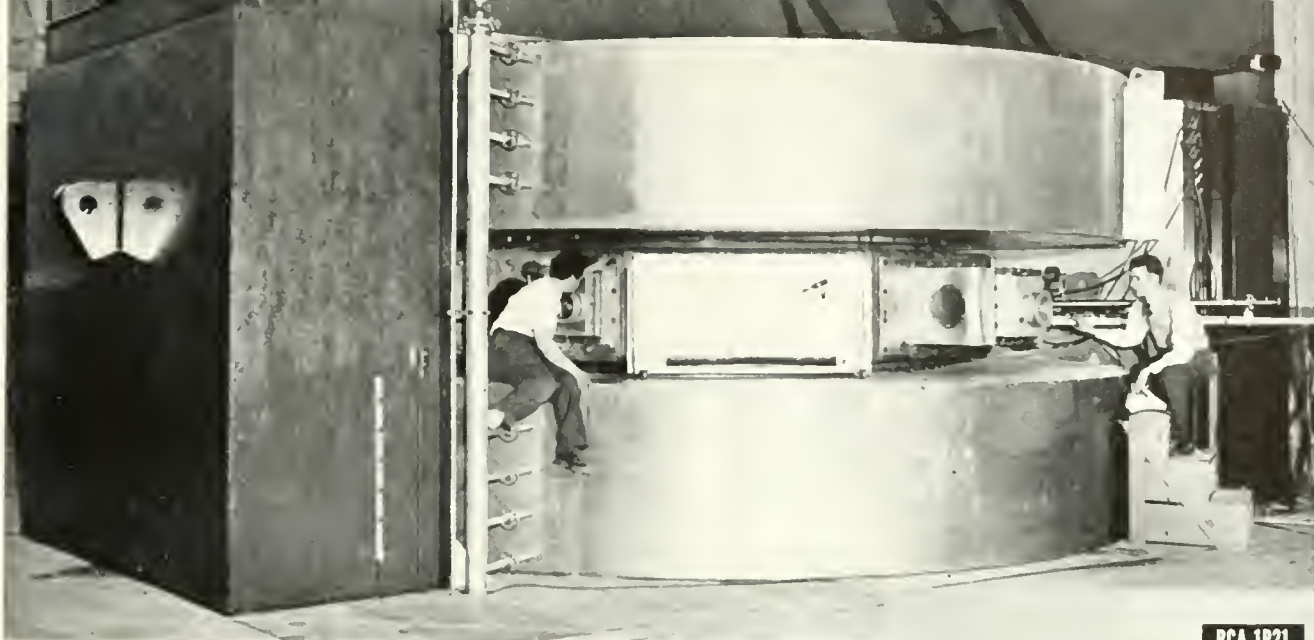
Because the new TV tower will lift New York's skyline into a higher altitude than ever before, aircraft traffic regulations will have to be altered accordingly. But far more significant than the incidental changes involved in the erection of the new mast is the better and more dependable program service which the multi-antenna facilities will make available to televiewers in metropolitan communities.

NBC UHF TV Station

(Continued from page 12)

more about the paths of signals reaching the receiving antenna from more than one direction. Further tests are desired to show how the strength of TV signals varies at different times of the day and season. But what is perhaps as important as any detail is exact information about the ultimate distances over which uhf television signals travel. Knowledge of the latter will have a direct bearing on the distances which must separate stations if they are to operate without interference on the same channel and on adjacent channels.

The Bridgeport project was initiated by Dr. C. B. Jolliffe, Executive Vice President in charge of RCA Laboratories. The NBC work is under the supervision of O. B. Hanson, NBC Vice President and Chief Engineer.



THE 130-INCH CYCLOTRON INSTALLED AT THE UNIVERSITY OF ROCHESTER USES THE ULTRA-SENSITIVE RCA MULTIPLIER PHOTOTUBE (RIGHT) TO MEASURE THE RADIATIONS PRODUCED WITHIN THE HUGE DEVICE.

Phototube Aids Atomic Research

Improved Tube with Built-in Electron Multiplier Provides Ultra-sensitive "Eye" in the Study of Radioactive Particles

IMPORTANT advances in nuclear research, astronomy, photoelectric spectrometry, and other fields involving work with light at extremely low levels are foreseen with the announcement of a greatly improved multiplier phototube by the RCA Tube Department.

Multiplier phototubes are extraordinary photoelectric "eyes" capable of picking up the feeblest illumination, converting it into electrical current, and "multiplying" or amplifying the current as much as several million times.

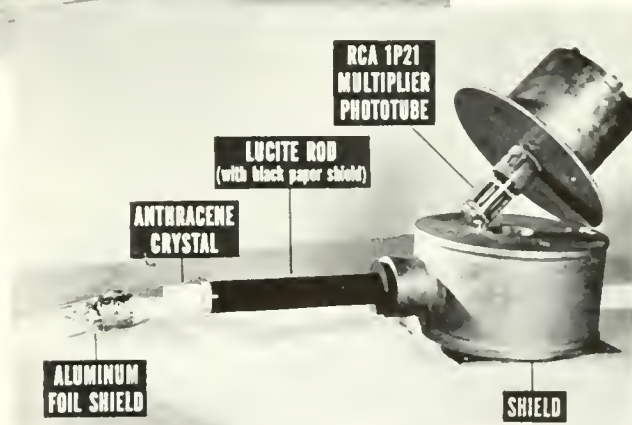
The new tube, labelled the 1P21, already established as outstanding in its field, has been made more useful as the result of a development program carried out at the Company's plant in Lancaster, Pa. One of the notable improvements embodied in the 1P21 is the six-fold reduction in operational "noise." This saving permits a corresponding reduction in the lower limit of measurable light intensities. Similarly, this extension in range makes the tube even more valuable as an aid to astronomers studying light from distant stars, to nuclear scien-

tists studying atomic radiation, and for other laboratory research work requiring measurement of light of extremely low intensity.

One interesting application of the tube has been made at the University of Rochester where operation of the institution's 250,000,000 volt cyclotron depends in great degree on the phototube. The Rochester atom-smasher, believed to be the largest built and which has been in full operation since the war, already has produced new knowledge of high energy particles and has been the means of producing mesons for nuclear study.

Involves New Technique

Typical application of the new tube in atomic research involves the use of a "light-piping" technique to measure radiation generated by a cyclotron. To overcome the problem of introducing a test instrument into the cyclotron itself, this technique utilizes a long light-conductive rod of quartz or clear plastic with a phosphor on the end of it. Flashes of light or "scintillations", produced when radiations from



radioactive particles strike the phosphor, are conducted down the rod to the phototube, which is housed in a light-tight box outside the cyclotron. In this way, radioactivity caused by the cyclotron beam can be measured accurately and conveniently.

The 1P21 is particularly useful where light is to be picked up from a small area.

The 1P21 utilizes the phenomenon of "secondary emission" to achieve its enormous amplification. Feeble illumination striking the photocathode of the multiplier tubes releases a number of electrons. These electrons are swept electrically through a series of amplifying stages within the tube, snowballing into an avalanche as additional electrons are released at each stage. The greatly magnified electrical current which emerges provides a highly useful signal for research work.

Crystals Police the Ether

Thin Wafers of Quartz Make it Possible for All Types of Radio Stations to Operate without Chaotic Interference



SAMPLE OF NATURAL QUARTZ CRYSTAL AS MINED IN BRAZIL'S MOUNTAINS AND RIVER BEDS.

CIRCULAR SAWS EDGED WITH DIAMOND DUST SLICE THE MOTHER CRYSTALS INTO THIN WAFERS.



QUARTZ SECTIONS ARE MOUNTED ON GLASS PLATES BEFORE SAWING THE CRYSTALS TO ROUGH DIMENSIONS.



MILLIONS of people operate their radio receivers and find each station precisely on its assigned frequency. The twist of a selector switch on a television set brings in the desired picture on its correct high-frequency channel. A fog-bound ship at sea obtains its bearings accurately from distant shore stations. An air liner makes a perfect landing in zero-zero weather. Police cars converge on an escaping criminal. A business man speeding along a highway reports to his home office by radio. Scattered groups of armed forces keep in constant radio touch with their commanding officer. Photographs are transmitted to distant points by radio signals. Much of the world's business is conducted through this modern miracle of radio communication which literally fills the radio frequency spectrum with a complex multiplicity of signals.

How is it possible, then, to avoid intolerable interference which would cause a Babel of meaningless dots-and-dashes and unintelligible voices? The answer is twofold. First, Government and international regulations assign each class of communication to specific portions of the frequency spectrum, like a certain group of keys on a piano. Second, each transmitting station is accurately controlled on its particular frequency by a truly remarkable little device called a "Crystal Unit". The heart of this unit is a small quartz plate, fashioned with great precision from a single crystal of silicon dioxide. This material, in its raw form, looks much like a hexagonal prism of glass, with somewhat irregular, tapering sides which terminate in a pyramidal apex at each end.

Natural quartz crystals are found in many parts of the earth, but the largest and best quality specimens come from the high mountains of Brazil. There is much speculation as to the age of these crystals and



By E. M. Washburn

*Manager, Crystal Engineering,
Industrial Products Section,
RCA Victor Division.*

under what conditions they grew. Although they are found thousands of feet above sea level, it is believed that they must have been formed hundreds of thousands and perhaps millions of years ago, when that part of the earth was submerged deep in the ocean's bed. Modern scientists have verified Biblical references to a tremendous catastrophe which overtook this earth when it nearly or actually collided with a meteorological body, possibly the planet Mars. A terrific impact of this type could well account for the violent upheaval which must have transported large sections of the earth's crust from the bottom of the ocean to form the awe-inspiring mountain ranges as they exist today.

Possess Remarkable Property

Whatever the true history of these crystals may be, it has been discovered that they possess a remarkable property called "piezoelectricity". This term means that when they are mechanically compressed along certain directions electrical charges are formed, and conversely, when electrical voltages are applied in a given manner mechanical distortion of the crystal takes place. This property is also found in many crystals other than quartz, but none of them have all

[26 RADIO AGE]

the desirable features of hardness, durability and economy of procurement which make quartz the outstanding material for stabilized control of radio frequencies.

How can small pieces of rock be used to control radio frequencies? The answer rests in another wonderful property of quartz crystals. When the raw material has been cut into thin wafers in certain directions by means of diamond saws, and rectangular or circular quartz plates fashioned from these wafers, each such crystal has the property of offering a very high resistance to all but certain critical frequencies. These are determined by the very precise orientation of the wafer from the mother quartz and the final, exact dimensions of the small crystal which is introduced to an electronic oscillator circuit. These critical frequencies or resonant points may be shifted to any desired position by slight changes in the crystal's boundary dimensions, and at each such resonant point the resistance or impedance of the quartz plate drops to a very low value. This behavior, combined with the piezo-electric property, permits the electronic circuit to function normally. Obviously, then, the only frequency at which that circuit can be employed is the exact value as determined by the resonant frequency of the crystal unit.

Now we begin to understand how the frequency of one radio transmitter can be controlled to a high degree of precision, and confusion in the radio spectrum avoided by controlling all transmissions in a similar manner. Since this was all

made possible more than a score of years ago, how can there be any justification for continued research by some of the world's best scientists and engineers? A little further logical reasoning will provide the answer to this question.

Usable Spectrum Limited

The presently usable radio spectrum is limited largely to frequencies below a few thousand megacycles, or a few billion cycles of alternating voltage per second of time. Actually, the vast majority of all radio communication takes place at much lower frequencies. The important consideration is that there exists a practical limitation to the width of the usable radio frequency spectrum, and already the demand for channel allocations is so great that there simply is not enough room for all unless the width of each channel can be greatly reduced.

The actual width required for each channel of communication depends upon two things, first, the type of transmission employed and second, the degree of frequency stability which can be maintained. Even though a frequency of transmission may be crystal controlled, the actual frequency may wander or drift away slightly from its assigned position. Changes in temperature, vibration or aging effects cause the crystal's properties to change slightly, with a corresponding variation in the exact position of its resonant frequency. It is quite common practice to avoid drifting effects due to temperature

variations by enclosing the crystal unit in an oven which is maintained at a constant temperature. This, alone, is highly beneficial in decreasing the channel width required in the frequency spectrum. However, there are very many applications where the weight, size or power requirements of such ovens can not be tolerated. For such use, then, the only remaining possibility is to so fashion the quartz plate that its tendency to drift is greatly reduced.

RCA engineers have determined to a high degree of precision the exact angles of orientation at which the finished quartz plates must be fabricated for lowest frequency drift. X-ray measurements of atomic planes within the quartz are used to an accuracy of less than one minute of arc. The optimum orientation is not a constant angle for all frequencies, and must be varied according to well defined orientation curves, depending upon frequency and crystal boundary dimensions.

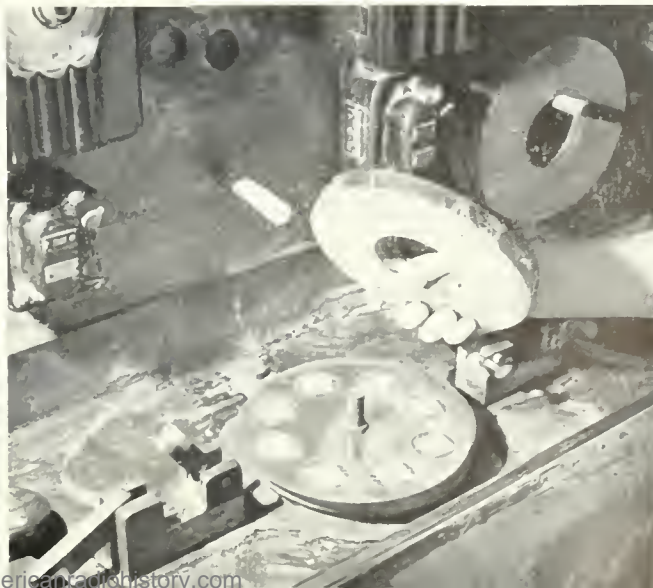
Aging of Crystals Important

A second problem confronting the crystal engineer is to develop a crystal fabrication technique which will decrease frequency drift due to aging effects. This is a far more serious problem than normally suspected. RCA research has found that aging effects alone can cause gradual frequency deviations far outside permissible limits, and this in a comparatively short period of time. RCA was one of the first to minimize the causes for this behavior by recognizing the existence

EACH CRYSTAL IS SUBJECTED TO X-RAYS TO DETERMINE THE ACCURACY OF THE SAWING PROCESS TO VERY CLOSE TOLERANCES.



GROUPS OF WAFERS ARE POCKETED IN A FLAT PLATE AND LOPPED TO EXACT DIMENSIONS BY APPLYING ABRASIVE MIXTURES.



of damaged crystal surfaces, as caused by the abrasives employed in lapping to desired crystal thickness, and removing this faulty material by dissolution in a potent chemical such as hydrofluoric acid. It was also found beneficial to submit all crystals to a high temperature baking cycle, such as an annealing process, to remove any final traces of strained areas within the quartz plate, after the etching operation. This practice, which has been employed by RCA for the past ten years, is now becoming recognized as an effective anti-aging treatment and is mandatory for many types of units.

Frequencies Rise to High Values

Usable radio frequencies extend to very high values, thousands of megacycles per second, but by far the major portion of crystal controlled frequencies lies below about 200 megacycles. Crystal units with natural resonant frequencies of this value are not yet commercially available, and unless employed in circuits specially designed to excite them at overtone or harmonic modes, the top practical frequency limit for high quality crystal units is about 20 megacycles. Obviously, then, it has been necessary to use frequency multiplier stages or special "overtone" crystals, to arrive at the desired carrier frequencies between 20 and 200 megacycles.

The early method of accomplishing this was to use a series of frequency doubling or frequency tripling stages in the transmitter design, between the crystal oscilla-

tor and final output stages. This system is still employed in many high power, fixed stations, but where space and weight are at a premium it is far more desirable to have the oscillator circuit itself operating at the carrier frequency, or as near that as may be feasible.

About 15 years ago, an RCA engineer discovered that a specially fabricated quartz plate could be excited to operate at three times its normal, fundamental value. This immediately had the effect of reducing the number of frequency multiplier stages required. Later developments showed that similar "overtone" crystals could be used reliably when operating at higher orders of odd harmonics, such as the 5th, 7th, 9th, etc. At present, there are but few practical uses of these units above the 5th overtone, but here RCA research is stepping in to show that the 7th and 9th modes also may be employed with dependability. Thus, this particular development is extending crystal oscillators to higher and yet higher frequencies.

Frequency Limit Raised

Only five years ago the top frequency for a crystal unit of the overtone type was about 20 megacycles. Today that limit has been pushed upward to 150 megacycles or even higher. The top limit has by no means yet been reached, the limitations being not the oscillator circuits nor the crystals, but rather suitable measuring equipment to test the uniformity of crystal unit performance characteristics.

The modern trend in crystal unit size and weight is to make them smaller and still smaller, and as light as possible. One factor which has contributed most to reduction in size is the deposition of the two metal electrodes directly to the major faces of the quartz plate in the form of thin metallic films of silver or gold. More than 10 years ago RCA pioneered in the fabrication of plated crystals and during World War II was the major supplier of plated, high-frequency crystal units for the armed services. The original electrode material of evaporated aluminum was changed to silver for better electrical contact. Present research is advocating the use of gold, for improved stability characteristics. Whatever material is employed, the weight per unit is far less than the former designs which used thick, separate, metal electrodes.

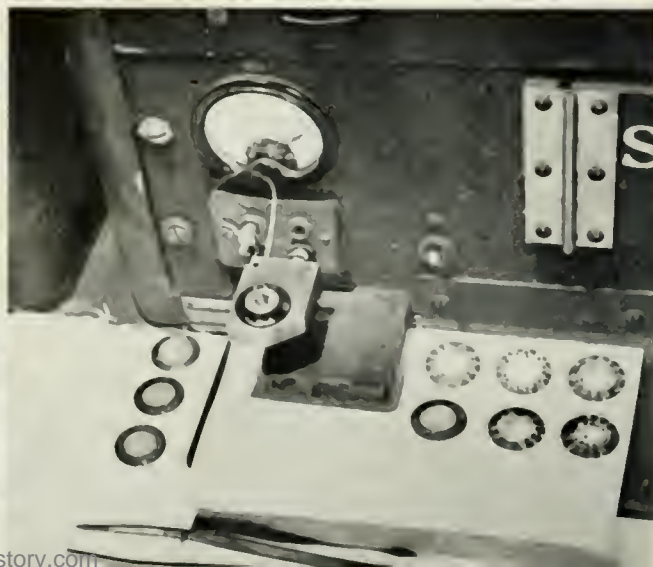
Weight Greatly Reduced

A typical modern, hermetically sealed unit with plated electrodes weighs but one-ninth of an ounce, as compared to a pre-war unit of the same frequency, weighing almost five ounces. An equally startling comparison is to note that a typical pre-war unit occupied a space of more than 2½ cubic inches, whereas the modern equivalent has a volume less than two-tenths of one cubic inch. Obviously, then, continued research has paid-off handsomely in both reduced size and decreased weight, and RCA is justly proud of its own contribution to this development.

SOME OF THE MANY TYPES OF QUARTZ CRYSTALS PRODUCED BY RCA FOR THE CONTROL OF RADIO FREQUENCIES.



INK PLACED ON VIBRATING CRYSTALS FORMS INTO PATTERNS WHICH INDICATE THE ACCURACY OF MANUFACTURE.



Famous Chimes Now "Official"

Familiar NBC Musical Station-Break Is Registered at U. S. Patent Office as First "Purely Audible" Service Mark

THE NBC chimes—famous "bing-bong-bing" notes sounded during station breaks on the network's affiliated radio and television stations from coast to coast—have received the distinction of being the first "purely audible" service mark dealt with by the U.S. Patent Office. The government department's official *Gazette*, published on January 17, 1950, contained a notice of the allowance of NBC's application to register the three chime-like notes as a "service mark" of the National Broadcasting Company.

The precise legalistic terminology of the Patent Office describes the resonant tones as a "sequence of musical chime-like notes which in the key of C sound the notes, G, E, C, the G being the one just below Middle C; the E the one just above Middle C, the C being Middle C, thereby to identify the applicant's broadcasting service."

"Service Mark" is New Term

"Service mark" is a relatively new term in the Trade Mark Division of the Patent Office. In 1946, a new federal trade mark law, sponsored by Representative Fritz Lanham of Texas, was enacted and gave recognition to trade symbols used in services as apart from trade marks applied directly to merchandise.

A "service mark" such as the NBC chimes—the first to be so officially labeled—is defined, in part, by the act as "a mark used in the sale or advertising of services to identify the services of one person and distinguished them from the services of others, and includes without limitation the marks, names, symbols, titles, designations, slogans, character names, and distinctive features of radio . . ."

The history of the NBC chimes goes back 23 years. It was in 1927 when NBC found the need for a signal—a "go-ahead" device—to put its programs on the air. Thus the



ORIGINAL NBC CHIMES WERE OPERATED MANUALLY NEAR STUDIO MICROPHONE.

three famous notes were linked into an audible mark readily identifiable by radio listeners as NBC's "signature". The NBC chimes have already been labeled as the best known sound sequence in the world.

Early days in NBC chime history were somewhat hectic, and many network old-timers recall the strange arrangements that sometimes went on the air. O. B. Hanson, Ernest La Prade and Philips Carlin each had a hand in the development of the present-day three-note signal, but not before experiments with seven-note, five-note and four-note signatures had been made.

First Chimes Sounded by Hand

Originally, the chimes were worked by hand, much like ordinary dinner-table chimes, according to La Prade, now NBC director of music research. "When we used seven notes," he said, "it seemed no two announcers ever got them in their proper order."

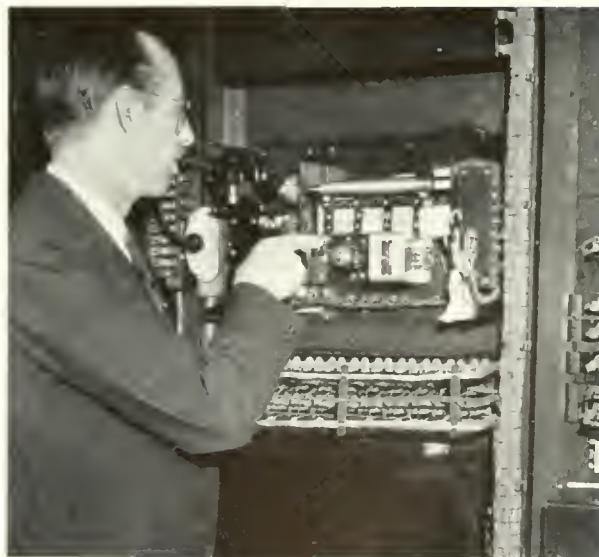
Since the adoption of the familiar "G. E. C" notes, NBC engineers developed an automatic system. Each of the three notes is composed of

eight partial notes, and the 24 partials are then tuned to perfection by an oscilloscope and standard frequency oscillator.

Hence, in today's modern radio and television studios, the chimes are put on the air by the push of a button. This trips an electrical relay in the master equipment room, setting rows of fingers on a revolving drum to plucking the eight separate metal reeds. The combined tones resulting are the three famous notes, each in perfect and automatic pitch. No microphone is used, as each of the metal reeds and a parallel strip of metal form a small condenser. The vibrations of the reed vary the capacity of the condenser, and these vibrations are amplified directly onto the NBC network circuit.

To keep NBC programs "on the nose," the chimes sound automatically at 30 seconds before the hour and 30 seconds before the half hour. They are preceded by an announcer saying "This is NBC, the National Broadcasting Company." This rule is not ironbound. An address by the President or one of his Cabinet members will not be thus interrupted, nor will various special events and programs ending with the national anthem or a prayer.

O. B. HANSON, NBC VICE PRESIDENT AND CHIEF ENGINEER, POINTS TO VIBRATING REEDS WHICH PRODUCE CHIMES AUTOMATICALLY WHEN AN ANNOUNCER PUSHES A BUTTON.



[RADIO AGE 29]

HONORS TO PERSONNEL

Scientists and Engineers of RCA Receive Recognition of Accomplishments in Electronic Field



MEDAL OF THE SWEDISH ROYAL ACADEMY OF ENGINEERING AWARDED TO DR. E. W. ENGSTROM, VICE PRESIDENT IN CHARGE OF RESEARCH OF RCA LABORATORIES. THE MEDAL ALSO WAS AWARDED TO DR. V. K. ZWORYKIN.



POTTS MEMORIAL AWARD RECEIVED BY DR. HARRY F. OLSON OF RCA LABORATORIES DIVISION FROM "AUDIO ENGINEERING" MAGAZINE FOR "OUTSTANDING ACCOMPLISHMENTS IN THE FIELD OF AUDIO ENGINEERING."



KEY OF ETA KAPPA NU ASSOCIATION WAS AWARDED TO DR. V. K. ZWORYKIN OF RCA LABORATORIES FOR HIS "TECHNICAL ATTAINMENTS AND CONTRIBUTIONS TO SOCIETY . . ."

THE 1950 MERIT AWARD OF THE AMERICAN SOCIETY OF INDUSTRIAL ENGINEERS IS RECEIVED FOR THE RCA VICTOR DIVISION BY D. F. SCHMIT, VICE PRESIDENT IN CHARGE OF ENGINEERING (CENTER) AND BENJAMIN R. CARSON, RCA DESIGNER-INVENTOR. THE AWARD WAS PRESENTED BY B. L. CHINNIAN (LEFT), NATIONAL PRESIDENT OF THE SOCIETY, FOR RCA'S DEVELOPMENT OF THE 45-RPM SYSTEM OF MUSIC REPRODUCTION.



Industrial TV Tube

(Continued from page 15)

deflection equipment for both the camera and its own 7-inch monitoring kinescope. It contains 44 tubes—about 50 per cent more than the average home television receiver and operates on 110-volt, 60-cycle power lines. The entire power consumed by the system is less than one-third of that required by an electric toaster.

The camera is 10 inches long, 3 $\frac{1}{4}$ inches wide, and 5 inches high. It has a remote focusing mount, which permits the operator to adjust optical focus by remote control from the master unit.

It is the aim of the RCA Engineering Products Department to prepare this new industrial television system for marketing, and during the next few months equipment will undergo rigid field tests.

Long-Play Record Catalog Made Available to Public

RCA Victor's inaugural catalog of 33 $\frac{1}{3}$ -rpm phonograph records, comprising 33 classical compositions specially suited for uninterrupted, long-play reproduction, was made available to the public during March. The same selections are obtainable on 45-rpm disks.

In reviewing the current status of the record situation, Paul Barkmeier, Vice President in charge of the RCA Victor Record Department said:

"RCA Victor will continue to produce the conventional 78-rpm records so long as there is a reasonable demand for them. However, public acceptance of the 45-rpm system, as reflected in constantly increasing sales of 45-rpm instruments and records, makes it inevitable that this system eventually will replace the 50-year-old 78-rpm system. Almost one million 45-rpm turntables are now in use in homes, and 45-rpm records are selling at the rate of almost 30 million a year.

"We are now releasing our initial catalog of improved 33 $\frac{1}{3}$ long play records for those music lovers who wish to hear the distinguished artists in the RCA Victor catalog in selections that are suited to long-play reproduction."

[30 RADIO AGE]

Radio System for Hospitals

Newly Introduced Equipment Provides AM and FM Program Service for Patients Confined to Beds and for Entertainment in Wards and Personnel Quarters

A NEW line of equipment designed primarily to afford entertainment and relaxation for patients in hospitals of 50 to 500 beds has been introduced by the RCA Engineering Products Department. As developed by the Sound Equipment Section of the Department, each installation consists of an FM-AM antenna, a basic four-channel central station and special hospital reproducer units.

The central station apparatus includes four radio tuners and accompanying amplifiers, control panels, wiring system, and a special time switch and clock which automatically controls the daily program schedule. No operating personnel is required.

Several methods are available for distributing both radio and re-

corded music programs to various locations in the hospital. Beds may be equipped with pillow speaker and plug selector switch assembly, allowing the patient to select his own program and enjoy the music without disturbing others in the room or ward. Individual monoset earphones provide the same individual reception for patients who are able to sit up or be out of bed.

Installation is Economical

The new system may be installed in any hospital at costs ranging from considerably less than \$5,000 for hospitals of approximately 100 beds to about \$17,000 for institutions of 500 beds.

The four-channel equipment permits selection of major network programs at any of the bedside out-



NEW HOSPITAL ENTERTAINMENT SYSTEM PROVIDES HANDY HEADPHONE OUTLETS FOR CONVALESCENTS, AND LOUD-SPEAKER DISTRIBUTION OF PROGRAMS IN RECREATION ROOMS AND PERSONNEL QUARTERS.

SAFETY OF WORKERS IN RADIOACTIVE MATERIALS IS ASSURED BY THE USE OF THIS MONITOR, DEVELOPED BY RCA. THE DEVICE INDICATES BY COLORED LAMPS THE PRESENCE AND INTENSITY OF DANGEROUS CONTAMINATIONS ON HAND AND FEET.



lets. Additional channels can be provided for local stations, wired music or recorded programs originating in the hospital. Loudspeakers may be installed to provide entertainment in recreation rooms, dining rooms, doctors' and nurses' quarters, or solariums. Flexibility of the system permits its use as a service for therapeutic treatment during convalescence and for morale building purposes.

The core of the central station equipment consists of four RCA radio tuners which provide complete AM and FM station coverage in the 535- to 1620-kilocycle AM band and 88- to 108-megacycle FM bands. The equipment operates from a 115-volt, 60-cycle, a-c power supply and has a power consumption of 1000 watts.

The new system, which in many instances may be incorporated in present hospital distribution systems, rounds out a complete line of RCA hospital sound equipment including such facilities as doctor and public area paging, intercommunication systems, television antenna distribution systems, and projection television for entertainment of convalescent groups.

[RADIO AGE 31]



THE RCA VICTOR 45-RPM AUTOMATIC RECORD PLAYER FEATURES THE FASTEST PHONOGRAPH RECORD-CHANGING MECHANISM EVER DEvised.

Phonograph History

(Continued from page 19)

the conventional violin did not record well and a special "Stroh violin", equipped with a horn, was required to direct the sound in the one desired direction.

Most of these difficulties came to an end in 1925 with the introduction of electrical recording, developed by the engineers of the Western Electric Company. Out went the bulky, inflexible recording horn and in its place came the microphone. The recording stylus was no longer actuated by sound waves but by electrical impulses from a vacuum-tube amplifier. The new system made it possible to record frequencies higher and lower than ever before etched into wax discs. A short time later, the companion piece to the microphone, the Orthophonic Victrola phonograph was introduced by the Victor Talking Machine Company. Within two weeks after Victor announced this model with its impressive life-like reproduction, orders totalling more than 20 million dollars at factory prices poured into the home office. To the public, the Orthophonic Victrola was another miracle in the field of sound.

Several important changes were made in phonographs during the

following years. The automatic record changer made its appearance on the Victrola in 1927. Needles were replaced by more efficient and durable jewel pickups. These developments and many others improved the phonograph, but engineers were not satisfied.

In 1939, ten years after the Radio Corporation of America acquired the Victor Talking Machine Company, RCA engineers began work on "Project X." The ambitious goal of this task was to break with the past, not by refining the instruments and methods, but to start again with fundamentals and incorporate the advantages of increased knowledge of electronics, recording techniques and instrument engineering. After a decade of research and development, RCA Victor announced the 45-rpm record and record player system in 1949.

The rest is history! As more and more people became acquainted with the superior quality, convenience, and economy of the "45", its public acceptance soared. Before the end of 1949, the new records were being manufactured at the rate of more than 25,000,000 annually and turntables capable of playing the "45" records were being produced at a rate in excess of 1,000,000 a year. Based on past experience, as well as on the overwhelming acceptance of "45", RCA Victor believes this will be the system preferred by the great majority of music lovers; and that eventually it will replace "78" as the standard system.

Luxury Liners to Carry Antenaplex System

When new luxury liners of the American President Lines and the American Export Lines go into service, passengers will be able for the first time to plug their portable radios into built-in antenna outlets and get clear AM and shortwave reception in cabins and staterooms. The two lines have signed contracts with RCA and the Commercial Radio-Sound Corporation for installation of the new marine RCA Antenaplex systems; each of which will feed more than 200 individual outlets from a single 25-foot whip antenna mounted above decks.

Toscanini on Tour

(Continued from page 6)

The smaller instruments rarely leave the sides of their owners. But the string basses, the harps and celli must be cared for. Two carpenters will go along for the entire tour, to crate and uncrate the instruments.

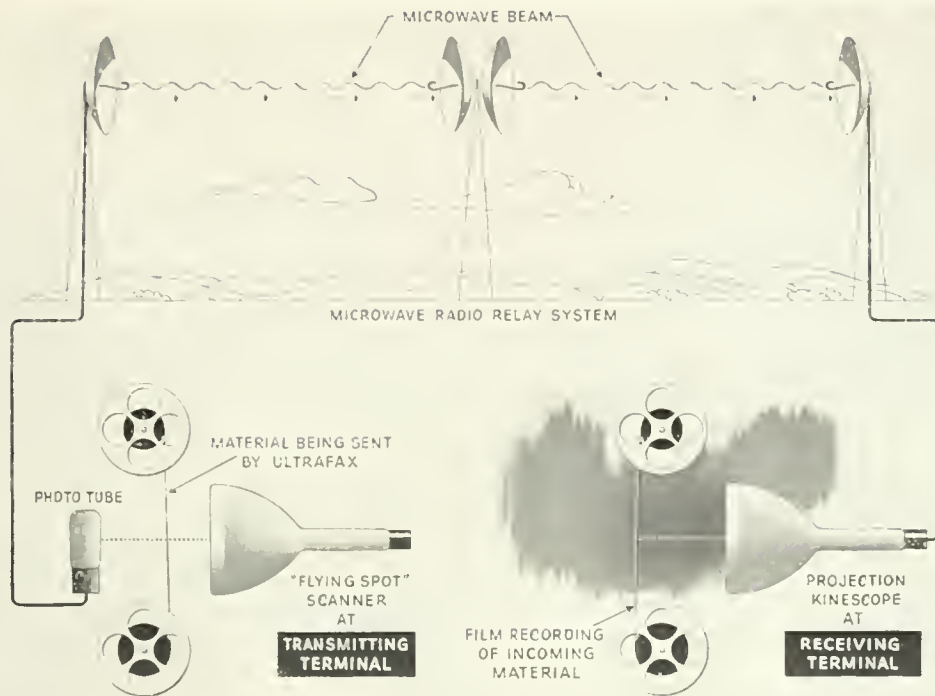
Toscanini and the orchestra will appear before audiences in their usual impeccability. Three huge wardrobe trunks, each the size of a closet, will be used to store the musicians' dress clothes, so that they will be fresh for each performance.

For the additional ease of the travelling musicians, special arrangements are being made to accommodate them at local athletic clubs, where they may exercise and refresh themselves.

Four railroads have cooperated in working this special train into their own schedules so that there would be no slip-up in the three-concert-a-week schedule of the NBC Symphony Orchestra.

Maestro Toscanini views the tour as an unparalleled opportunity to see more of this country, which he greatly loves and admires. For this reason, his private car, which is the last one in the train, has a full observation lounge to afford him an unobstructed view of the countryside.

Toscanini conducted the first NBC Symphony broadcast on Christmas night, 1937, and has been the regular conductor of the orchestra since that time. The famous maestro made a personal appearance tour in the Spring of 1940, when he and the NBC Symphony gave a series of sixteen concerts throughout South America. This will be Toscanini's first coast-to-coast tour with orchestra in the United States, although he has conducted both the NBC Symphony and other major orchestras in principal cities of the East and Mid-West. His last appearance in Carnegie Hall, April 26, 1949, established an all-time box-office for the house, a performance of Verdi's "Requiem" for the benefit of the New York Infirmary grossing more than \$50,000 for the Building Fund of the institution.



PERIODICAL DEPT.

SIMPLIFIED DIAGRAM OF A COMPLETE ULTRAFAX SYSTEM SHOWING THE PRINCIPAL ELEMENTS WHICH MAKE POSSIBLE THE MILLION-WORDS-A-MINUTE TRANSMISSION SPEED OF THE NEWLY DEVELOPED MEDIUM OF COMMUNICATION.

Ultrafax: Million Words a Minute

Sarnoff Foresees Ultrafax Opening New Era in National and International Communications—He Urges Study Looking Toward the Establishment of a New National Communications Policy

ULTRAFAX, a newly developed system of television communications capable of transmitting and receiving written or printed messages and documents at the rate of a million words a minute, was demonstrated publicly for the first time by the Radio Corporation of America at the Library of Congress, Washington, D.C., on October 21.

Brigadier General David Sarnoff, President and Chairman of the Board of RCA, declared that Ultrafax, which splits the seconds and utilizes each fraction for high-speed transmission of intelligence, is as significant a milestone in communications as was the splitting of the atom in the world of energy.

Among the possible developments which General Sarnoff foresaw were:

1. The exchange of international television programs achieved on a transoceanic basis.

2. A service of television and Ultrafax by which the same receiving set would bring various types of publications into the home, or a newspaper for that matter, without interrupting the program being viewed.

3. A system of world-wide military communications for this country, scrambled to the needs of secrecy, which with ten transmitters could carry in sixty seconds the peak load of message traffic cleared from the Pentagon Building in twenty-four hours during the height of World War II.

4. The establishment of great newspapers as national institutions, by instantaneous transmission and

reception of complete editions into every home equipped with a television set.

5. The transmission of a full-length motion picture from a single negative in the production studio simultaneously to the screens of thousands of motion picture theatres throughout the country.

6. The possibility of a new radio-mail system with the vast pickup and delivery services of the Post Office Department.

Representatives of the United States Armed Forces, Government agencies, industry and the press witnessed the introduction of this advanced communications system. RCA presented the demonstration as a "progress report" to show that the system has reached a stage of development where plans can be