BROADCAST NEWS

REG. U. S. PAT. OFF.

To Our Readers . . .

We take special pleasure and pride in presenting to you in this issue several unusual features which will no doubt be welcomed as timely and interesting.

¶ The profusely illustrated description of the new WLW, entitled "FIVE HUNDRED KILOWATTS," by Loren F. Jones, is a veritable romance of the new high-power era in broadcasting.

¶ The detailed description of "NBC AT RADIO CITY," by C. L. Beach, is also generously illustrated and will very likely prove fascinating alike to those who have and have not visited this modern Temple of Broadcasting Art.

¶ In striking contrast, this issue contains a document of rare historic and human interest in the story by George Clark, entitled "PIONEER BROADCASTING," with many quaint pictures of the humble beginning out of which has so swiftly grown the great and flourishing industry of today.

¶ It is our hope that you will find "Broadcast News" increasingly interesting and helpful.

Sincerely,

R. J. Cunningham

RCA Victor Company, Inc., Camden, N.J.

NUMBER 11 PRICE 25 CENTS MAY, 1934

RCA Victor Company, Inc.

A Radio Corporation of America Subsidiary

Camden, N. J.

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BROADCAST TRANSMITTERS — **POWER RADIOTRONS**

POLICE TRANSMITTERS — **POLICE RECEIVERS**

SPECIAL COMMUNICATION EQUIPMENT

BROADCAST NEWS

Edited by
E. JAY QUINBY

NUMBER 11 MAY, 1934

HARMONIES IN LIGHT AND SHADE

AT WESTMINSTER, LONDON . . . **RAYMOND SOOY,** WHO IS IN CHARGE OF **RCA VICTOR** SOUND RECORDING, PAUSES BEFORE THE GRAND ORGAN IN THE CENTRAL CATHEDRAL. (SEE ARTICLE ON "RECORDINGS AND TRANSCRIPTIONS" ON PAGE 34)

Published Occasionally and

RCA VICTOR COMPANY, INC.
CAMDEN, N. J., U. S. A.

Five Hundred Kilowatts

By LOREN F. JONES, in charge of Broadcast Transmitter Engineering, RCA Victor Company

MOST technical progress advances slowly—it advances in small steps. It is difficult to imagine a building ten times the height of the Empire State Building or a locomotive ten times the power of the present ones. Yet the RCA Victor Company and its associated companies, in the short space of one year, have designed, manufactured and installed a broadcast transmitter of ten times the output power of any other ever sold in this country!

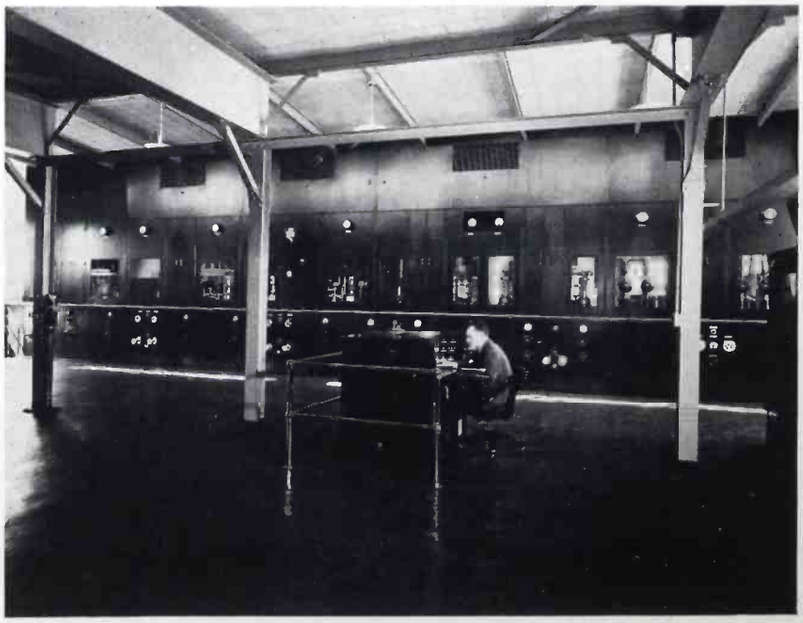
As we study the technical aspects of the history of broadcast transmission, we find that continuous trends have existed toward higher power and toward better performance from the fidelity viewpoint. The new WLW installation represents the most recent and noteworthy achievement in these trends. Along with KDKA and WGY, WLW has always pioneered in the use of higher power. It has followed a program policy designed to take advantage of the forty million or so listeners who, of necessity, are outside of the class A service area of any broadcast station. This policy has proved to be a unique success in the past. It is a policy that particularly requires and justifies the use of very high power, a fact that was wisely foreseen by Mr. Powell Crosley, Jr., and by Mr. J. A. Chambers, his technical supervisor, several years ago. It was evident that the use of 500 kilowatts would reduce apparent fading because of the action of receiver automatic volume controls, and that it would considerably increase the number of WLW listeners by making the WLW sky-wave, in most parts of the country, predominantly stronger than the sky-waves of other stations. So Messrs. Crosley and Chambers decided to install 500 kilowatts if and when suitable equipment could be made available. Their foresight and initiative in this pioneering project deserve great commendation.

LOREN F. JONES, RCA VICTOR

General Design

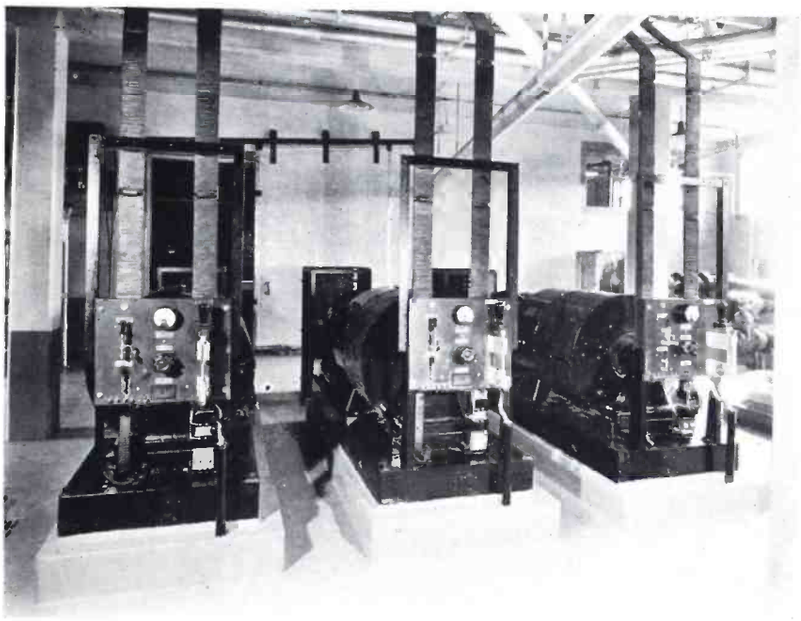
Proposed designs for a 500-kilowatt broadcast transmitter were studied by the RCA over five years ago, and a tentative design was chosen. But when the WLW proposition opened near the middle of 1932, the picture had somewhat changed, in that Class B modulation had, by that time, been developed and had been successfully applied in several RCA Transmitters. After carefully analyzing the relative advantages of Class B modulation, compared to all other types, it became apparent that the economies of Class B modulation are outstanding. Not only did the utilization of Class B modulation result in a saving of thousands of dollars in the WLW main rectifier and substation costs, it saves WLW approximately $20,000 per year on the power bill, assuming eighteen hours per day operation. There is a very appreciable saving in tube costs, too. It was already known that the performance obtainable from properly designed Class B modulation is equally as good as is obtainable by other methods. So Class B modulation was decided upon.

Next, for reasons of reliability, it was decided to divide the power amplifier into three units, each unit employing four 100-kilowatt tubes, and to divide the modulator into two units, each unit employing four 100-kilowatt tubes, and to arrange for the



MAIN PANEL 500 KW AMPLIFIER

THE MAIN PANEL OF THE 500-KW AMPLIFIER. THIS PANEL IS ABOUT 55 FEET LONG BY 13 FEET HIGH. THE THREE POWER AMPLIFIERS ARE TO THE LEFT. **MR. WHITEHOUSE** IS STANDING BY THE DOORS OF POWER AMPLIFIER NUMBER 3. THE TWO MODULATORS ARE TO THE RIGHT, AND THE MAIN RECTIFIER IS TO THE EXTREME RIGHT.



4300 AMPERE FILAMENT SUPPLY

THE THREE MOTOR GENERATORS SHOWN FURNISH 4300 AMPERES AT 33 VOLTS FOR FILAMENTS. EACH GENERATOR IS DRIVEN BY AN 85-HORSEPOWER 2,300-VOLT MOTOR. THESE MACHINES ARE AUTOMATICALLY AND COLLECTIVELY CONTROLLED FROM THE CONTROL CONSOLE.

automatic isolation of any unit in which a tube or any part becomes defective. The result is that a defect in a modulator or a power amplifier, regardless of whether this defect is merely a burned-out tube or is something more serious, causes no more than several seconds' interruption to the program. This isolation scheme is distinctly novel and is completely successful.

Control Circuit

The operation of the isolation feature of the control circuit is briefly described as follows:

If a short circuit occurs in a power amplifier unit (or modulator unit) the plate overload relay associated with the particular tube through which the overload takes place immediately causes the main breaker to open. Incidentally, the total elapsed time from the occurrence of the short-circuit to the complete interruption of the 2,300-volt primary supply and the extinguishing of the arc is *4 cycles*. After this instantaneous operation, the transmitter immediately goes back on the air. If the short circuit has, in the meantime, disappeared, operation continues in the normal manner. However, if the short circuit persists, the transmitter again shuts down. It remains shut down until the defective power amplifier unit has been completely isolated from the remainder of the circuit. The radio frequency excitation becomes disconnected, the grid bias voltage becomes disconnected, the plate voltage becomes disconnected, the radio frequency output circuit becomes disconnected and short-circuited, and the door interlock and the water interlock connections are appropriately affected. This is all accomplished by a 42-foot multi-contact switch located on the ceiling of the basement. This switch, which is *electro - hydraulically operated*, has about seventy-five contacts and is able to carry 150 amperes at 30,000 volts. After the above functions have taken place, the transmitter automatically goes back on the air with a power of about 330 kilowatts. *The entire time off the air amounts to three seconds!* A similar sequence of events takes place when a modulator unit isolates, except that in this case the equipment comes back on the air after three seconds with full power, but with somewhat reduced modulation. It is entirely possible, without any retuning or readjusting of any kind, to operate the equipment with two power amplifiers and two modulators, two power amplifiers and one modulator, one power amplifier and one modulator, three power amplifiers and one modulator, or three power amplifiers and two modulators.

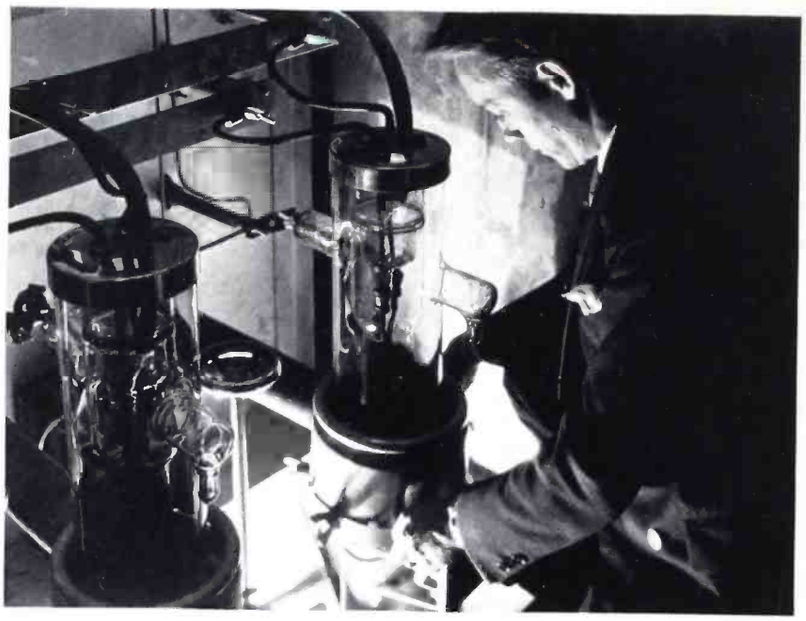
When a unit has become isolated it may be entered with complete safety, and the filament supply and the water to the vacuum tubes may be turned off for tube replacement, or other repairs may be made. When it is de-

CONTROL CONSOLE

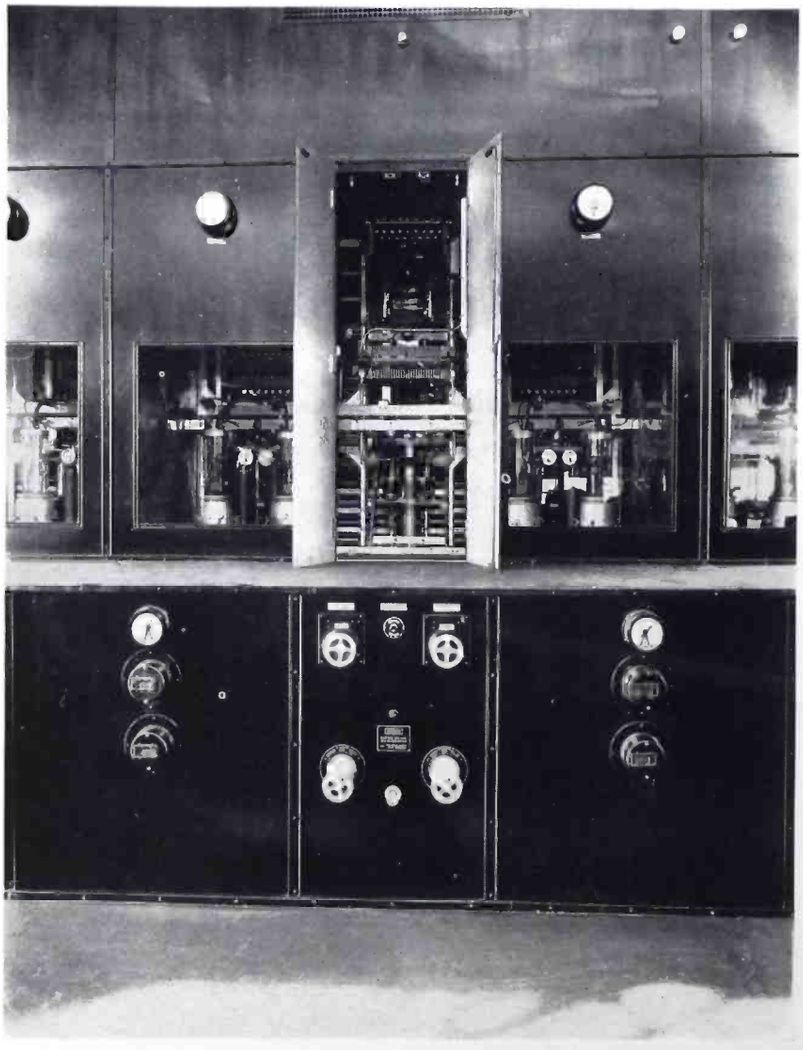
THIS CONTROL CONSOLE PROVIDES COMPLETE CONTROL AND SUPERVISION FOR THE 500-KW **WLW** TRANSMITTER, THE 2.5 KW **WSAI** TRANSMITTER AND THE 10 KW **W8AXL** TRANSMITTER. **MR. J. E. WHITEHOUSE,** CHIEF TRANSMITTER ENGINEER OF THE **CROSLEY STATIONS,** IS SHOWN OBSERVING THE POWER SUPPLY VOLTAGES BEFORE STARTING THE 500 KW TRANSMITTER. ON EITHER SIDE OF THE ELECTRIC CLOCK MAY BE SEEN TWO NEON LIGHTS FORMING PART OF THE THYRATRON OVER-MODULATION INDICATOR.

sired to put the unit back in service it is only necessary to press a button on the operator's control console, whereupon, after an interval of three seconds, the unit is in service.

There is not space here to mention more than a few of the more interesting features of the control circuit. The RCA-870 tubes in the main rectifier have such large cathodes that a thirty-minute heating period is required. To conserve the operators' sleep, a clock is provided to automatically turn on the cathode heaters one hour before morning program time. When the operator arrives on the scene he sits before the operating console and puts 500 kilowatts on the air by pressing several buttons. One of them starts the cooling system. This includes not only the water pump for the distilled water and the pump for the pond water, but it also includes the air blowers for the tube cells and the temperature-controlled air blower for the rectifier tubes.



THIS VIEW SHOWS **JOE CHAMBERS** PLACING A TUBE IN ONE OF THE MODULATOR UNITS



FRONT VIEW OF 170 KW POWER AMPLIFIER. THE LOWER PANEL CONTAINS THE THERMOMETER, WATER FLOW INTERLOCKS, VALVES, AND TUNING CONTROLS.

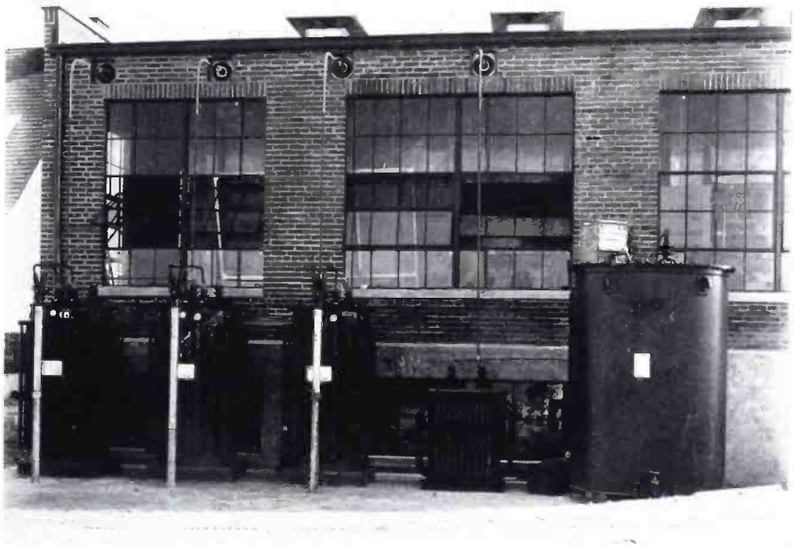
After the water flow has reached its normal rate, the water flow interlocks close their respective circuits and it is then possible to start the 4,300-ampere filament supply. Filament current is furnished by three 1,500-ampere generators connected in parallel, each being driven by a 2,300-volt induction motor. Various alarms and buzzers automatically indicate excessive water inlet temperature, excessive outlet temperature, incorrect voltage on the rectifier filaments, or other misadjustments.

After the cooling system is started and the filament and bias voltages are normal, the old 50-kilowatt WLW transmitter, used as an unmodulated exciter, may be energized. A low voltage of about 8,000 volts is then applied to the 500-kilowatt amplifiers and modulators by using a delta-wye connection on the main rectifier primary. After a minute or so the primary connection is changed by remote control delta-delta, whereupon the normal output of 500 kilowatts is radiated.

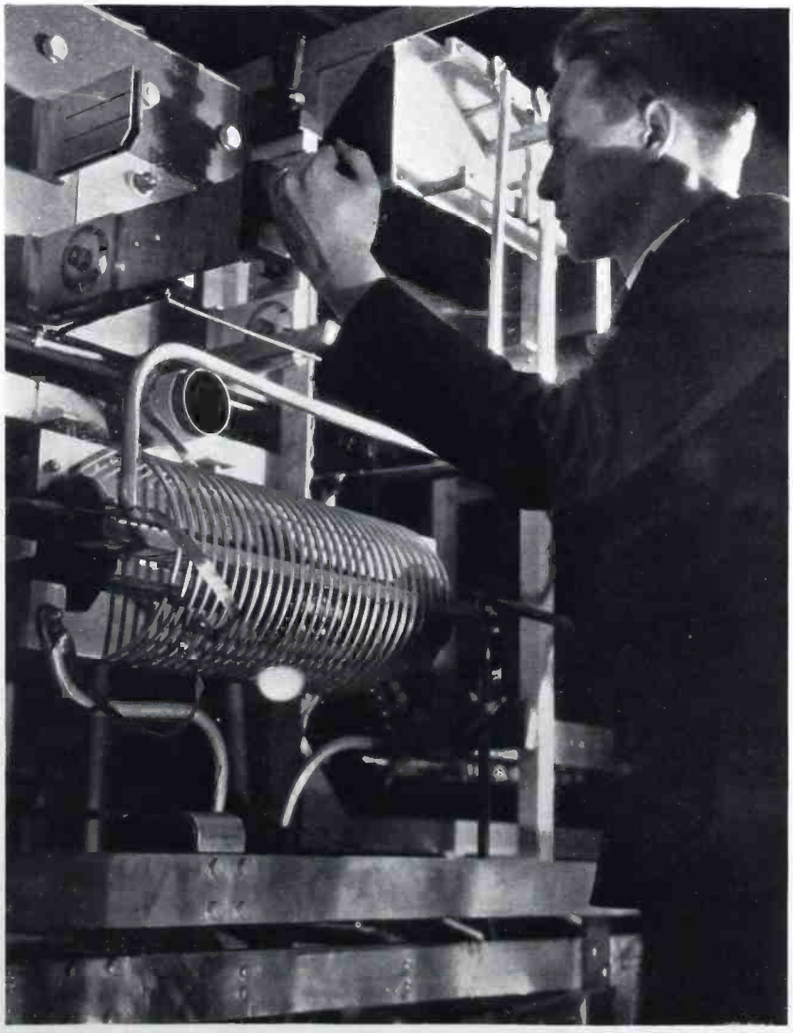
In case of overloads, there are so many tubes involved that it would be difficult to check the targets of each of the overload relays. An enunciator system is therefore provided which automatically indicates, after each overload, the circuit and tube in which the overload took place.

Power Amplifiers

There is not space to describe in detail the design of the power amplifiers. Each one may be entered from the "cat-walk" along the front of the transmitter, and from a rear door as well. Each power amplifier is individually shielded. Air dielectric condensers are used, the plates being made of a number of aluminum tubes. No wood insulation is used anywhere in the amplifiers. A 40-ohm resistor is connected in series with each power amplifier anode, so that the short-circuit current flowing through the tube during an internal re-over will not exceed several hundred amperes. The UV-862 tube is able to stand plate currents of several hundred amperes, momentarily, without great harm. Even though the short-circuit current flows for only a brief interval, sufficient energy is dissipated in the 40-ohm resistor to require its having a large thermal capacity. So it is made of street-car starting grids. Radio-frequency excitation is brought to each power amplifier through concentric transmission lines. The outputs are connected directly to the isolation switch, thence through concentric transmission lines to the harmonic filter.



THIS VIEW SHOWS THE MAIN PLATE TRANSFORMERS, FILTER REACTOR, AND MODULATION TRANSFORMER



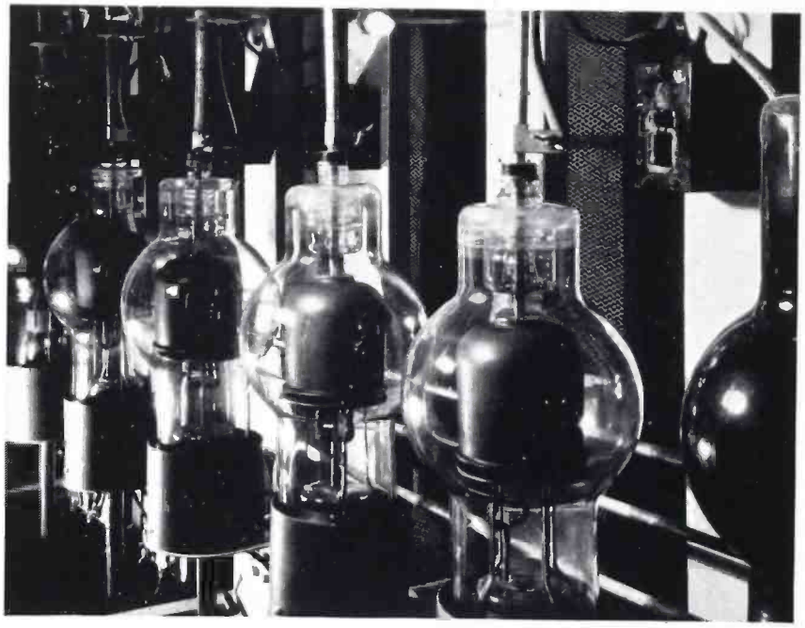
JOE CHAMBERS CLOSING A FILAMENT SWITCH IN ONE OF THE POWER AMPLIFIERS. NOTE THE GRID TANK COIL JUST BELOW HIS ARM.

The historical "pan-cake" type of coil has been reverted to for the tank and coupling inductances. This type coil is more efficient and economical than other types and, in conjunction with the unique tuning scheme that has been employed, it is more practicable. The tuning scheme constitutes part of the primary coil. One-half of one turn is placed on hinges and is swung back and forth by front of panel control, thereby varying the inductance through a considerable range. To reduce harmonic radiation, an electrostatic shield is placed between the tank and coupling coils. The pan-cake coupling coil is mounted on hinges in such a way that, using a front panel control, its spacing from the tank coil can be varied. Thus the mutual coupling may be varied without affecting either the tank coil or coupling coil inductances.

Each amplifier constitutes a complete unit with its own shielding, internal lighting, doors, water interlocks and forced ventilation.

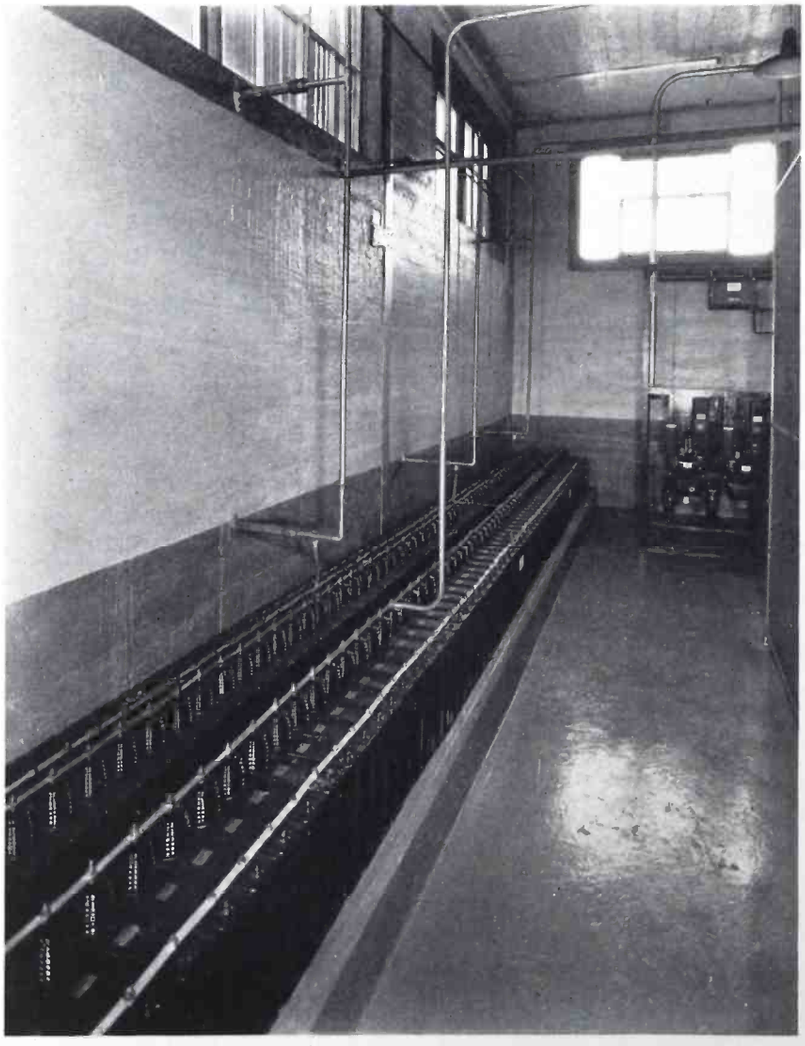
Modulators

The modulator units themselves are quite simple. As explained above each one employs four 100-kilowatt tubes in push-pull, Class B. The interstage transformers that supply audio voltage to the modulator grids weigh two tons each. The audio transformer coupling, the modulator outputs to the power amplifiers weigh approximately twenty tons each. Direct current for the power amplifiers is provided through a modulation reactor. Incidentally, this reactor is quite hefty. When a 6-volt storage battery is connected across it and the circuit is broken, a 3-foot arc takes place! The entire audio system is capable of producing *350 kilowatts of audio power at all frequencies between 30 and 10,000 cycles!* The output of the modulators is approximately 165 db. above the output delivered by the microphone. This represents an amplification of seventy quadrillion times (70,000,000,000,000,000).



MAIN RECTIFIER

THE RCA-870 TUBES IN THE MAIN RECTIFIER. THESE AIR-COOLED TUBES HAVE AN ANODE CURRENT RATING OF 450 AMPERES AND HAVE AN ACTUAL EMISSION OF ABOUT 1,500 AMPERES EACH. YET THE POWER REQUIRED BY EACH CATHODE IS ONLY 325 WATTS



THE FILTER CONDENSER OF THE MAIN RECTIFIER HAS A CAPACITY OF 220 MFD. WHEN THIS CONDENSER IS CHARGED TO 12,000 VOLTS AND THEN SHORT-CIRCUITED, THINGS HAPPEN.

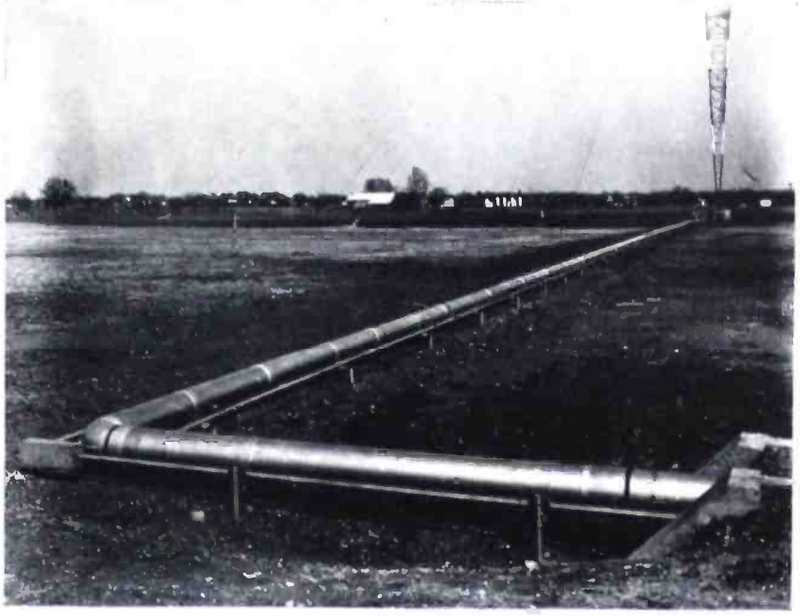
Main Rectifier

The main rectifier, employing six RCA-870 tubes in a conventional 3-phase, full-wave bridge circuit, is unique in its simplicity. The RCA-870 is a new type of air-cooled mercury vapor tube, similar in appearance to the well-known UV-857, but about twice as large. The cathode is heated indirectly. (Besides the six tubes that are actually in the circuit, a seventh tube is kept heated for immediate availability as a spare.) This type tube has a continuous direct-current anode current rating of 150 amperes, an intermittent rating of 450 amperes, and *an actual emission from the cathode of about 1,500 amperes!* Yet the energy required to heat the cathode is only 325 watts.

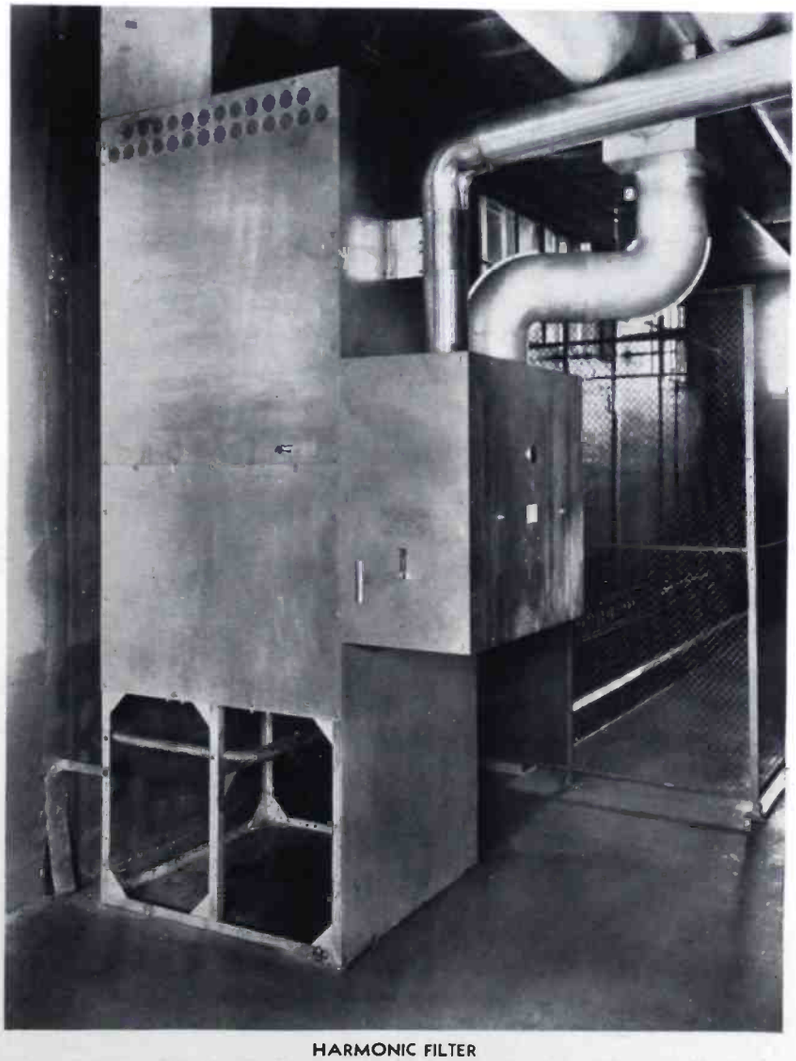
Another unique feature of this rectifier is its high-speed breaker. Of the 4 cycles of elapsed time between the occurrence of a short circuit and the opening of the 2,300-volt rectifier primary circuit, 1½ cycles is required for the operation of the direct-current overload relay, 1½ cycles for the operation of the main breaker, and 1 cycle for the extinguishing of the arc.

It is the highest-speed mechanical breaker of its rating that has ever been made. (Fifty amperes at 125 volts is required to operate the closing electro-magnet.) *This breaker weighs 1½ tons and has an interruption capacity of 12,000 amperes!*

An impressive row of Pyranol capacitors forms the filter condenser of the main rectifier. The capacity is 220 mfd. The several persons who have had the pleasure (?) of seeing this condenser short-circuited when charged to 12,000 volts haven't been quite the same since. On these occasions, those who were upstairs merely thought that a thunderbolt had struck the basement. Those who were in the basement have something to tell their grandchildren about.



THE LARGEST AND LONGEST CONCENTRIC TRANSMISSION LINE IN THE WORLD. THIS 820-FOOT CONCENTRIC LINE, WITH AN OUTSIDE DIAMETER OF 10 INCHES, IS KEPT NEAR THE GROUND, AND GROUNDED EVERY 20 FEET, TO PREVENT HARMONIC RADIATION. THE CONSTRUCTION IS SUCH THAT ANY OF THE MYCALEX INSULATORS WITHIN THE LINE OR ANY SECTION OF THE LINE MAY BE REPLACED IN A FEW MINUTES' TIME.



HARMONIC FILTER

THIS LARGE HARMONIC FILTER IS CONNECTED BETWEEN THE AMPLIFIERS AND THE ANTENNA TRANSMISSION LINE. NOTE THE HANDLE FOR SHIFTING FROM 50 KILOWATTS TO 500 KILOWATTS. THIS FILTER REDUCES THE STRONGEST HARMONIC TO A RADIATED STRENGTH CORRESPONDING TO 1/5000TH WATT.

Cooling

The cooling system is entirely non-ferrous. It utilizes 6-inch copper pipes and represented quite a problem in hydraulic engineering. The outdoor spray pond is 75 feet by 75 feet by 3 feet deep. It normally loses about 300 gallons of water per hour, due to the necessary evaporation, and will probably lose another 100 gallons or so on windy days. There is an automatic means for removing air bubbles from the distilled water. The distilled water circulates through the tube jackets at the rate of 500 gallons per minute.

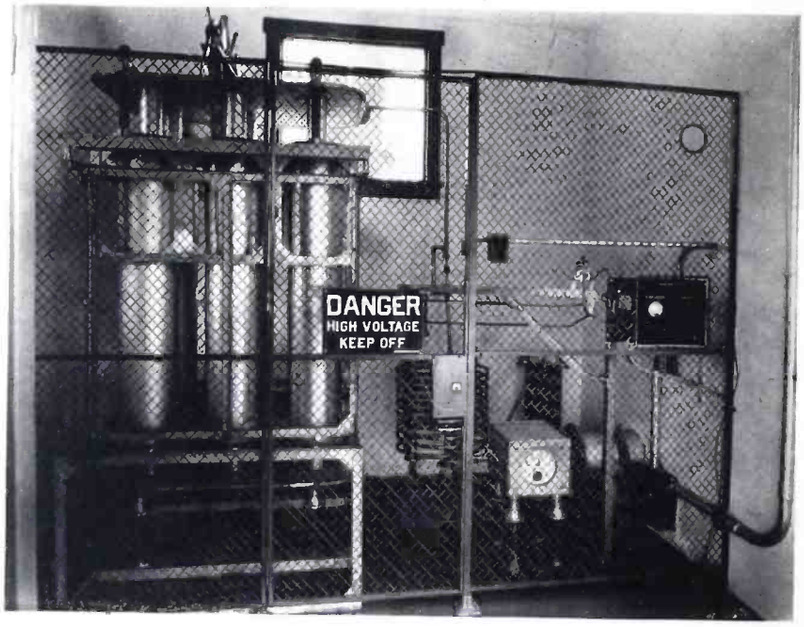
Besides the water cooling, there is required a considerable amount of air cooling both for the tube seals and for carrying off the general dissipation of the 500-kilowatt amplifier equipment. Altogether 20,000 cubic feet per minute of air is furnished. The air for the RCA-870 tubes is passed through a temperature regulated chamber where the outlet temperature is controlled within certain limits.

Transmission Line

The transmitter is coupled to the antenna by an 820-foot concentric transmission line. This is the longest and largest concentric line ever used for broadcasting purposes. It is supported about one foot above the ground, as shown in the accompany-

ing photograph. The diameter of the outside tube is approximately 10 inches. This type of line not only reduces harmonic radiation—it greatly simplifies the equipment required in the antenna tuning house. Mycalex insulation is used. The entire line structure is so designed that the inner tube or outer tube or any insulator can be replaced in a few minutes. Arrangements are provided for switching the transmitter end of the line to the 50-kilowatt transmitter rather than to the 500-kilowatt, in case of emergency. This change-over can be made in less than one minute.

Precautions are taken to keep the inside of the line dry and to properly ventilate it. The line has not given the least trouble on any occasion, even when carrying a power of 700 kilowatts, 100 per cent modulated. It is one of the most worthwhile of the many unique features of this transmitter.



ANTENNA TUNING EQUIPMENT

THE EQUIPMENT IN THE ANTENNA TUNING HOUSE IS SIMPLE BUT HIGHLY EFFICIENT. A NEW TYPE OF CONCENTRIC TUBE CONDENSER IS SHOWN TO THE LEFT. IT CANNOT BE DAMAGED BY LIGHTNING. THE TRANSMISSION LINE INDUCTANCE AND AMMETER ARE SHOWN CLEARLY. THE END OF THE TRANSMISSION LINE IS FLARED OUT TO PREVENT THE ENTRANCE OF RODENTS. THE SMALL RECTIFIER SHOWN TO THE RIGHT OPERATES METERS AND SIGNALS ON THE CONTROL CONSOLE.

Antenna Tuning Equipment

The equipment in the antenna tuning house consists, essentially, of nothing but a condenser connected from the antenna to ground, and an inductance connected between the antenna and the internal conductor of the transmission line. This method of coupling is very economical and, at the same time, it forms an additional stage of filter for harmonics. Power for the tower lights is supplied to the base of the tower through a suitable double conductor choke coil. This coil delivers 60 cycles, 110 volts to the low-voltage end of the transmission line inductance. From this point the 60-cycle lines pass through the inside of the tubing of which the inductance is wound, thence to the antenna. This system has proved itself impervious to lightning. It has been struck many times without damage.

A small rectifier located in the antenna tuning house produces direct current in proportion to the antenna current, and this direct current deflects a meter calibrated in antenna amperes on the operator's console. Also this rectifier produces an audio signal for monitoring purposes and for the operation of the over-modulation indicator.

Over-Modulation Indicator

Of the many useful devices in the control console, including 32 buttons, 30 lights, a clock, several meters and several rheostats, one of the most interesting is the modulation alarm indicator. This device, employing a grid-controlled rectifier tube, is connected to the output of the monitoring rectifier in such a way that, whenever the modulation exceeds a certain predetermined peak percentage, a neon light is caused to flash. This device is calibrated to indicate modulation peaks within an accuracy of several per cent. Its operation is practically instantaneous.

Installation

The first equipment arrived on the field approximately July 1, 1933. Complete equipment was on hand by about September 1st, and on November 1st, 500 kilowatts was put on the air. Within a few days this power was increased to well over 500 kilowatts, with 100 per cent modulation. A number of tests were then run to determine the performance and to detect any defects. It is gratifying to state that not a single change of major importance or of appreciable expense was made in the design, in spite of the new circuits and ideas that were put into practice for the first time. During the latter part of the installation and test, an average of six engineers were kept on the job. In every important respect, the installation and test progressed in accordance with the schedule formed many months before, an achievement all too rare in broadcast installation history.

Performance

The normal power output is 500 kilowatts. The hum level is approximately 70 db. below the level of a 100 per-cent-modulated signal. The frequency characteristic is about 1 db. low at 30 cycles, 1 db. low at 50 cycles, ½ db. low at 100 cycles, thence absolutely flat to 5,000 cycles, then ½ db. low at 8,000 cycles and 2 db.

low at 10,000 cycles. The audio harmonic content, expressed in RMS values, rises continuously from zero at zero per cent modulation to about 6 per cent at 95 per cent modulation.

The prevention of radio-frequency harmonics received unusual attention, due to the increasing interference that is being experienced from broadcast station harmonics. At WLW the result of the preventive measures is that the harmonic values are so low that it is difficult to measure them, especially the second, unless unusually selective measuring equipment is available. With a fundamental field strength of 6.5 volts per meter at one mile, the strength of the strongest harmonic is 400 microvolts per meter at one mile. This means that the most powerful harmonic, so far as radiation along the ground is concerned, has a strength of 1/5,000ths watt, as compared to 500,000 watts for the fundamental—a ratio of 1 to 2,500,000,000!

CONVENTION COMMITTEE . . . . . INSTITUTE OF RADIO ENGINEERS

PHOTOGRAPHED AT RADIO HEADQUARTERS, IN PREPARATION FOR THE NINTH ANNUAL CONVENTION, MAY 28TH, 29TH AND 30TH, 1934, TO BE HELD AT THE BENJAMIN FRANKLIN HOTEL, PHILADELPHIA, PENNSYLVANIA. STANDING—LEFT TO RIGHT, **E. B. PATTERSON** (ENTERTAINMENT); **A. F. MURRAY** (EXHIBITION CHAIRMAN); **KNOX McILVAIN** (REGISTRATION CHAIRMAN). SEATED—LEFT TO RIGHT, **E. W. ENGSTROM** (TECHNICAL SESSIONS AND PAPERS); **H. W. BYLER** (TREASURER); **W. F. DIEHL** (CONVENTION CHAIRMAN); **JESSE HAYDOCK** (PUBLICITY); **E. L. FORSTALL** (PROGRAM CHAIRMAN). THOSE ATTENDING THE INSTITUTE OF RADIO ENGINEERS ARE TO BE THE GUESTS OF THE **RCA VICTOR COMPANY, INC.**, AT A LUNCHEON IN CAMDEN, ON TUESDAY, MAY 29TH. **HARRY SADENWATER** IS THE CHAIRMAN OF ENTERTAINMENT, **R. L. SNYDER**, THE TREASURER, **PIERRE BOUCHERON** IS THE PUBLICITY CHAIRMAN, AND **MRS. W. H. W. STERRETT** IS THE LADIES' COMMITTEE CHAIRMAN

Pioneer Broadcasting

By GEORGE H. CLARK, RCA Historian

RCA is today the proud grandfather of considerably more than a hundred highly vocal descendants, poetically called "Children of the N. B. C." Their voices are heard, when conversing in their customary bass, from coast to coast, including the Canadian on the north and the Mexican on the south; and when they fly into excited soprano, only the modest initial design of this globular conductor to which they are restricted—as far as we know—prevents them from exceeding the present maximum of twelve thousand five hundred miles. The Voice of the World!

But there was a moment, young radio gentlemen, in a certain year B.C. (before Camden), when RCA became a father for the first time. This first-born broadcasting station would look strange indeed to our modern eyes with its five hundred watt panel, its non-inverted towers, and its horizontal aerial. But to the young father, Baby 'DY (WDY, Roselle Park, New Jersey, to you) represented the first and last word in speech transmission equipment, even down to the fuse links on its power panel—safety pins, they were called.

Despite paternal pride, however, there had been prior stations of the kind, and, even before them, pioneer efforts which were destined to culminate later in the World-Listening-In. WDY's playmates, and their predecessors, were several, and deserve record in this encyclopoedia.

The first speech through the American ether may be with fairness dated 1906, when Professor Reginald A. Fessenden radiophoned a Christmas message from Brant Rock station, "BO."

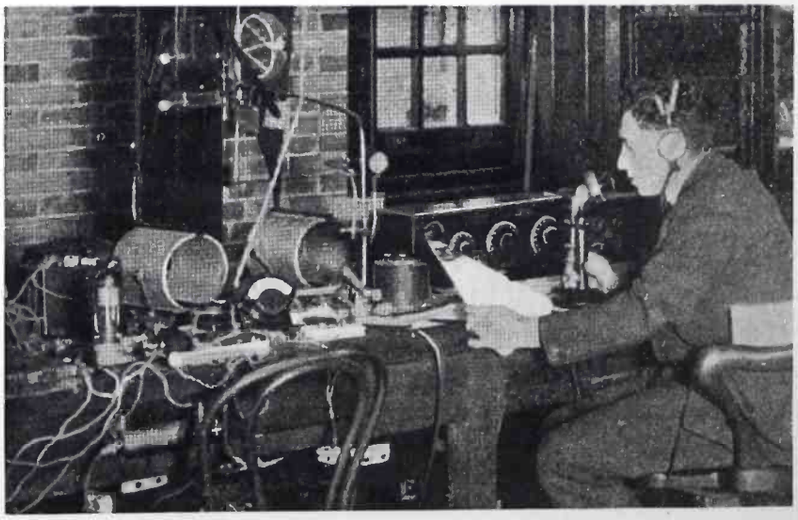
Radiograms had been sent several days in advance to operators of the United States Navy and of the United Fruit Company, suggesting that they listen in to this program, and many of them, doing so, heard phonograph music, and a violin solo

GEORGE H. CLARK, RCA

and a song by Professor Fessenden. (Incidentally, the Professor established a precedent which has, unfortunately, not been followed up. He says of his vocal selection: ". . . although the singing, of course, was not very good.") This, and a succeeding New Year's program, were heard as far south as the West Indies. However, this should be classified as a test of radio-telephony, received by professional operators, and was not broadcasting as the term is defined today.

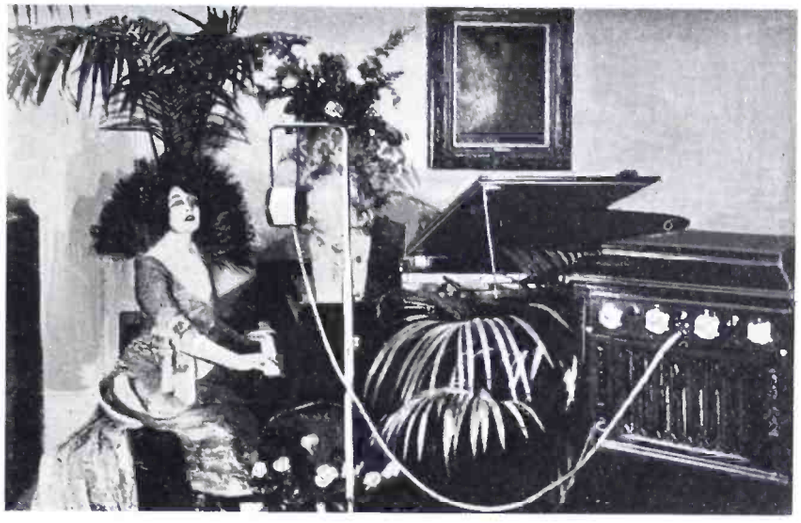
Dr. de Forest came closer to the goal, by concerts from High Bridge and other points in New York City, listened to by a restricted and highly technical group. But even this, and the similar work of some of the earlier amateurs, does not qualify as broadcasting. Of course, it is admitted that we are making the definition, but it is the one in general use today. This definition is that broadcasting means sending out voice, and music, and incidental sound effects, in a general program; maintaining it for definite and advertised periods; and having for its reception an audience of home listeners whose interest in receiving the program is solely for the entertainment and educational value which it possesses.

Is it forcing the issue to insist that we have a listening audience which is neither professional, semi-professional nor amateur, as well as a transmitted program and newspaper announcements to connect the two, in order to have "modern broadcasting"? Not if we are to differen-

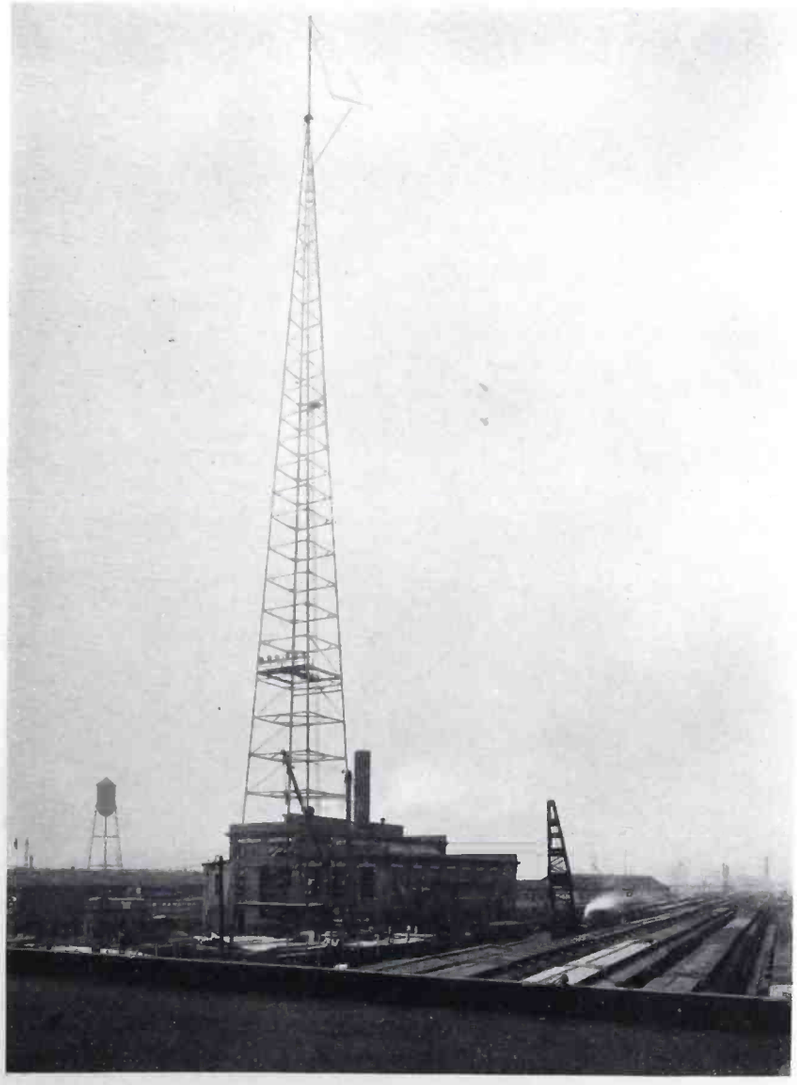


A TEMPORARY RADIOPHONE STATION, OPERATED BY **RCA** AND THE NATIONAL AMATEUR WIRELESS ASSOCIATION, AT THE 71ST REGIMENT ARMORY, IN 1921. THE ANNOUNCER, **HENRY KASNER,** IS NOW IN CHARGE OF SHOWS AND DEMONSTRATIONS FOR **RCA VICTOR**. AMONG THE PERFORMERS AT THIS STATION WERE **SOPHIE TUCKER** AND **ANNA CASE** (WHO BLEW OUT A TUBE WHEN SHE TOOK ONE OF HER FAMOUS HIGH C's)

tiate between radio-telephony and broadcasting. A somewhat similar situation exists in the dissemination of printed news. Typing a letter to an individual corresponds to "point-to-point" telephony, as Fessenden's tests between Brant Rock and Jamaica. Multigraphing a form letter to be sent to a mailing list is much the same as the "limited broadcasting" of de Forest, Fessenden and others to a special audience. Publishing a newspaper is in the same class with unlimited broadcasting, to the general public, which is what we know as "broadcasting" today. This does not evade the fact that even in the good old spark days the sending of a message "blind" had the broadcast tag applied to it. It just happens to be too bad that the modern use of the term blithely ignores all that has gone before, but it does, and you know it, and even Jay Quinby knows it.



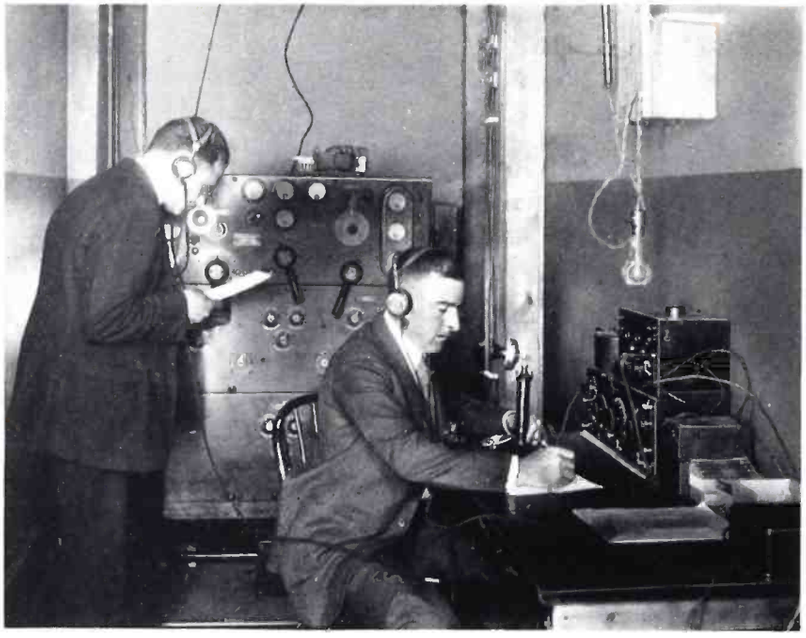
OLGA PETROVA, FORMALLY OPENING THE STUDIO AT WJZ, NEWARK, N. J.



ANTENNA OF STATION WJY, AT THE LACKAWANNA RAILROAD TERMINAL IN HOBOKEN, N. J. THE RADIO TOWER, WHICH IS STILL STANDING, WAS ORIGINALLY BUILT AS PART OF THE LACKAWANNA'S RADIO TRAIN DISPATCHING SYSTEM, AND ENABLED THE ROAD TO KEEP TRAINS RUNNING DURING BLIZZARDS THAT CRIPPLED WIRE COMMUNICATIONS AND COMPLETELY PARALYZED OTHER ROADS IN THE DISTRICT. SIMILAR STATIONS WERE LOCATED ALONG THE LINE AT BINGHAMTON, SCRANTON AND BUFFALO

Passing now from radio-telephony to broadcasting, the first station to send out regular, advertised programs, to simple receiving apparatus capable of operation by the non-technical hands of Mr. and Mrs. John Citizen, was KDKA, Pittsburgh, of the Westinghouse Company, and it fully deserves the title of pioneer. All the more so because it was through its own rare foresight that these receiving sets were to be had. The Aeriola Junior and the RC receiver had as much to do with actually creating "broadcasting" as did the sending set in Frank Conrad's home.

Not that this was recognized at once by everyone, however. These receivers had but a single circuit, for the Westinghouse designers figured that reception in the home must be simplified down to the utmost, if home-folks who could not even replace a burned-out fuse were to be able to operate the devices. No "forest of knobs" here; no complicated table of settings; merely one circuit and one handle to vary it. I can recall the personal scorn with which this single-circuit receiver was viewed by "old-style" radio engineers, i. e., myself, for it was held that this was going back to the days of 1900. But later, we—I—realized that the new transmitters were so much more



PIERRE BOUCHERON, WHO IS NOW ADVERTISING MANAGER, RCA VICTOR, ANNOUNCING AT THE BROADCASTING STATION WJY, HOBOKEN, IN 1921, AND GEORGE HAYES (AT RECEIVER), WHO IS NOW MANAGER OF RCA ARGENTINA, AT BUENOS AIRES

sharply tuned than the old spark sledge-hammers that a single circuit receiver was in 1921 actually workable! Little by little, actual use showed that for handling by people who knew nothing of radio's technicalities the single circuit was just what had been needed. It was a bold psychological move in the struggle to bring radio out of the attic into the sitting-room, and it worked. How well it worked I can realize today as I stroll home from the office at seven p. m., and find that, as I pass house after house, I am never out of touch with what Amos is saying to Andy.

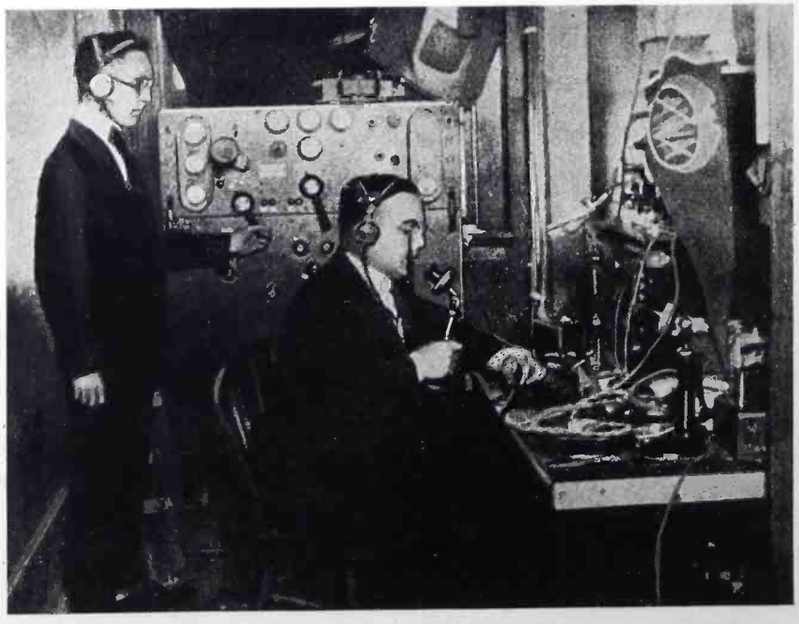
That's how playmates were born. KDKA's little sister WJZ soon came into being, in Newark, N. J., and her voice reached to the Woolworth Building, where RCA by that time was busily engaged in selling tubes, telephones and tele-receivers. In less time than it took to erect a tower and antenna, RCA was in the broadcasting game for itself. Shortly after, WDY was born.

WDY had its genesis in a one-day experiment of RCA in broadcasting, over in Hoboken, N. J., on July 2, 1921, with the call letters WJY. This station was installed, in a hurry, at the D. L. and W. terminal in with that of its sister program, WJZ, of Newark. In between, it grew from rather humble beginnings to a position in which the press referred, quite casually, to "the two giant broadcasting stations, WJZ and WDY." During that short period, RCA learned to love its little daughter, and still smiles indulgently and with becoming pride when one of the announcers signs off with "This is the National BROADCASTING *Company*."

WJY was installed, in a hurry, at the D. L. and W. terminal in Hoboken so that RCA could broadcast the Dempsey-Carpentier boxing match for the heavyweight championship of the world, which took place at Boyle's Forty Acres, in Jersey City. The antenna was strung between a steel tower and the clock tower of the Lackawanna terminal, this steel tower having been used some years previous in tests of train-radio by the railroad company. The wave length used for broadcasting was sixteen hundred meters, and the General Electric Company's 3½-kilowatt base station set which was used as transmitter radiated fifteen amperes.

Pierre Boucheron, now Advertising Manager for the RCA Victor Co., Inc., at Camden, N. J., was master of ceremonies and handled the microphone. George Hayes, who is now manager of RCA Argentina at Buenos Aires, acted as operator, and WJY immediately assumed great importance to the listening public.

This broadcasting stunt was staged for the American Committee for Devastated France, and the Navy Club of the United States. The latter organization, as shown by the accompanying illustration of a pamphlet describing the forthcoming broadcast, was headed by no less illustrious a personage than our country's President of today. The fight itself was under the management of Tex Rickard. The National Amateur Wireless Association, whose



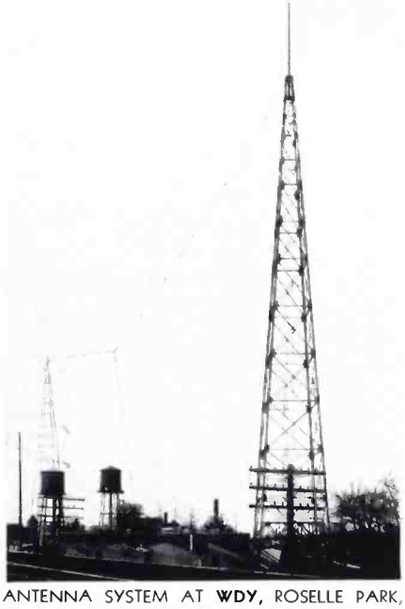
J. ANDREW WHITE (AT RIGHT) AND H. L. WELKER, CONDUCTING A PRELIMINARY TEST OF STATION WJY, HOBOKEN, 1921

president was Guglielmo Marconi, was asked to take care of the reception and the loudspeaker installations, at various halls, theatres, sporting clubs, Elks, Masonic and K. of C. club-houses, and other public meeting places. About one hundred such gatherings were arranged, the proceeds from the admissions to these to be divided equally between the two beneficiating clubs. Participating amateurs received certificates signed by Tex Rickard, Georges Carpentier, Jack Dempsey, Miss Anne Morgan and Franklin D. Roosevelt.*

Remote control was not in the picture in those days, hence it was necessary for the "sports announcer" at the ringside to describe the fight over an A. T. & T. private wire to the radio station, where it was typed directly from the telephone and handed to the radiophone operator. Major J. Andrew White, "radio's pioneer impresario," was the ringside announcer, and J. O. Smith was the relay describer whose voice was heard by the three hundred thousand "ear-witnesses" to the fight. The event was a tremendous success scientifically, having been heard as far away as Florida, but financially it benefited the two club organizations in name only.

*For this occasion, we recall having organized, in company with Laurence M. Cockaday (now Editor of *Radio News*), a temporary receiving station located at the roof garden of the Bunny Theatre on Broadway, New York. The public jammed the place, and marveled at the clarity of the program emanating from our "powerful" Magnavox loudspeaker. Mr. Cockaday still has the scroll of the N. A. W. A. which he received for these efforts.—Ed.

PAUL GODLEY BROADCASTING HIS STORY OF THE TRANS-ATLANTIC AMATEUR RADIO TRANSMISSION TESTS, AT STATION **WDY**, ROSELLE PARK, N. J., 1922



ANTENNA SYSTEM AT **WDY**, ROSELLE PARK, N. J., ORIGINALLY THE MARCONI FACTORY, LATER TAKEN OVER BY RCA.

STUDIO AT **WDY**, ROSELLE PARK, N. J. 3½ KW. BASE STATION SET IN CENTER. NOTE WICKER FURNITURE AND ELECTRIC HEATER AT EXTREME LOWER LEFT. AN UPRIGHT TELEPHONE TRANSMITTER, SUPPLIED WITH THE SET, WAS USED AS A MICROPHONE

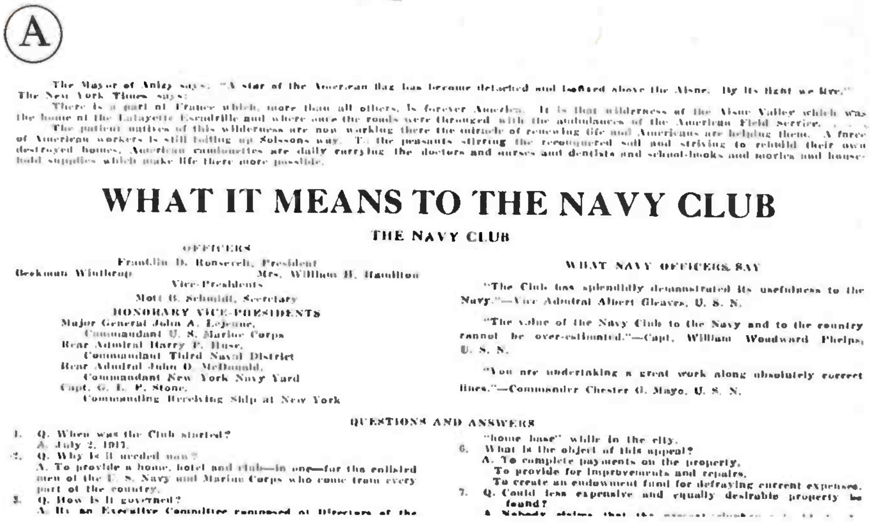
The event was also a huge success insofar as inoculating RCA with a permanent broadcasting urge was concerned. Plans were made for letting the broadcasting installation stay at Hoboken for six or eight months . . . for retaining the installation permanently and starting a regular broadcasting program as soon as a Government license could be obtained . . . for locating the station at some point farther from New York. Finally, the idea of installing the station in the General Electric factory at Roselle Park, N. J., was considered, and this won out, partly from sentimental reasons, as this factory had formerly been under the old Marconi Wireless Telegraph Company of America. To this location, sixteen miles west of New York, the transmitter of the Hoboken experiment was moved and George Hayes, Henry Kasner, Ernest Amy and Fred Kroger, together with W. J. Purcell and other engineers of the General Electric Company, placed radio apparatus and power machinery, and erected a special antenna system, under the direction of Lee L. Manley, of the M. R. I. department of RCA. Noisy generators, leaky circuits were eliminated one by one, and finally, on December 14, 1921, station 2XR —soon changed to WDY—was on the air. J. Andrew White, "whose keen humor serves to brighten the long winter nights in thousands of homes," J. O. Smith, "who draws on his fund of wit to make his

THE EVER POPULAR **VAUGN DE LEATH**, "ORIGINAL RADIO GIRL," WHO APPEARED FIRST AT **WJZ**, NEWARK, IN 1921, AND WHO PROBABLY TODAY FEELS THE SAME WAY ABOUT THE HAT AS WE DO ABOUT THE "MIKE"

announcements keen and snappy"—I quote from the Newark *Sunday Call*, and certainly not from any records of my own—made up, with technical engineer Ernest V. Amy, the station staff. This was long before N. R. A.

The station depended on extemporaneous announcement and spontaneously inspired artists to a very great extent. Partly because it was organized hurriedly, and did not have time to work up a regular program fabric before going into operation. Partly because of the difficulty of getting talent to traverse the almost inseparable barrier between Broadway and the hinterland of Roselle Park. Once there, the rigors of a New Jersey winter had to be neutralized by a few pitifully overworked electric heaters. No wonder that portable heating had to be provided. No wonder that the announcements were made, to a great extent, on the spur of the moment. Full credit is due to Messrs. White and Smith for almost always having a room full of guests, in spite of all these difficulties.

"'We are now going to have a little informal party, and you are all invited to be present, through the air.' So said a new voice by radio last Wednesday night . . . from station WDY. The character and warmth of the voices which came through the air held an intimate quality from which was entirely removed all semblance of the customary methods of announcement." (Thus the Newark *Sunday Call* as to WDY's opening program.) Besides the announcer, who seemed to draw most of the reporter's enthusiasm—or maybe the reporter drew it from him—there was Harry Howard, of Hitchy Koo, who sang "Anna from Indiana" in a way, so the newspaper said, that brought "spontaneous applause from the little gathering in the radio room, which was carried out over the air in a manner which was most unusual, and which gave a 'we're present' sensation to the listeners." Also there was Nat Saunders, who sang a song new to the air, "Swanee Mammy;" then Jack Cook entertained with vaudeville. "The night



(A)

The Mayor of Anizy says: "A star of the American flag has become detached and floated above the Aisne. By its light we live."
The New York Times says:
There is a part of France which, more than all others, is forever America. It is that wilderness of the Aisne Valley which was the home of the Lafayette Escadrille and where once the roads were thronged with the ambulances of the American Field Service. . . .
The patient natives of this wilderness are now working there the miracle of renewing life and Americans are helping them. A force of American workers is still toiling up Soissons way. To the peasants stirring the reconquered soil and striving to rebuild their own destroyed homes, American camionettes are daily carrying the doctors and nurses and dentists and school-books and movies and household supplies which make life there more possible.

WHAT IT MEANS TO THE NAVY CLUB

THE NAVY CLUB

OFFICERS
Franklin D. Roosevelt, President
Beekman Winthrop — Mrs. William H. Hamilton
Vice-Presidents
Mott B. Schmidt, Secretary
HONORARY VICE-PRESIDENTS
Major General John A. Lejeune, Commandant U. S. Marine Corps
Rear Admiral Harry P. Huse, Commandant Third Naval District
Rear Admiral John D. McDonald, Commandant New York Navy Yard
Capt. G. L. P. Stone, Commanding Receiving Ship at New York

WHAT NAVY OFFICERS SAY

"The Club has splendidly demonstrated its usefulness to the Navy."—Vice Admiral Albert Gleaves, U. S. N.

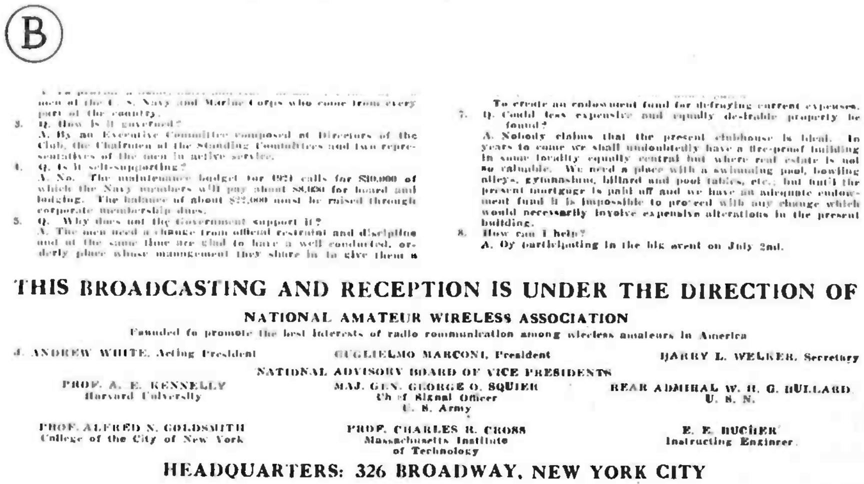
"The value of the Navy Club to the Navy and to the country cannot be over-estimated."—Capt. William Woodward Phelps, U. S. N.

"You are undertaking a great work along absolutely correct lines."—Commander Chester G. Mayo, U. S. N.

QUESTIONS AND ANSWERS

1. Q. When was the Club started?
A. July 2, 1917.
2. Q. Why is it needed now?
A. To provide a home, hotel and club—in one—for the enlisted men of the U. S. Navy and Marine Corps who come from every part of the country.
3. Q. How is it governed?
A. By an Executive Committee composed of Directors of the

"home base" while in the city.
6. What is the object of this appeal?
A. To complete payments on the property.
To provide for improvements and repairs.
To create an endowment fund for defraying current expenses.
7. Q. Could less expensive and equally desirable property be found?
A. Nobody claims that the present clubhouse . . .



(B)

men of the U. S. Navy and Marine Corps who come from every part of the country.
3. Q. How is it governed?
A. By an Executive Committee composed of Directors of the Club, the Chairmen of the Standing Committees and two representatives of the men in active service.
4. Q. Is it self-supporting?
A. No. The maintenance budget for 1921 calls for $30,000 of which the Navy members will pay about $8,000 for board and lodging. The balance of about $22,000 must be raised through corporate membership dues.
5. Q. Why does not the Government support it?
A. The men need a change from official restraint and discipline and at the same time are glad to have a well conducted, orderly place whose management they share in to give them a

To create an endowment fund for defraying current expenses.
7. Q. Could less expensive and equally desirable property be found?
A. Nobody claims that the present clubhouse is ideal. In years to come we shall undoubtedly have a fire-proof building in some locality equally central but where real estate is not so valuable. We need a place with a swimming pool, bowling alleys, gymnasium, billiard and pool tables, etc.; but until the present mortgage is paid off and we have an adequate endowment fund it is impossible to proceed with any change which would necessarily involve expensive alterations in the present building.
8. How can I help?
A. By participating in the big event on July 2nd.

THIS BROADCASTING AND RECEPTION IS UNDER THE DIRECTION OF

NATIONAL AMATEUR WIRELESS ASSOCIATION

Founded to promote the best interests of radio communication among wireless amateurs in America

J. ANDREW WHITE, Acting President — GUGLIELMO MARCONI, President — HARRY L. WELKER, Secretary

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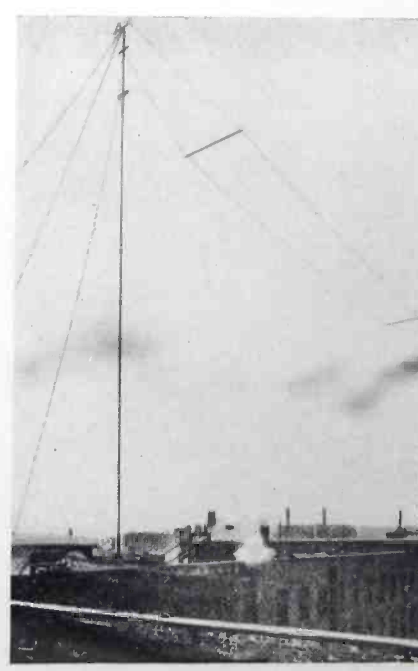
HEADQUARTERS: 326 BROADWAY, NEW YORK CITY

EXTRACTS FROM FOLDER SENT OUT TO AMATEURS BY **J. ANDREW WHITE**, TO GET THEM TO ARRANGE LISTENING AUDIENCES FOR THE EVENT. A—FEATURES NAME OF **FRANKLIN D. ROOSEVELT**. B—FEATURES NAME OF **MARCONI, SQUIER**, ETC.



ANTENNA OF THE PIONEER BROADCASTING STATION **WJZ**, NEWARK, ON THE ROOF OF THE WESTINGHOUSE FACTORY, 1921

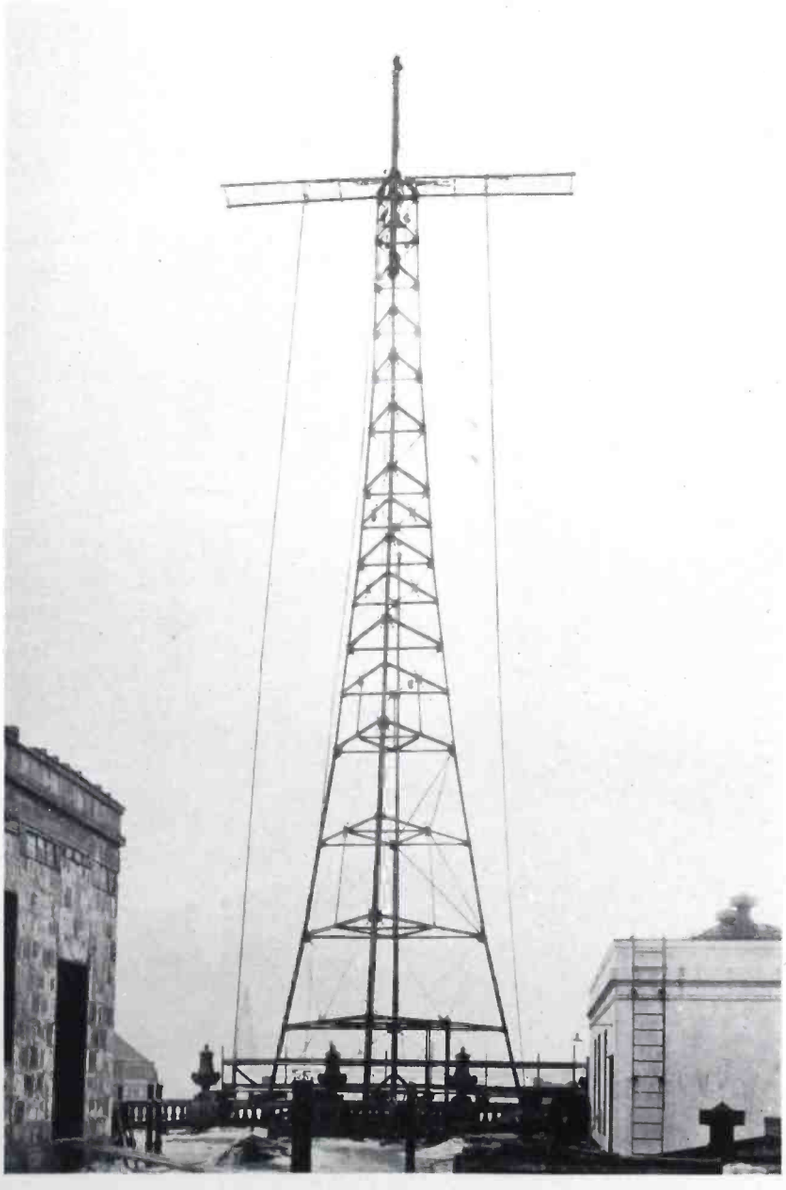
was cold outside," says our contemporaneous commentator, "but it was certainly summertime on the air. Everybody had a good time, including the entertainers, the guests of the station, and the radio public at large. This type of broadcasting is bound to be popular."

He was right. It was. Although at times, from the very nature of the preparation, or lack of preparation, of the program, the offerings verged on the crude (and I quote from my notes of those days, for "I was there"), yet this very informality seemed to please many people. It certainly pleased the radio editor of the Newark *Sunday Call*, who, while keeping one arm around WJZ and KDKA, reached out with the other and patted Baby 'DY on the back, not once but often.

Burlesque and good-natured joshing seemed to be a favorite feature of the new station.

But it was on Friday evenings that WDY, "that cute castle of cordiality," excelled itself. That was "Radio Party" night, when theatrical stars from Broadway gave their all, without money but with benefit of dinner and wine, for radio. Never were these party programs announced in advance, chiefly because the program director never knew, until the moment of going on the air, who would be his performing guests of the evening, and even then he wasn't always sure. Despite the handicaps of transportation, temperature and temperament, the program always went on the air and stayed on. During one of these Friday evening specials, on February 10th of 1922, Eddie Cantor was the leader of the "gang." I wish I had heard J. O. Smith leading the chorus of "We want Cantor."

JUST PRIOR TO THE EPOCHAL BROADCAST, **J. ANDREW WHITE**, TALKING WITH **MONSIEUR CARPENTIER**—LATTER AT LEFT, HOLDING ONE OF THE "GIANT" 250-WATT TUBES. (FROM WORLD-WIDE WIRELESS, JULY, 1921)



ONE OF THE TWO TOWERS OF WJZ, AFTER THE STATION HAD BEEN MOVED TO AEOLIAN HALL, NEW YORK CITY, 1922—PROBABLY THE FIRST PERMANENT STEEL TOWERS TO BE ERECTED EXCLUSIVELY FOR BROADCAST PROGRAMS

There were serious events as well. Dr. Richard Strauss, "the world's greatest living musician," gave a recital on December 22, 1921, piano-player rolls prepared by him especially for this occasion providing the music from WDY. It was planned originally to have Mme. Elisabeth Schumann sing, in the Knabe studios in New York City, to the accompaniment provided by WDY, via receiver and loudspeaker, but an electric motor in the building interfered, so this interesting stunt failed. On another program, Sigmund Kentner, twelve-year-old xylophonist, was the feature. Paul Godley, amateur and professional radio man all in one, gave a talk on trans-atlantic reception, on January 25, 1922, telling of his experiences on the Scottish moors, receiving signals from American amateur stations, under the auspices of the A. R. R. L. There was no lack of program material, serious or gay.

(Continued on Page 64)

Synchronization

By C. W. HORN, General Engineer, National Broadcasting Company

IT MAY seem curious to us now when it is stated that synchronization of two broadcasting stations, while born of "necessity," did not come about due to the shortage of radio broadcasting channels. The "necessity" herein mentioned is a personal matter rather than an effort to solve a technical problem.

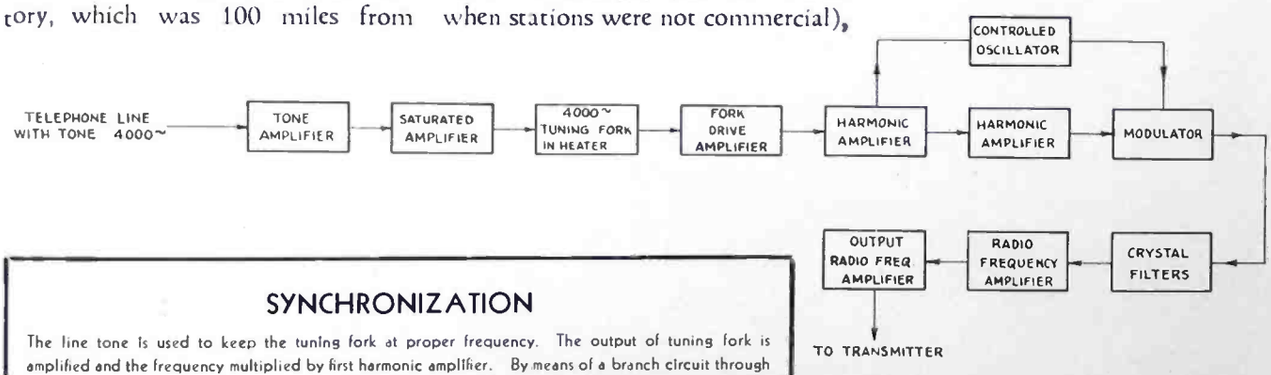
I was not authorized to build an additional station, so I compromised with my conscience and erected what we called a "booster station." This first synchronized station was WBZA in Boston. WBZ at Springfield, Mass., sought additional program sources and, finding the importation of talent from New York City somewhat expensive, decided that it was preferable, especially from a policy standpoint, to utilize talent from New England and particularly Boston. This station, which was a pioneer in New England, and has the honor of holding the first broadcast license issued as such, desired to emphasize its New England service by using New England talent as much as possible. For this purpose line connections were established between Springfield and Boston and a studio erected in the latter city.

Almost immediately complaints were received that talent appearing at the Boston studio could not very well be received in the Boston territory, which was 100 miles from

C. W. HORN, NBC

Springfield. This was due particularly to the high absorption territory between the two cities. After having expended considerable sums for wires and studios, I requested authority from my superior, the late Mr. H. P. Davis, vice-president of the Westinghouse Electric and Manufacturing Company and generally known as "the father of broadcasting," to erect another station in Boston. For reasons best known to himself, he declined me the authority to do so.

However, the complaints became more and more numerous, and as most of the talent in those days served without pay (this was a time when stations were not commercial), we soon found it necessary to do something to solve this problem. We arranged for the construction of a 500-watt transmitter. Inasmuch as no appropriations had been made, this equipment was built locally and was not a factory job. It was installed at the Hotel Brunswick in Boston in November, 1924. As I had definitely been informed that I could not erect a new station, I consoled myself with what I called a "booster." However, in order that there be some distinction between a "booster" station and a new station, it was necessary that I operate this apparatus on the same frequency as the mother station at Springfield. At first we tried this without frequency control, but soon found it desirable to try out quartz-crystal control, with which experiments were then being made. However, we received complaints of interference and decided that it was necessary to have this station in absolute step for synchronizing with WBZ at Springfield. Our next move was to send a carrier frequency of 55 kilocycles, which was later reduced to 27½ kilocycles, over the connecting lines and use this carrier frequency for controlling the frequency of WBZA at Boston. Subsequently, refinements were made with increase in efficiency.



SYNCHRONIZATION

The line tone is used to keep the tuning fork at proper frequency. The output of tuning fork is amplified and the frequency multiplied by first harmonic amplifier. By means of a branch circuit through the "controlled oscillator," a beat-frequency is produced in the "modulator" stage after main circuit frequency has been again multiplied through additional harmonic amplifier. This beat is the radio frequency of the station carrier wave, and after passing through the "crystal filter" stage, where all frequencies except the desired one are attenuated, additional amplification is applied and then connected to the station transmitter, in place of the regular crystal frequency generator. This is merely the bare outline of what takes place—the **WJZ-WBAL** installation is all A.C. operated. Various indicating devices are provided, such as lights to show line tone is on or off, meter to show if line tone is controlling fork, etc.

To further emphasize the fact that this Boston station was a "booster" for WBZ at Springfield, I requested the Department of Commerce, regulating radio broadcasting in those days, for permission to use the same

call letters on the two stations. The Department would not agree with me that here was one station with two outlets, but insisted that I must have a separate call letter. However, they would accommodate me by giving me WBZA, although I remember that I wanted it as WBZ-1. Some time later when Mr. Davis discovered that there was a station in Boston and while I was "on the carpet" for disregarding his orders, I did a masterful selling job in convincing him of the difference between a "booster" station and a new station.

We engaged in additional experiments on controlling a distant station. By means of a short-wave signal from KDKA, Pittsburgh, we built a system whereby KYW in Chicago was controlled. As the short wave had a tendency to fade and become irregular at times, we developed apparatus which overcame these obstacles. A great deal of fine engineering work was done by the engineers connected with these stations and many of the devices now used were first investigated under such conditions.

As for the technical details of these early synchronization experiments, I might state that we went through the whole list from the very simplest efforts to the more successful ones now in use. Naturally, the first tests were attempts to operate on approximately the same frequency without any control between the two stations. This did not succeed so well, for reasons which are known to us all now. We determined, therefore, to have a controlling medium between the two transmitters. We provided a line over which a frequency was transmitted and which was multiplied until the carrier frequency was obtained. Refinements were then made in isolating the line from the local transmitter but still maintaining control of the frequency.

In the experiments made later at WEAF - WTIC and WJZ - WBAL more refinements were made and a very high degree of stability was obtained. Not only did we endeavor to keep the frequency of the two stations controlled but their phase relationship as well. We had to contend with varying line conditions, but we succeeded in making devices which overcame these difficulties. We had an ideal condition in the WEAF-WTIC tests in that we could get half way between the stations and make observations of the two ground waves and how they affected each other. It enabled us to check the stabilizing apparatus and we found that the phase variations between the two transmitters were practically zero. We could do this by finding points where the two waves were directly out of phase, the carrier tended to neutralize. We frequently sat for long periods at such points, watching the amount of drift. By calling up one of the stations and having them make adjustments, we could move the point where the waves tended to neutralize back and forth.

With such an ideal, almost laboratory, set-up we made measurements as to the relative carrier wave strengths which would produce distortion. Of course, we found that if both carriers were equal in intensity and therefore could practically neutralize each other, there would be no carrier frequency to sustain whatever side bands were left. We did find that where the ratio became three to one, that is, one carrier was three times as strong as the other, the signal was considered fair, and that when it reached four to one, the signal might be classed as good. These measurements were made on ground waves only.

The above activities took place before there was any so-called shortage of channel facilities and therefore were some time prior to experiments which were undertaken by different engineering organizations for the purpose of providing additional radio facilities. These were truly pioneering efforts.

CARLOTTA DALE, CHARMING SOPRANO, WHO REGULARLY ENTERTAINS THE AUDIENCES OF **WCAU** AND **W3XAU** FROM THEIR MODERN STUDIOS IN PHILADELPHIA

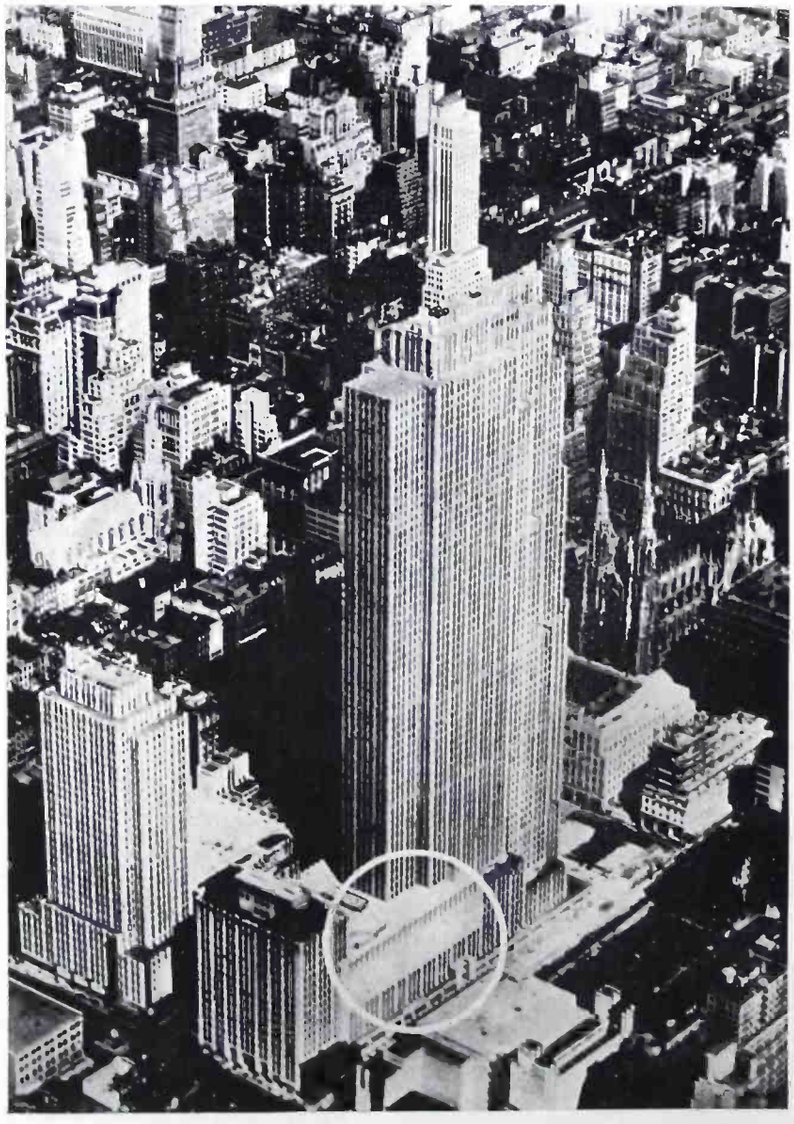
NBC at Radio City

By C. L. BEACH, Transmitter Sales Engineer, RCA Victor Company

OFFICIALLY opened on November 15, marking another epoch in Radio history, the National Broadcasting Company's new studios in New York City "went on the air" with an inaugural program. This program was heard by millions of listeners not only in the United States but in many other countries via short-wave transmission. Sixteen studios were equipped and ready for use for the inaugural program.

C. L. BEACH, RCA VICTOR

The new home for NBC is located in the seventy-story RCA Building, which building is the center portion of the Radio City project. NBC offices are in the main part of the seventy-story section, while the studios comprise the whole of a ten-story portion adjoining the west side of the 836-ft. tower. On the north side of the RCA Building is the RKO Building, containing the well-known Radio City Music Hall, while on the south side of the RCA Building is a smaller unit of the Radio City project containing the "Center Theatre."



NEW HOME OF NBC NBC Photo

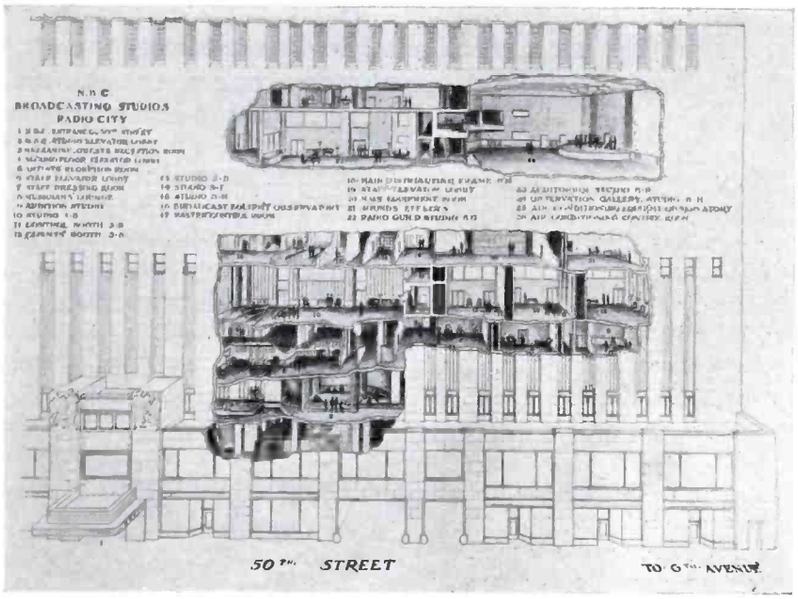
CIRCLED IN THE CENTER FOREGROUND IS THE NBC STUDIO SECTION IN RADIO CITY. OFFICES ARE IN THE TOWER BUILDING. AT THE LEFT IS THE RKO BUILDING AND RADIO CITY MUSIC HALL, WHILE IN THE RIGHT BACKGROUND ARE THE BRITISH EMPIRE BUILDING AND LA MAISON FRANÇAISE, ACROSS FROM ST. PATRICK'S CATHEDRAL

As the National Broadcasting headquarters are a part of the RCA Building, a word or two concerning this building may be of interest. This building has 2,113,000 square feet of floor area and seventy-four elevators to take care of the tenant and daily transient population of 62,000 people. The building is in the middle section of the Rockefeller Center, extending from Forty-eighth Street to Fifty-first Street and from Fifth Avenue to Sixth Avenue.

In the NBC ten-story section of the building there are three separate groups of elevators for the broadcasting quarters. There is also a fourth group of elevators to serve clerical, business and executive offices. All of these elevators are strategically located.

Air Conditioning

Air conditioning of the NBC quarters is of major importance, as sound insulation of the studios eliminates windows and ordinary ventilation. Therefore, air conditioning required the installation of one of the largest and most complete systems of ventilating, temperature and humidity control ever used. This complicated system maintains correct conditions by circulating 224,000 cubic feet of air per minute in studios, control booth, observation and equipment rooms, as well as other space used in the production of broadcast programs.



EXPLODED VIEW OF NBC's STUDIOS NBC Photo
LOOKING INTO THE NEW HOME OF **NBC** IN RADIO CITY, NEW YORK. THE DRAWING SHOWS THE TEN-STORY STUDIO BUILDING, WITH THE FRONT WALL REMOVED, MAKING IT POSSIBLE TO SEE HOW **NBC** OPERATES IN ITS NEW HEADQUARTERS. THIRTY-FIVE STUDIOS ARE LOCATED IN THE BUILDING, INCLUDING THE LARGEST ONE IN THE WORLD

The delicate control, and supervisory Engineer, of this applied "manufactured weather" is located on the tenth floor together with the blower fans, chilling and warming chambers, air filters, and indicating and recording instruments. Refrigerator machines for cooling the air are installed in the basement of the building.

A continuous twenty-four hour automatically recorded record is kept of conditions at over sixty points throughout the building. Special acoustic treatment of air ducts prevents sound from being transmitted from the air conditioning machinery to the studios or sound from a studio getting into any other studio through the air ducts.

Studios

National Broadcasting headquarters require an area of 400,000 square feet and will have thirty-five studios. The auditorium studio, known as "8 H," is the largest in the world, being 78 ft. by 132 ft. and three stories in height. The spectators' gallery along one side of the second floor level has a seating capacity of 250. A semi-circular expanding raised platform stage in this studio can easily accommodate a 100-piece orchestra. The pipe organ grille is located in the ceiling directly above the stage.

The next in size to the 8 H studio is the 8 G studio, two stories in height and 50 ft. by 89 ft., and is equipped with a stage and a glass curtain. This studio provides facilities for dramatic programs to be viewed by an audience who may at the same time hear the players through high quality loudspeakers, yet in no way can the spectators disturb the artists. This studio is also provided with an observers' gallery separated from the studio by a large specially constructed glass window.

In connection with the two studios just mentioned, please refer to the reproduction of the eighth floor plan for relationship of studio 8 H with 8 G and other "speaker" studios.

Other studios include two units 50 ft. by 80 ft., four units 30 ft. by 50 ft., two units 25 ft. by 40 ft. This group of studios is two stories high and has glass windowed observation galleries. All studio observation facilities are enclosed, sound proof and provided with high quality loudspeakers so that spectators may hear the programs being broadcast. This group of studios also has a separate "Sponsors'" observation gallery with high quality reproducing loudspeaker equipment.

Another studio—probably the first of its kind—on the eighth floor, is exclusively for children's programs and is suitably decorated to maintain the appropriate atmosphere for such programs. The children have a special lounge room adjoining.

On the 9th floor there is an unusual arrangement of 4 studios surrounding a central control room. Practically all of the area of the 4

AUDITORIUM STUDIO (8 H) SHOWING RETRACTABLE STAGE AT RIGHT, UPPER AND LOWER CONTROL BOOTH IN LEFT CENTER, AND SPECTATORS' GALLERY AT EXTREME LEFT. WHEN THE SIZE OF THE PRESENTATIONS WILL PERMIT, SPECTATORS ARE ALSO SEATED IN THE PARQUET. OVERHEAD MAY BE SEEN THE SOUND RE-ENFORCING LOUDSPEAKERS WHICH PERMIT THE AUDIENCE TO HEAR THE SAME PROGRAM BALANCE (MIXTURE) AS THAT BEING PUT ON THE AIR

THE TWO-STORY 8 G STUDIO, IN WHICH THE STAGE MAY BE SEPARATED FROM THE AUDIENCE BY SLIDING SOUND-PROOF GLASS CURTAINS. OBSERVATION GALLERIES ARE ALSO PROVIDED FOR CLIENTS AND OTHER SPECTATORS. THIS IS THE ONLY STUDIO IN WHICH FIXED SEATING ACCOMMODATIONS FOR THE AUDIENCE ARE PROVIDED

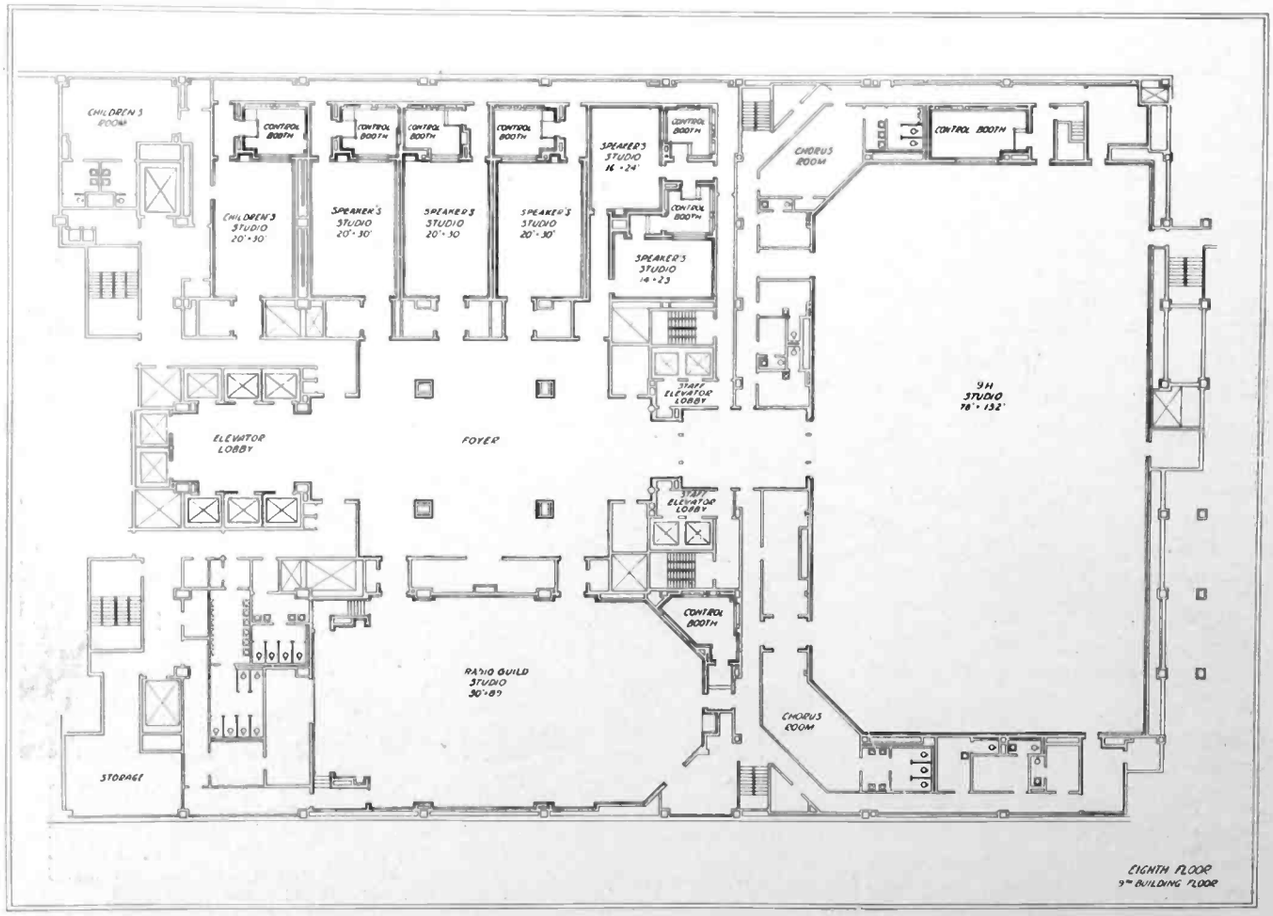
walls of this control room consist of specially constructed windows. These windows allow an unobstructed view of the 4 studios. A separate hallway leads into this control room, which hallway eliminates the necessity of passing through one of the 4 studios. Until such time as these facilities are used for television, certain types of programs requiring multiple arrangements can be advantageously set up in this group of 4 studios.

Due to the vast size of Studio 8 H, when television comes, it will be possible to erect several stage sets at one time, and to handle them in a manner similar to a "movie lot."

In addition to the studios mentioned heretofore, there are a number of smaller units known as "speaker studios." These studios are the correct size and correctly decorated and furnished, each in a different style, to give harmonizing surroundings for such programs as interviews or a single speaker. One of these "speaker studios" is shown in the accompanying photograph.

Decorations

The decorative scheme of the NBC studios is based primarily on color, either harmonizing or contrasting. In general the mode of decorations can be classified as conservatively modified "modern." Simplicity in design is the keynote and colors are the predominating characteristics. About the only exception to this mode of decoration is found in the specially designed "speaker studios." In these studios it was found possible to use wood paneling. One of the



ONE OF THE FOUR "SPEAKERS'" STUDIOS. HERE VISITING NOTABLES MAY BE SEATED IN COMFORT WHILE ADDRESSING THEIR AUDIENCES THROUGHOUT THE NATION OR THE WIDE WORLD

"speaker studios" is English Tudor with oak panels and a characteristic fireplace; another is done in the Georgian style, utilizing birchwood; one is done in early American, utilizing knotty pine, while still another has a modern mode in Friamer wood. The furnishing of each of these "studios" is appropriate to the individual style.

In the main reception lobby, as well as in the sponsors' and guest rooms, wood paneling is used and fireplaces are in evidence. A very pleasing and delightful reaction is obtained when one views the huge drape covering a portion of the rear wall of the mammoth auditorium studio 8 H. This drape, which is used as a covering and for controlling a resonating surface of the studio wall, is made of heavy silk especially woven, treated and designed for this particular use. The drape is brocaded fabric of a color called "flame," into which is woven a somewhat conventional gold figure. Black velvet panels flank either side of this drape and provide a striking contrast that is, in effect, genuinely magnificent.

Decorating materials used in the studios, control booths, corridors, reception, waiting and dressing rooms are all of textile and wood; very little wall paper or paint has been used.

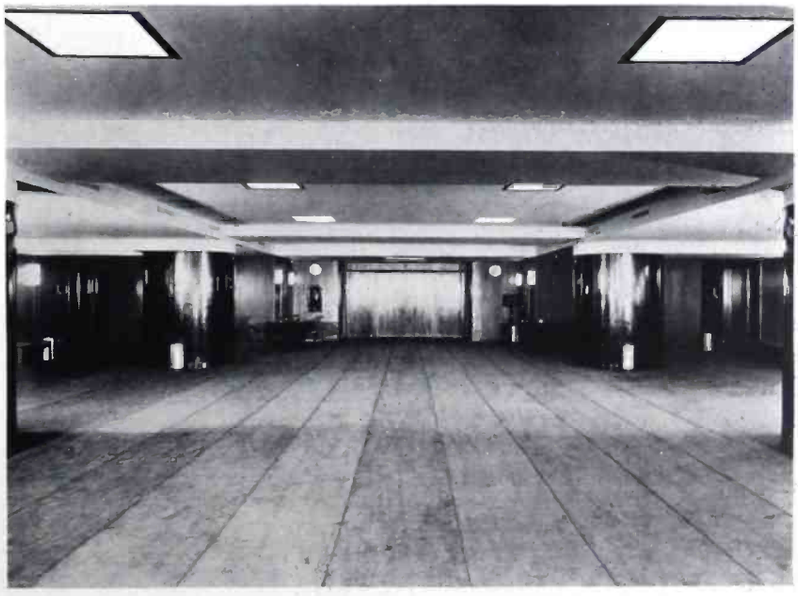
Samples of the 244,908 square feet of fabrics were subjected to very rigid acoustic tests before being accepted for use in the studios and NBC headquarters. It was necessary to conduct over 6000 tests on the various samples. The results of these tests made it necessary to have many of the fabrics especially woven to meet specifications. About 40 different fabrics were used in various forms of silk, cotton, wools, etc. Even the special glue used to affix fabrics to the walls and ceilings was acoustically tested. Exclusive of construction lumber, 4 carloads and 15 kinds of wood were used as follows:

Lace wood, gray hardwood, teak wood, oriental wood, American redwood, Knotty pine, English oak, Circassian walnut, American walnut, Ebonized maple, mahogany burl, mahogany crotch, butternut wood and friamer or primavera.

Sound Proofing

In this day and age of applied science, utilization of floating power, silent cabin aeroplanes, noiseless recording, quiet mesh gears, etc., we also have "floating broadcast studios," such as the studios at Radio City. To obtain adequate sound proofing, it was necessary to construct the studios so that the floors, walls and ceilings literally float in the building steel framework. The studios are not unlike rooms within rooms, in that part of the complete sound insulation is accomplished by suspending the rooms from the main building by means of specially designed heavy felt pad hangers. The space between the inner and outer rooms and the main part of the building is packed with tons of rockwool.

The heavy felt pads at the point of contact prevent direct transmission of vibration from the building to the



LOBBY LOCATED ON THE EIGHTH FLOOR, AT THE ENTRANCE TO THE AUDITORIUM STUDIO (8 H). THE WOOD PANELING AND OTHER DECORATIONS ARE OF MODIFIED MODERN DESIGN, FINISHED IN PLEASING COLOR COMBINATIONS

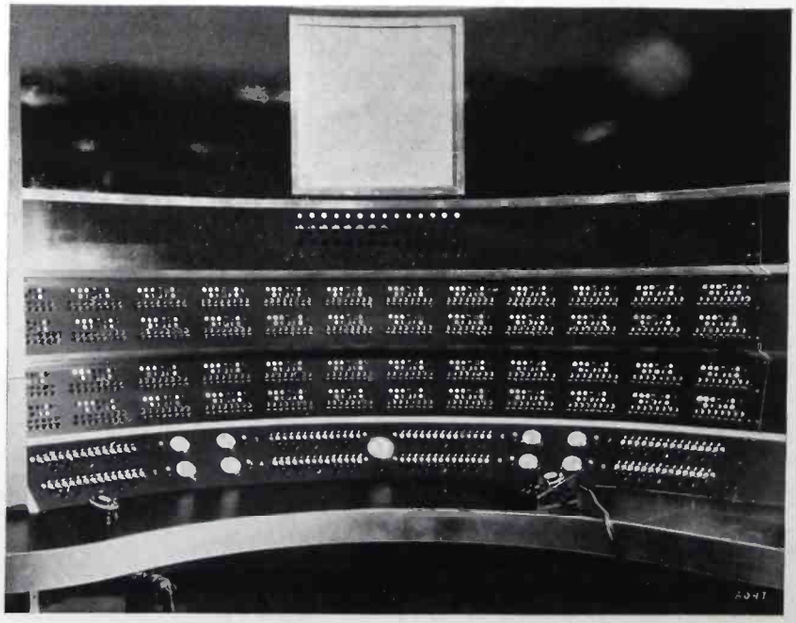
THE **NBC** ENGINEERS WHO PLANNED AND DESIGNED **NBC's** NEW HOME IN RADIO CITY. LEFT TO RIGHT (TOP ROW): **CHESTER RACKEY,** DESIGN ENGINEER; **O. B. HANSON,** MANAGER OF TECHNICAL OPERATIONS AND ENGINEERING; **JAMES G. STRANG,** JOB SUPERINTENDENT. (BOTTOM ROW) **WILLIAM A. CLARKE,** ARCHITECTURAL SUPERVISOR; **VINCENT J. GILCHER,** PLANT ENGINEER; AND **ROBERT M. MORRIS,** DEVELOPMENT ENGINEER

studio, and vice versa. The inner, or exposed surfaces of the floors, walls and ceilings are covered with 153,000 square feet of perforated transite and textile materials.

Some of the studios are equipped with power-operated sliding wall panels made of sound-absorbent materials. The position of these panels may be controlled from the Studio Control Booth so that various acoustical conditions may prevail for any particular program set-up. Opening the sliding panels exposes hard, sound-reflecting surfaces.

Eight thousand, five hundred square feet of glass, comprising the many large windows separating studios from control booth, clients' booths, and observation galleries, are three-ply plate glass. The glass in these windows, being too heavy to remove for cleaning after having once been placed, necessitated hermetically sealing to keep the inner surfaces clean. Hermetically sealing presented another problem with regard to changing barometric conditions. These changes in pressure would result in several tons of variable force against the glass. The changing conditions would break the glass unless the air pressure with relation to the inner and outer surfaces of the glass is equalized. In order to eliminate the danger to life and property, a system of so-called breather or equalizing air valves were installed in each of the windows. These valves incorporate a bacterial filter.

There are 296 sound-proof doors leading from the studios into corridors and control booths. These doors weigh in most cases approximately 300 lbs. each, and are constructed of several layers of sound-absorbent materials and incorporate a sheet of heavy-gauge lead. The heavy-duty hinges and automatic door-closing mechanisms are completely concealed. Although the doors are heavy, they are not hard to open or close due to the special design of hinges and closing mechanisms. When a door is closed, all clearances between the door and frame are sealed against sound trans-



CLOSE-UP OF THE LEFT-END SECTION OF THE MASTER CONTROL DESK

NERVE CENTER OF A NETWORK—ANOTHER VIEW OF THE MASTER CONTROL ROOM OF **NBC's** RADIO CITY HEADQUARTERS. THROUGH THESE SWITCH-BANKS THE OPERATORS ROUTE THE **NBC** PROGRAMS FROM THE STUDIOS TO THE VARIOUS NETWORKS COMPOSED OF THE 87 **NBC** ASSOCIATE STATIONS FROM COAST TO COAST

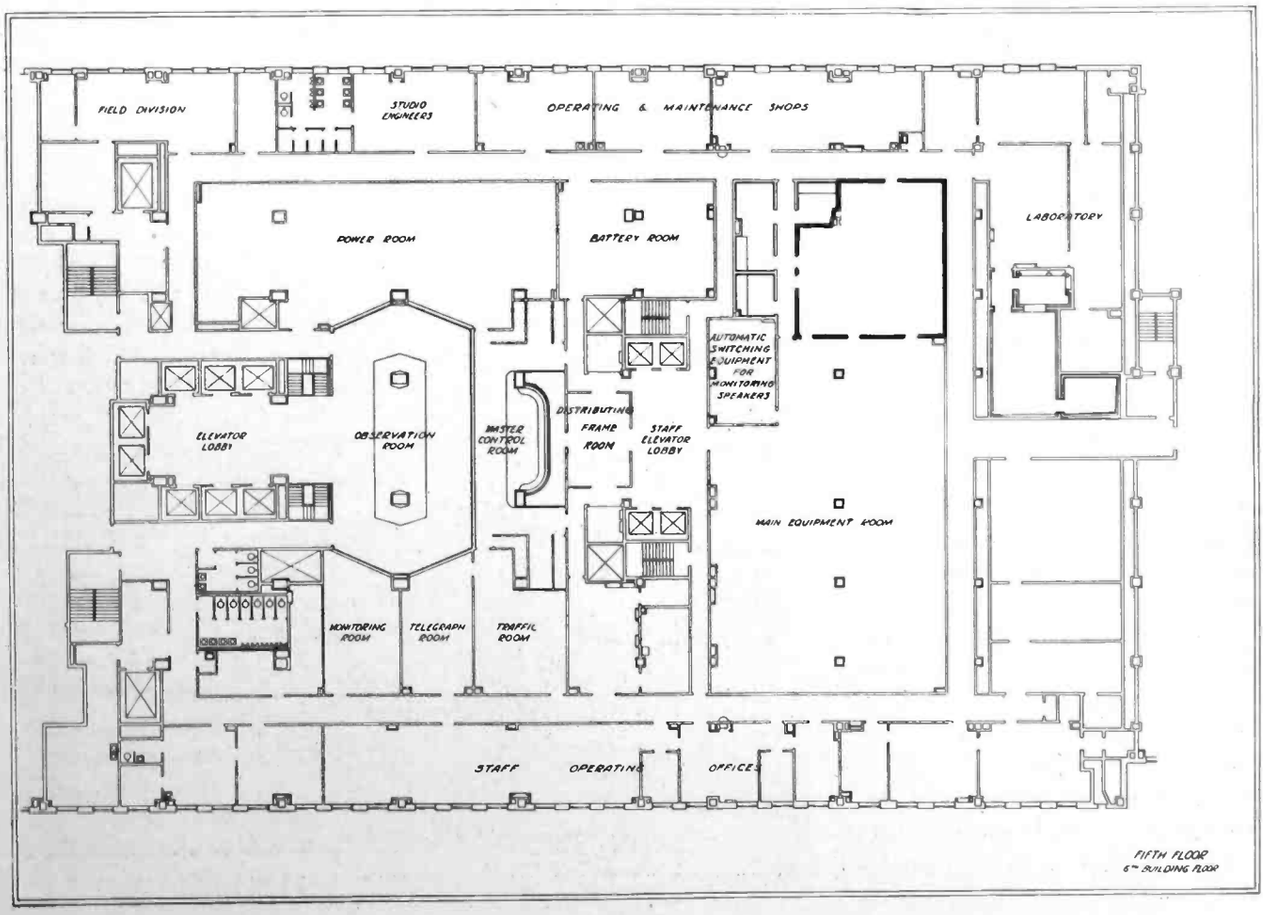
mission by the use of pneumatic rubber and other materials at the point of contact.

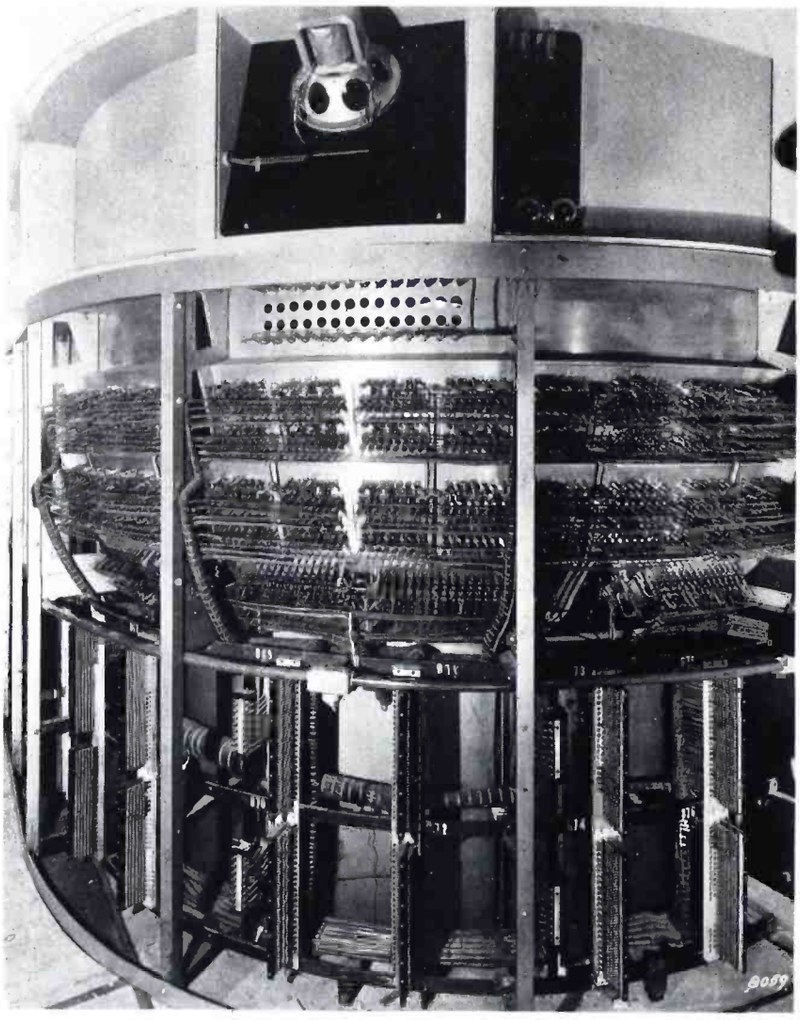
A large system of broadcast studios such as that in Radio City requires extensive engineering not only on the part of NBC engineers responsible for the system, but when suppliers of materials and equipment were called upon to meet specifications, this automatically set in motion hundreds of other engineering staffs.

Technical Arrangement of NBC Headquarters

In modern broadcast studio construction, it is necessary to have the Main Control Room and other plant equipment as centrally located as possible in relation to the studios and audition rooms. In the ten-story NBC Studio Building in Radio City, the "Master Control" is situated on the 5th floor. Studios are located on the floors above and below this level. On the 5th floor in addition to the Master Control are a main equipment room (containing most of the amplifiers), power room, battery room, clock control, automatic monitoring switching system, main distributing frame room, technical laboratories, operating and maintenance shops, telegraph and teletype room, switching booths, studio engineering office, field division headquarters, maintenance supply room, engineering department laboratory, as well as the engineering executive offices, etc.

From the glass-enclosed observation room on the 5th floor a full





CLOSE-UP OF THE INTRICATE MECHANISM AND A VIEW OF THE MANY THOUSANDS OF ELECTRICAL CONNECTIONS WHICH ARE LOCATED BEHIND THE MASTER CONTROL DESK

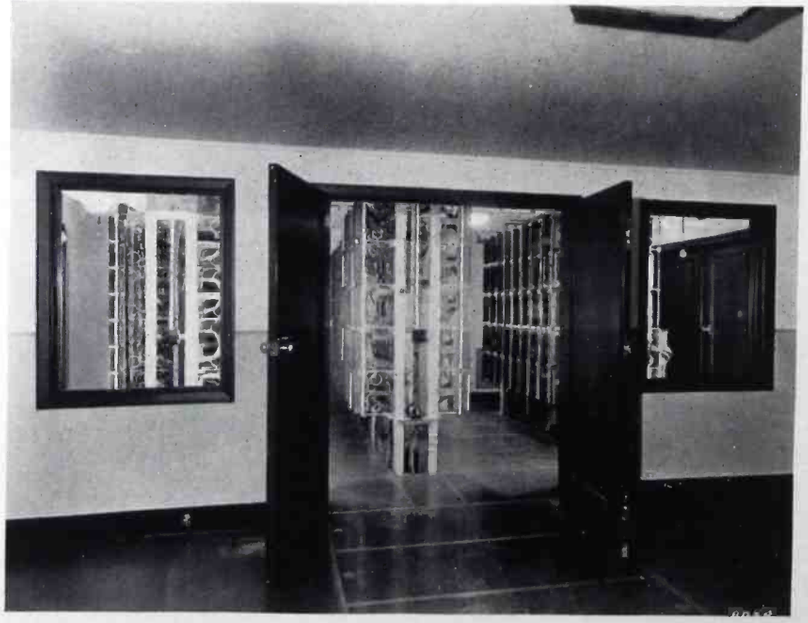
view may be obtained of the "Master Control Desk," power room and also telegraph and teletype facilities. In the lobby of the observation room is a model of the WJZ transmitting station, which station is located at Bound Brook, New Jersey. This model is about 12 ft. square and complete in every detail including grounds, landscaping, buildings, antenna towers, etc.

The Master Control Desk is the largest and most complete piece of equipment ever built for broadcast service. All of the NBC broadcasting programs are routed through this desk. Switching control at this point provides proper distribution of programs from the studios to the various networks and 87 NBC associated stations from coast to coast.

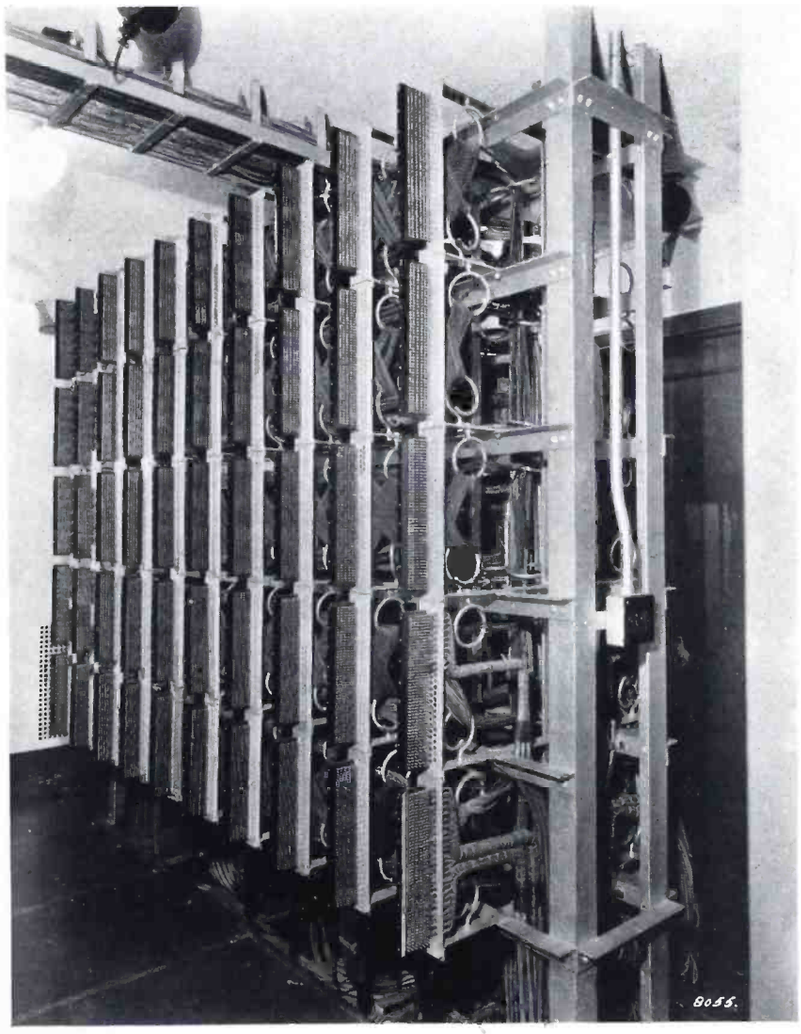
Testing apparatus also may be controlled from this desk. The desk contains hundreds of control switches, indicating lamps and jacks, also clocks, telegraph circuits, monitoring speakers and several microphones. Mounting of the equipment in this 27-ft. long unit required drilling and finishing approximately 6000 holes; in addition there are openings for clocks and other equipment in the ½-inch specially formed aluminum panels. There are 2,500 electrical relays associated with this "Master" control.

In the Master Control Room are located other facilities as follows: Test board for telephone and broadcast lines, test equipment, telephone exchange for private lines to outside pickup points, automatic recording equipment for program level and carrier, patching circuits and associated equipment, monitoring loudspeakers, hundreds of jacks for circuit termination, also trouble alarm system.

In addition to the Master Control Room, a special control room has been provided for handling of special events, such as broadcasts from other countries, airplanes, ships at sea, mobile transmitters, and so forth. This special control room permits a "director" to keep in touch with the originating point of the transmission, and pickups may be handled from ten different points at one time to feed



VIEW LOOKING INTO THE MAIN DISTRIBUTING FRAME ROOM SHOWING THE THREE FRAMES WHERE ARE TERMINATED 1250 MILES OF WIRE



THIS VIEW SHOWS A CLOSE-UP OF ONE OF THE THREE MAIN DISTRIBUTING FRAMES WITH THE TERMINATION BLOCKS AND METHOD OF HANDLING THE WIRES AND CABLES TO THE BLOCKS

the program to the broadcasting network, as required. An "announcer's position" is also incorporated in conjunction with the "director" to handle program continuity. In this special program arrangement, as many as twenty-one microphones may be used.

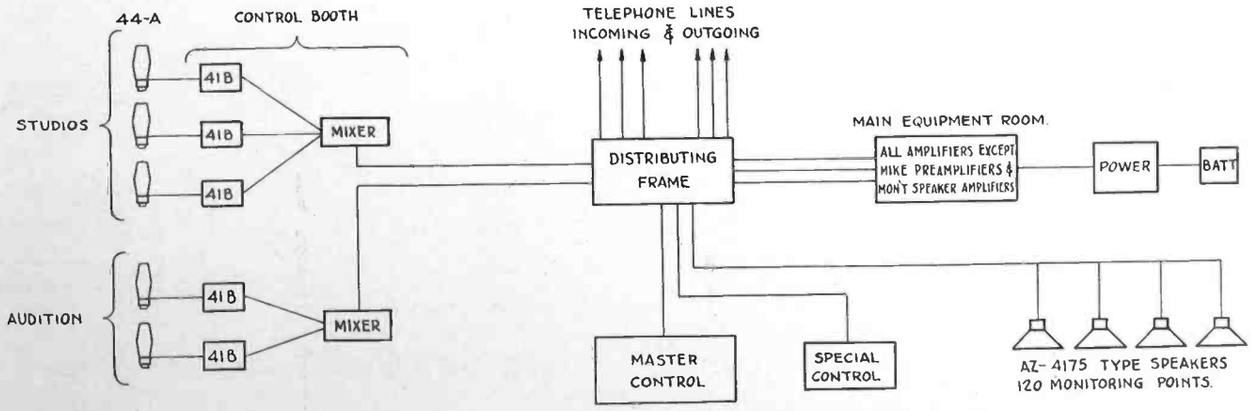
Main Distributing Frame

Back of the Master Control Room is located the "main distributing frame." At this frame terminate all the incoming and outgoing telephone lines, all circuits to the Master Control Room and special control room, all studio speech and program switching channels, audition studio circuits, monitoring channels serving 120 points, program channels and switching and signalling circuits from the main equipment room. Power circuits are also routed through the main distributing frame room.

This room is remarkable in many respects in that over 1250 miles of wire are routed through or terminated at this point. There are literally hundreds of thousands of soldered connections to terminal blocks located on this distributing frame to complete thousands of circuits. The wires terminating or routed through this room include single pairs and various sized cables, some containing 1800 conductors. The room is constructed of fire-proof materials and is equipped with a special CO_2 automatic fire protection; obviously no water can be present in this room, even in case of fire.

Power Supply

The power supply to NBC headquarters to drive ten specially designed motor generator and battery charging units is 208 volts, 3 phase, 60 cycles. The photographs of the power room show the filament and plate supply charging motor gen-



SCHEMATIC BLOCK DIAGRAM N.B.C STUDIO SYSTEM.

(ABOVE) POWER CONTROL DESK SHOWING POWER CIRCUITS IN MINIATURE, TOGETHER WITH INDICATING METERS AND LIGHTS. THIS DESK IS THE REMOTE CONTROL POINT FOR ALL OF THE POWER EQUIPMENT

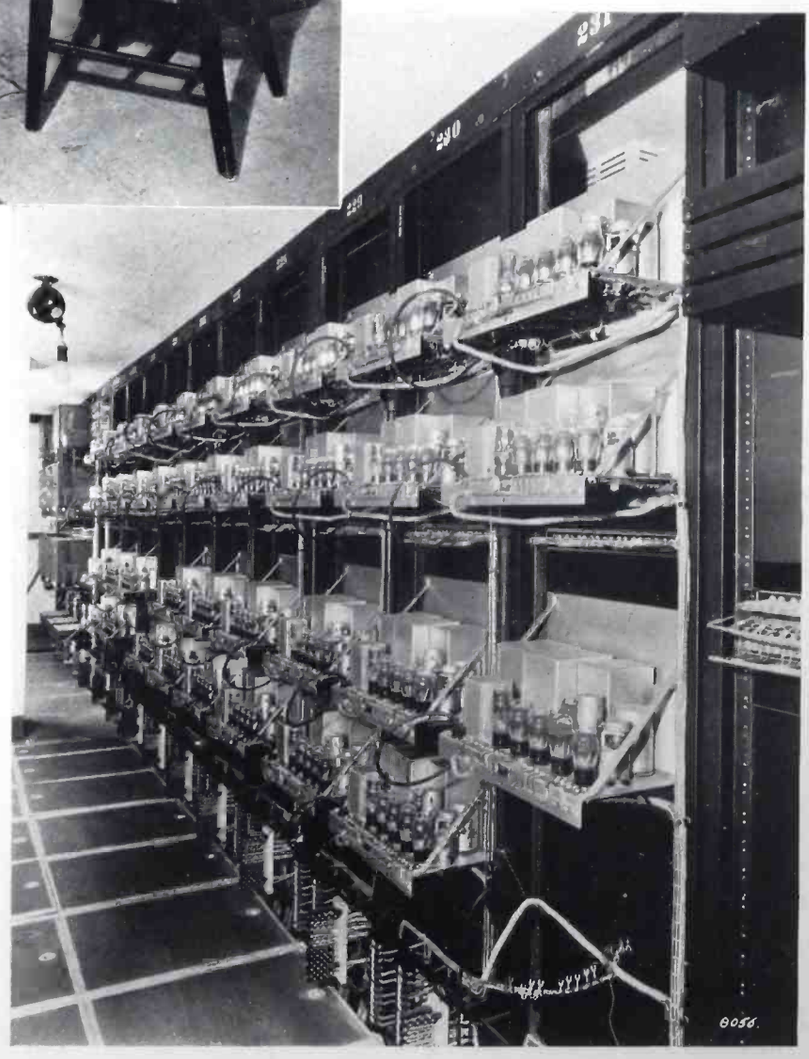
erators, exciter units, power control desk and the eight power boards which include the power distribution board, motor generator control board, fuse and circuit breaker alarm systems and filter equipment.

The motor generators are mounted in such a way that any vibration that might be present in the machines is prevented from being transmitted to the building frame. These machines have a "loaded" cement base very carefully mounted on spring cushions. The springs are just the proper size and under the correct compression to thoroughly insulate vibration in the machines from the floor on which the machines rest. Isolation of any vibration or noise was necessary due to the fact that the machines are directly over studios on the floor below the power room.

Located in the power room is the electrical mechanism for setting to the correct time the 275 synchronous electric clocks throughout the NBC portion of the building. Clocks are checked several times each day and are accurate to within a very few seconds at any time during the twenty-four hour period; correct time, of course, being very necessary for broadcast network synchronizing and announcements for starting and terminating broadcast programs.

The storage batteries, weighing fifty tons, used in conjunction with the power supply system, are adequate to continue broadcasting operations for a week without recharging. Except in cases of a main power supply

(BELOW) REAR VIEW OF A GROUP OF "ALL-AC OPERATED" MONITORING AMPLIFIERS OF THE AA-4194 TYPE. MANUFACTURED FOR NBC BY RCA VICTOR CO., INC.



(ABOVE) TYPE AZ-4175 HIGH-QUALITY MONITORING LOUDSPEAKER AND DIAL CONTROL PROGRAM SELECTOR

failure, the storage batteries are not called upon to supply power for the system, as the motor generators carry the load at all times, permitting the storage batteries to continuously get a "floating charge." These batteries also function as a part of the filter system to smooth out any voltage variation that might occur from the charging motor generators. The voltage ripple from this power supply is less than one microvolt per volt.

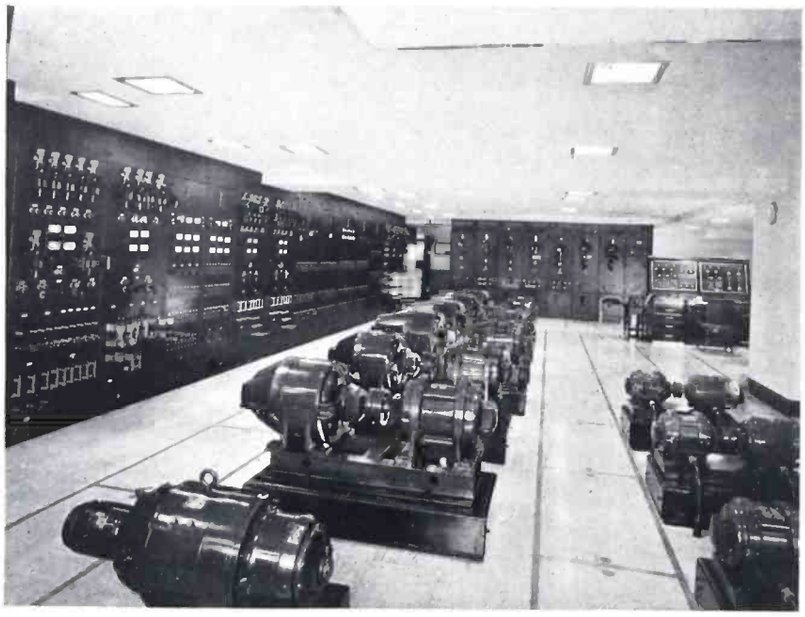
Equipment Room

In this room are located over 300 speech input equipment racks, which racks are used for mounting most of the 300 amplifiers. The amplifiers include studio amplifiers, monitoring amplifiers, line amplifiers, test amplifiers and talk-back amplifiers. These latter amplifiers are used for studio booth to studio loudspeaker program directing during rehearsals.

(BELOW) THE TWO-STORY STUDIO (3-E), IN WHICH THE WALLS ARE PROVIDED WITH ACOUSTIC PANELS WHICH ARE ADJUSTABLE FROM THE OPERATOR'S CONTROL BOOTH. THUS RESONANT OR ABSORBENT SURFACES MAY BE PROVIDED AS DESIRED

(ABOVE) RECEPTION LOBBY AND DESK, LOCATED ON THE SECOND FLOOR OF THE NBC HEADQUARTERS AT RADIO CITY

Other apparatus in the equipment room includes the radio receiver monitoring system, monitoring automatic switching apparatus, power protection devices, interphone central station (broadcast facilities), relay system for program channel switching. In addition to the



VIEW OF POWER ROOM SHOWING THE TEN MOTOR GENERATOR UNITS, SWITCHBOARDS AND POWER CONTROL DESK

apparatus just mentioned are many hundreds of terminating jack strips, test board, maintenance desk and other miscellaneous equipment.

Studio Control Booth

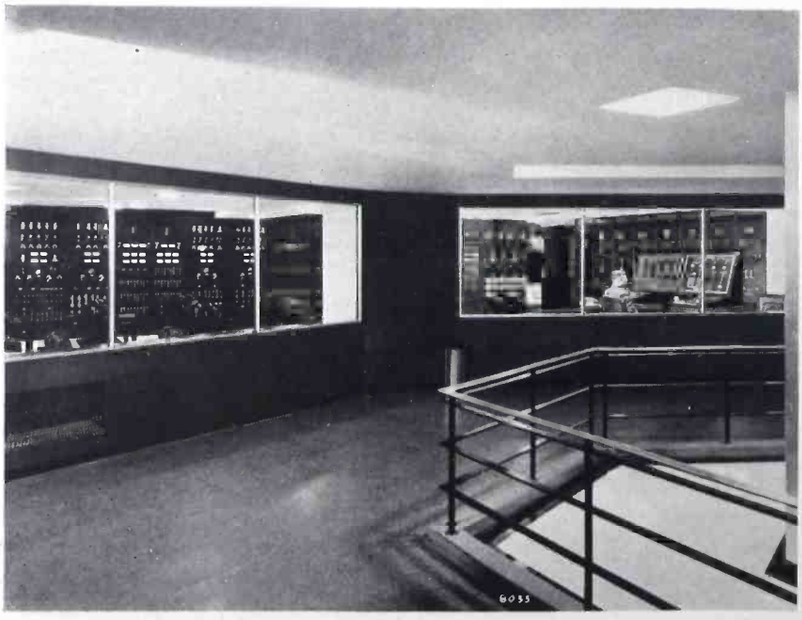
Each of these booths is equipped with a large special glass window looking into their respective studio. Studio 8 H has two control booths; the main booth is located at the floor level, the secondary booth is above at the second floor, or gallery level. Due to the vast size of Studio 8 H, it is sometimes necessary to utilize both for adequate control of the large program setup. Each studio control booth is equipped with a booth console control desk (see photograph) wherein are mounted microphone mixers, main gain control, volume indicating instruments and other control units so necessary for proper handling of the broadcast programs.

In addition to the control console in each control booth, there are two speech input equipment racks for mounting the numerous Type 41-B microphone pre-amplifiers, meter panel, circuit breakers, relays and indicating lights. The photograph shows the Type AZ-4175 high fidelity loudspeaker located at the left of the equipment racks. The microphone standing on the control console is used for studio talk-back and directing.

All of the 250 studio microphone outlets (for both velocity and condenser type) are terminated at these consoles, also all pre-amplifiers, signalling system, indicating lamps, talk-back control and inter-phone.

NBC Photo

RICHARD C. PATTERSON, Jr., EXECUTIVE VICE PRESIDENT OF **NBC**, TRIES OUT THE NEW DIAL SYSTEM IN **NBC's** RADIO CITY HEADQUARTERS, WHICH AUTOMATICALLY TUNES IN FORTY-TWO DIFFERENT STATIONS OR STUDIOS. **O. B. HANSON** (LEFT), **NBC** MANAGER OF TECHNICAL OPERATIONS AND ENGINEERING, EXPLAINS THE WORKINGS OF THE "GADGET"



LOOKING INTO THE POWER ROOM FROM THE VISITORS' FIFTH-FLOOR OBSERVATION LOBBY

"FIFTY TONS OF STORAGE BATTERIES." THE HEAVY METAL BARS CARRIED ON THE CEILING INSULATORS ARE THE 14-VOLT BUSES

Monitoring System

High fidelity loudspeaker reproducing units are installed in each studio control booth, studios, clients' booths, public observation rooms, waiting rooms and offices. These units are known as Type AZ-4175 Monitoring Loudspeakers. One of these units is shown in the accompanying photographs. You will note that the design of this unit allows unusual accessibility of component parts for any servicing that might be required, such as renewing vacuum tubes. These loudspeakers were especially designed for the new NBC Studios, and are very carefully designed and constructed so that the correct electrical and acoustical balance is obtained. These monitoring speakers are capable of reproducing not only the fundamentals of speech and music but the overtones existing at the higher frequencies—so necessary for "recreating" the original broadcast programs.

Each of the 120 monitoring loudspeaker locations is provided with an automatic telephone type selector dial. Mounted with the dial is the "On-Off" power control button, together with "volume + – button, also "re-dial" button. Selection of one of fifty programs is obtained by pushing the "ON" power button, dialing the proper number (mostly two number combinations) and setting the volume desired by utilizing the + – volume control button. To select a different program only requires pushing the "re-dial" and dialing the proper number combination.

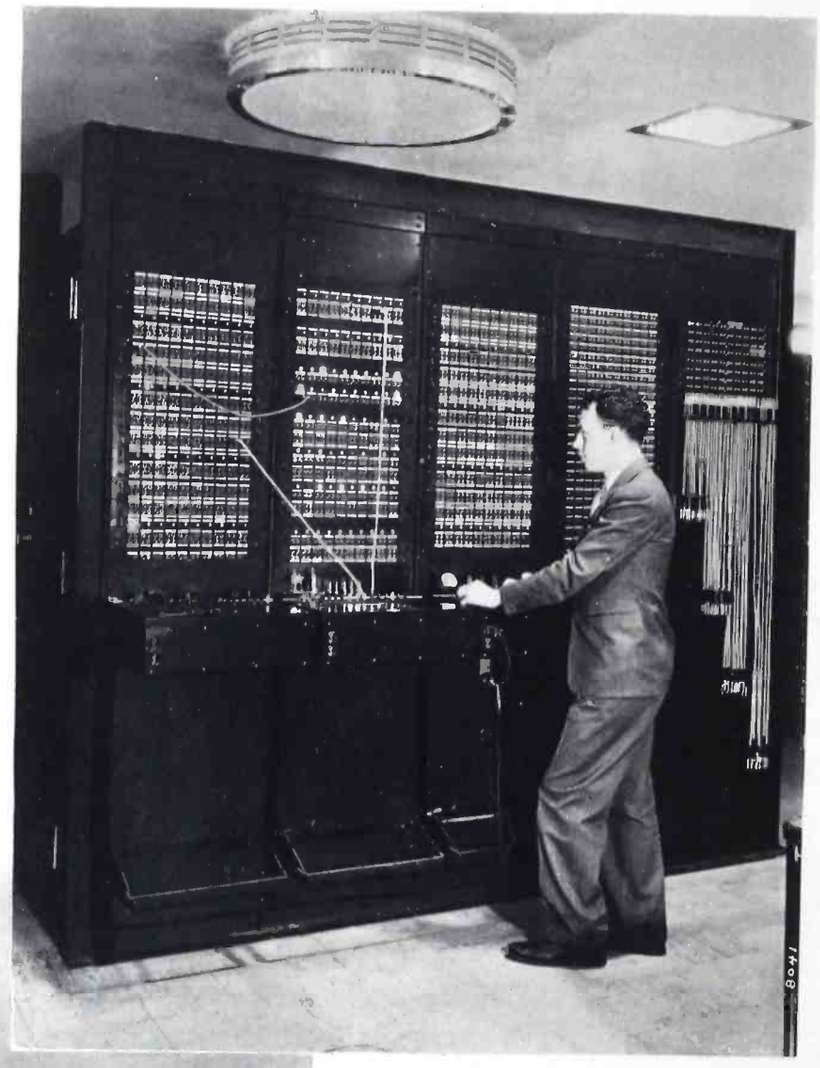
Vacuum Tubes

Insomuch as we are all familiar with vacuum tubes as used in broadcast receivers in the home and elsewhere and as a matter of statistics, it is interesting to know that there are 2000 vacuum tubes in use at NBC Radio City Studios. The condition of most of these tubes is checked every day so that there will be no chance of program failure due to a tube not functioning properly.

In conclusion, we might mention that anyone having a chance to visit the new NBC headquarters in Radio City, New York, would find it well

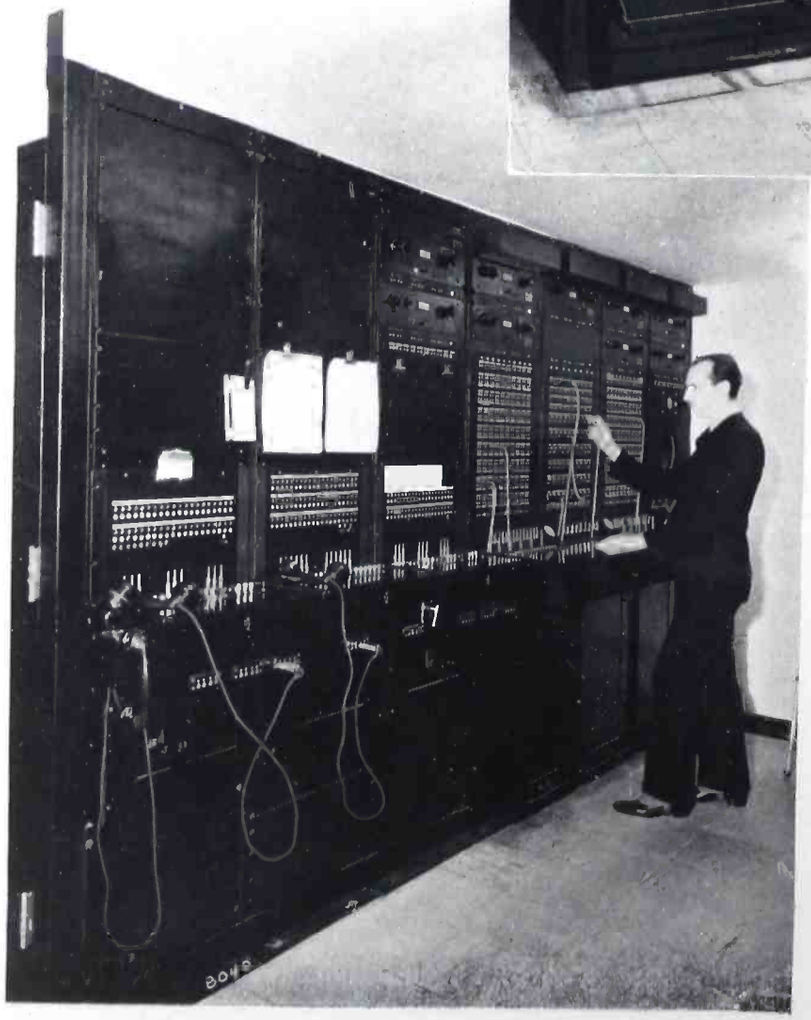
VIEW SHOWING SOME OF THE RACKS AND AMPLIFIERS LOCATED IN THE EQUIPMENT ROOM. AMPLIFIERS SHOWN ARE STUDIO, TALK-BACK, ISOLATION AMPLIFIERS SUPPLIED TO NBC BY RCA VICTOR CO., INC.

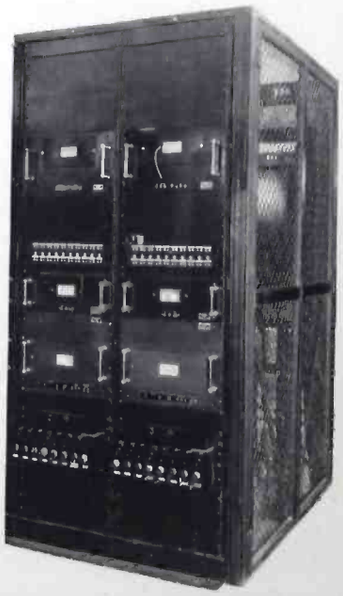
worth their time to go through this vast and modern broadcasting studio system. Specially conducted tours are arranged for visitors throughout the day and evening, which tours are under the supervision of trained guides, who explain the various points of interest and some of the intricacies of the broadcasting art. The tour includes a visit to a museum containing a historical collection of radio equipment and vacuum tubes and, as an indication of what can be seen in this exhibit, one section incorporates the evolution of the microphone as used in broadcasting. Actual workable apparatus is on display.



(BELOW) VIEW SHOWING TERMINATION OF OUTSIDE PICK-UP LINES, ALSO PRIVATE TELEPHONE LINE EXCHANGE. THE ENGINEER IN THE PHOTOGRAPHS IS STANDING IN FRONT OF THE "DROP-CORD PATCHING" UNIT. AT THE TOP MAY BE SEEN SOME OF THE SPECIAL TELEPHONE LINE EQUALIZERS SUPPLIED BY **RCA VICTOR CO., INC.**

(ABOVE) LINE TERMINATING RACKS LOCATED IN THE MASTER CONTROL ROOM

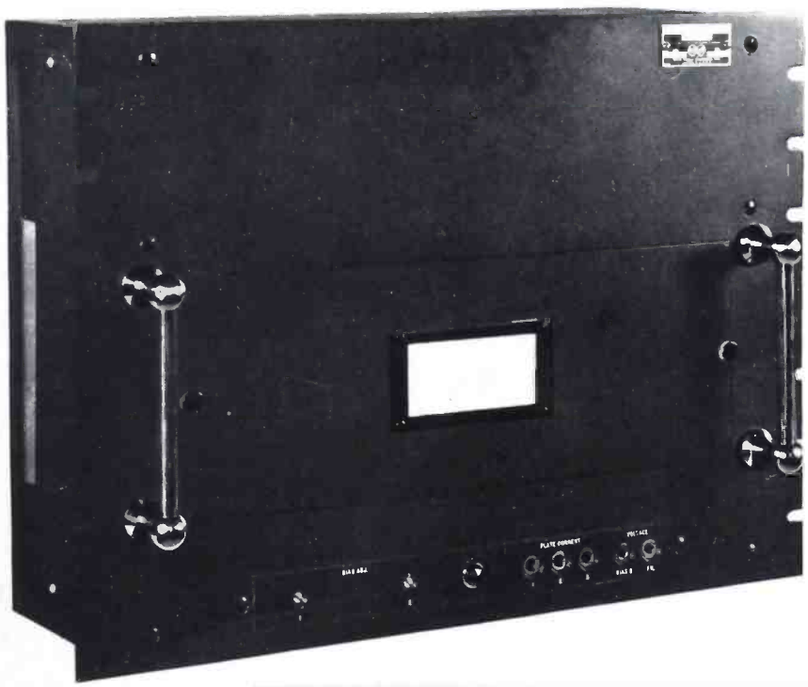




(ABOVE) A TYPICAL SPEECH CHANNEL LINEUP AT THE TOP IS THE LINE AMPLIFIER, TYPE AA-4162, IN THE CENTER IS THE TALK-BACK AMPLIFIER, TYPE AA-4164, AND AT THE BOTTOM IS THE STUDIO AMPLIFIER, TYPE AA-4163

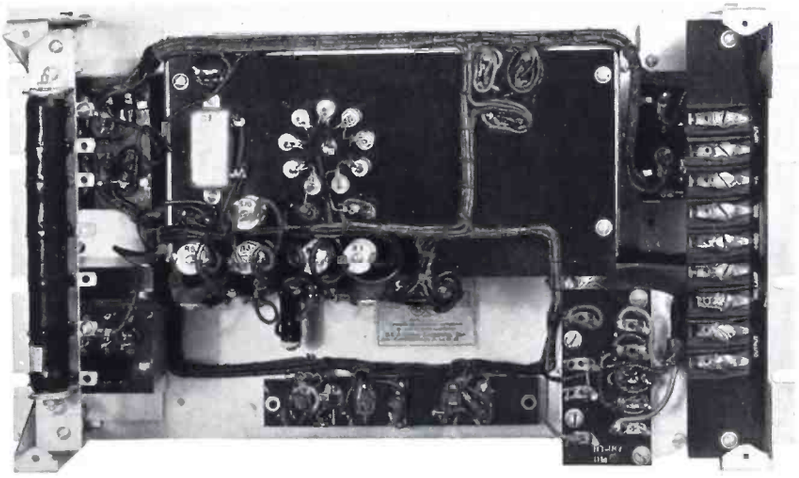
SOME OF THE EQUIPMENT AT NBC's Radio City Studios

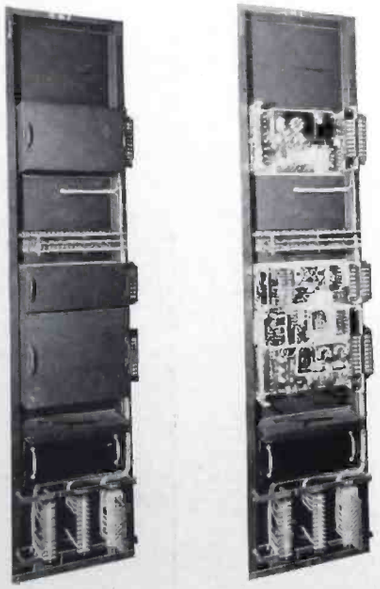
(SEE ALSO TWO PAGES FOLLOWING)



(LEFT) FRONT VIEW OF **RCA VICTOR** TYPE AA-4163 STUDIO AMPLIFIER

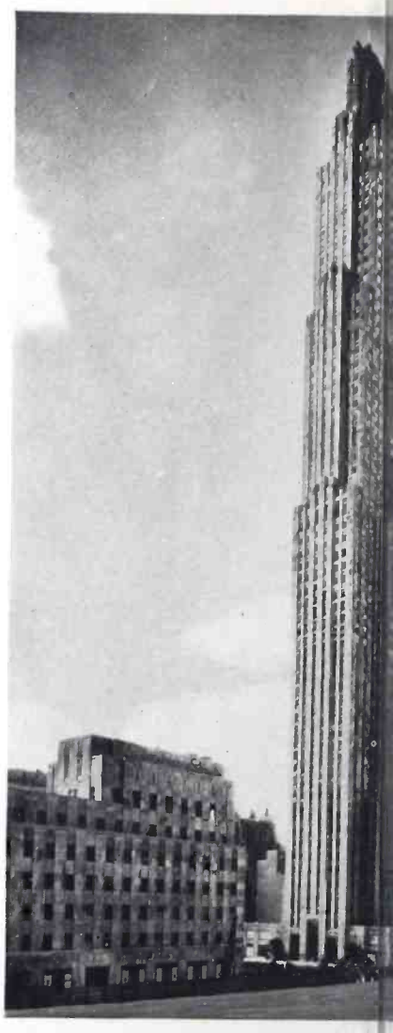
(RIGHT) REAR VIEW OF RCA VICTOR LINE AMPLIFIER, TYPE AA-4162. SHIELDING COVER REMOVED. NOTE ACCESSIBILITY OF COMPONENT PARTS





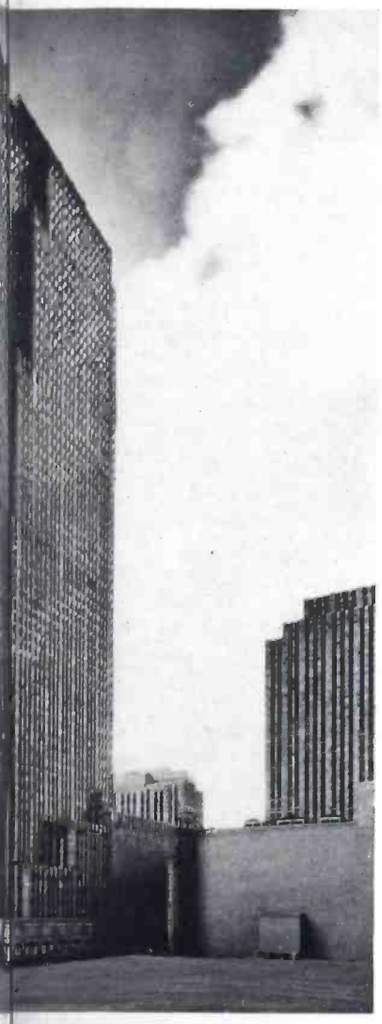
(ABOVE) REAR VIEWS OF SPEECH CHANNEL EQUIPMENT SHOWN ON OPPOSITE PAGE. ONE WITH COVERS IN PLACE AND THE OTHER WITH COVERS REMOVED. THIS EQUIPMENT WAS SUPPLIED BY **RCA VICTOR COMPANY, INC.**

(BELOW) ANNOUNCERS' CONTROL DESK (EACH STUDIO IS EQUIPPED WITH ONE OF THESE UNITS)



NBC AT "R

1. THE TOWERING RCA BUILDING, IN ROCKEFELLER CENTER, NEW YORK, IN WHICH ARE LOCATED THE STUDIOS AND EXECUTIVE HEADQUARTERS OF NBC
2. WORLD'S LARGEST BROADCAST ROOM. THE AUDITORIUM (8-H) STUDIO IN NBC's RADIO CITY HOME
3. THE CLIENTS' OBSERVATION GALLERY, OVERLOOKING THE AUDITORIUM STUDIO
4. THE TWO-STORY STUDIO 3-B, SHOWING THE ADJUSTABLE STAGE IN THE FOREGROUND
5. THE MASTER CONTROL ROOM, WHERE OPERATORS ROUTE THE NBC PROGRAMS FROM THE



DIO CITY"

STUDIOS TO THE VARIOUS NETWORKS, COMPOSED OF 87 NBC ASSOCIATE STATIONS FROM COAST TO COAST

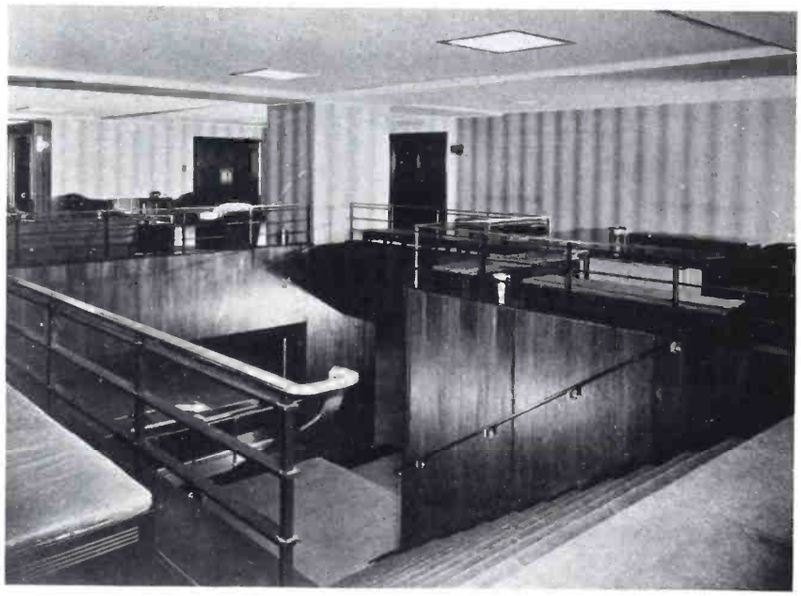
6. BOOTH CONTROL CONSOLE, AND THE WAY THE STUDIO APPEARS TO THE CONTROL ENGINEER

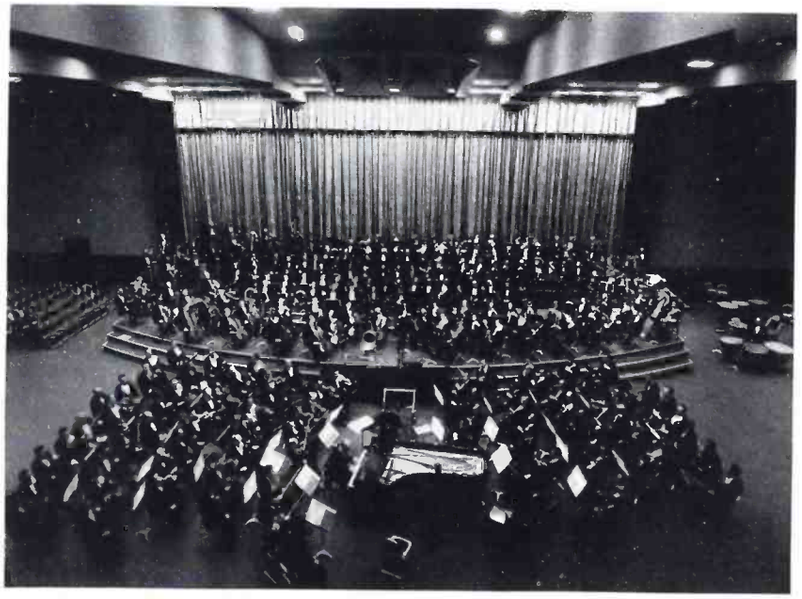
7. MEZZANINE LOUNGE, SHOWING VIEW DOWN STAIRCASE INTO RECEPTION LOBBY

8. THE LARGEST ORCHESTRA EVER HEARD ON THE AIR, BROADCAST FROM THE WORLD'S LARGEST RADIO STUDIO. FOUR HUNDRED MUSICIANS PLAYING IN THE HUGE AUDITORIUM STUDIO

(5)

(7)





(8)

(6)

Recordings and Transcriptions

Raymond Sooy, and his brother Charles, have become famous the world over through their sound recording activities both at Camden, New Jersey, and far afield.

ONE of the very interesting activities of the RCA Victor Company is found in the business of sound recording—a fascinating art which requires a maximum technical and artistic ability on the part of the personnel engaged in this work.

It is a far cry from the early attempts at recording on the primitive little six-inch discs by means of the megaphone, and the stylus vibrated by a mechanical diaphragm—to the modern electrical method employing microphones, amplifiers, and the electro-magnetic stylus on thirty-minute records. The years intervening between those early attempts and the up-to-date High Fidelity methods have been full of scientific ventures and interesting experiences, as revealed in an interview with Raymond Sooy, who has been in charge of recording in the RCA Victor organization since 1903. He has personally supervised the recording of all the great artists who from time to time have visited Camden, so that their artistry might be preserved for posterity. He has recorded Caruso, Alma Gluck, Sembrich, Tetrazzini, Ellen Terry, Calvé, Cavalleria, Farrar, Melba, Homer, McCormack, Chaliapin, Gadsky, Titta Ruffo, Scotti, Kreisler, Paderewski, Kubelik, Plancon, and such outstanding organizations as the Philadelphia Symphony, under Leopold Stokowski; the Boston Symphony, originally under Dr. Karl Muck and later under Dr. Serge Koussevitzky; the Minneapolis Symphony, directed by Eugene Ormandy; the St. Louis Symphony under the direction of Rudolph Ganz; the San Francisco Symphony with Alfred Herrz directing; the London Symphony Orchestra under the direction of Sir Edward Elgar; the Symphony Orchestra under Sir Landon Ronald (in London), and the Symphony Orchestra under Albert Coates (in London).

RAYMOND SOOY, RCA VICTOR

The electrical, mechanical and acoustical problems involved in recording these great artists and these great organizations are as many and as involved as the problems of artistic personalities and temperamental complexes. A great symphony orchestra, having travelled across the continent, may be at last seated in the big recording studio, with the harps, the kettle drums, the bass viols, and all the smaller instruments safely unpacked and carefully tuned. At last, after all the weeks of preparation and careful arrangements have been made to "shoot" the sound, the leader rises before his music stand, taps his baton for attention, raises it high in the air—starting buzzer sounds, and—the temperamental director lays down his baton, turns on his heel and walks out. He has just remembered something else that he would rather do at the particular moment and everything else must be postponed until the morrow.

CHARLES SOOY, RCA VICTOR

"The business of recording these great artists," Raymond Sooy tells us, "is full of surprises. Mostly these people are temperamental, and I never know whether they will accuse me, as one did, of poisoning his drinking water—or whether, like the towering Chaliapin (after four years' absence), they will kiss me on the forehead. Some want the temperature at 60 degrees Fahrenheit and some at 80 degrees. Naturally, this affects not only the musical instruments but also the recording equipment, but we always manage to please them somehow, and 'get' the sound."

The famous Church Studio of the RCA Victor Company in Camden, N. J., has been the scene of recording most of the world's greatest artists and musical organizations in recent years, although much of the modern popular material is recorded in studios located in the various big cities of America and the wide world. One of the modern RCA Victor recording studios is located in New York, another in Chicago, and another in Hollywood. The foreign recording studios are located in Brazil, Argentina, Chile, China and Japan. The Gramophone Company, an associated organization, has recording studios in London, Paris, Calcutta, and other large cities of the continent. Original wax impressions of recordings made in most of these remotely located studios are carefully packed and shipped to "Radio Headquarters" at Camden, N. J., where they are processed and where sub-

sequently the quantities of pressings are made for sale not only in the United States but often abroad—in and about the territory where the recordings were made. Today, the familiar picture of the Victor Dog "Nipper" listening attentively to "His Master's Voice" is generally conceded among advertising men to be the best known trademark the world over.

The entire activities of the Recording Division, under the direction of Mr. Edward Wallerstein, are divided into branches, as follows:

A.—Electrical Transcriptions for Broadcasting.

B.—Electrical Transcriptions for Industrial and Commercial Applications.

CARUSO, GALLI-CURCI, DE LUCA, BADA—ON THE STEPS OF THE CAMDEN STUDIOS, WHICH ALL THE GREAT VOCAL ARTISTS HAVE VISITED AT ONE TIME OR ANOTHER

THE GREAT ARTIST HAS PASSED ON—BUT HIS VOICE WILL BE WITH US FOREVER. A DRAMATIC SETTING WHICH "BROUGHT DOWN THE HOUSE" DURING A RECENT PRESENTATION AT THE METROPOLITAN OPERA HOUSE IN NEW YORK. THE STAGE WAS DARK, EXCEPT FOR THE SPOT SHOWN HEREWITH—AND A VICTOR "RED SEAL" RECORDING BY THE BELOVED **CARUSO** WAS PLAYED SOFTLY THROUGH ELECTRICAL AMPLIFIERS

C.—Victor records for sale to the public (domestic).

D.—Records for sale to the public abroad (export).

E.—Records in foreign tongues or of foreign types for domestic sale.

F.—Personal recordings (for private performance).

G.—Sound on film, for motion pictures.

The Church Studio at Camden is a most interesting spot to the select few whose privilege it is to gain admittance, but for obvious reasons this part of the plant is not made accessible to sightseers. Aside from the fact that the presence of visitors is likely to disturb the recording artists and interfere with the work in progress, there is a great risk involved in letting the uninitiated wander about in a place where so much delicate equipment is exposed to the accidental or deliberate touch of the curious.

In addition to the permanent set-up for sound recording in the various studios mentioned, portable recording equipments are often dispatched far afield to "get" sound which cannot be brought into the studios. For example, a great symphony or a great choir performing outdoors in the huge Hollywood Bowl produces an entirely different effect from that which could be obtained in a studio,

HOPI INDIANS, PHOTOGRAPHED IN THE CAMDEN RECORDING STUDIOS DURING THE MAKING OF THE FIRST GENUINE INDIAN RECORDS

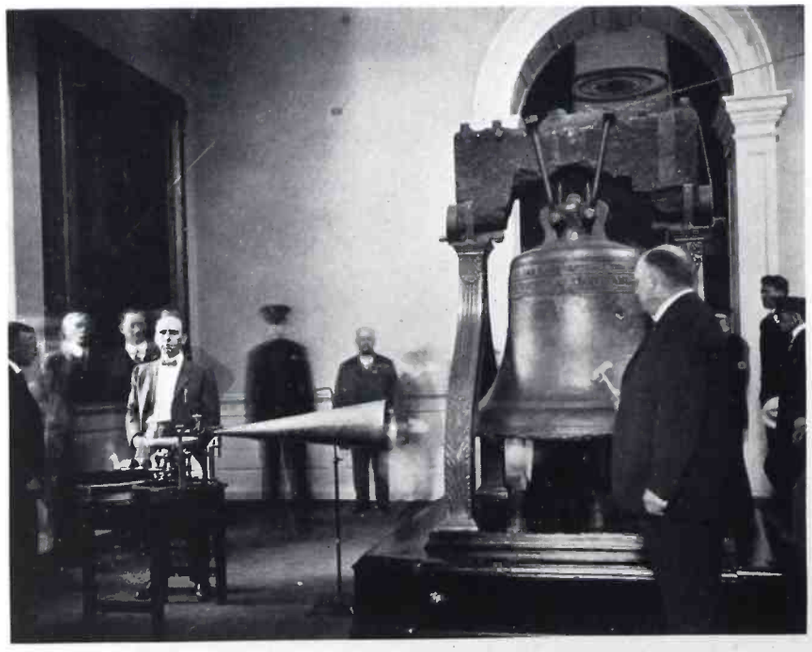
were it even possible to crowd these large organizations into a studio, and it becomes necessary to send portable recording equipment out on location to pick up many performances of this kind. The choir and the grand organ in the Mormon Tabernacle at Salt Lake City have been recorded in this manner, and when played upon the modern reproducing equipment in a living room, the listener receives the impression of being seated right in the great tabernacle.

On a recent recording trip to San Antonio, Texas, over 200 selections were made within the short space of three weeks, using portable recording equipment. Many Mexican selections, several "hillbilly" recordings and a number of race records were made during this session, and the original waxes were shipped into Camden for processing and releasing over an extended period of time.

In addition to the sound on disc recording activities, Mr. Raymond Sooy directs the sound on film recording work, which includes motion pictures, theatrical subjects such as dramas, comedies, news reels, etc., and also numbers of industrial films for use in sales-promotion and general prestige work. Thus, for example, a large coffee firm has produced an industrial sound motion picture which depicts the production of coffee—from its growth on the mountain sides in the Andes, its transportation over narrow-gauge railroads to the coast, transshipment into steamers bound for America, unloading on the docks in the United States, grinding and packing in the domestic plant, to finally showing the sale over the counter to the ultimate consumer and the enjoyment of the product at the breakfast table. In a picture of this type, as much attention is paid to the sound effects as to the optical effects, because it is of the greatest importance that the message of the sponsor be carried home forcefully to the observer, and yet in a manner which will be entertaining. To accomplish this, the voice of the announcer describing the various scenes and explaining the process is accompanied by a subtle background of music which changes in character with the scenes.

Post-synchronization is one of the most interesting tricks of the game.

LIEUTENANT GENERAL SADAO ARAKI
WAR MINISTER OF JAPAN, IN THE RECORDING STUDIOS AT TOKIO IN 1933. HE DIRECTED THE ACTIVITIES OF THE JAPANESE FORCES IN MANCHURIA



A PORTABLE RECORDER OF THE PAST
MAYOR SMITH, OF PHILADELPHIA, STRIKING THE LIBERTY BELL AS A SIGNAL TO OPEN THE SAN FRANCISCO EXPOSITION IN 1905, AND **RAYMOND SOOY** (BEHIND THE OLD-FASHIONED RECORDING DEVICE), MAKING A RECORD OF THE PROCEEDINGS

YES, IT WAS ONCE A HOUSE OF WORSHIP
TODAY IT IS THE FAMOUS "CHURCH STUDIO" WHERE THE WORLD'S GREATEST ARTISTS RECORD THEIR PERFORMANCES FOR POSTERITY

How are the various sound effects applied to a motion picture which has been originally "shot" silent? In answer to this question, Mr. Raymond Sooy leads us over to a huge file cabinet, and we note the index on each drawer classifying the various types of sound effect-records contained within. Some of the titles are as amusing as they are revealing, as, for example:

Crying Baby
Barking Dog
Howling Mob (Male)
Boos and Hisses (Female)
Steam Locomotive (Starting)
Train (Entering Tunnel)
Airplane (Taking Off)
Paddle Wheel Steamboat (Passing and Whistling)
Machine Gun Fire

and (here we hark back to the hectic days of 1918 over in rain-soaked Brest):

Walking on Duck Boards

Next Mr. Sooy escorts us to the mixing room, where a recordist sits before a control panel gazing out through a soundproof plate glass window at the image of a film which is being screened. To one side in this soundproof booth is a long table upon which is mounted a battery of turntables, all revolving in unison. A combination of sound-effect records has been prearranged on these turntables, and as the sound-effect man views the action on the screen, we note that, guided by a "cue sheet," he is manipulating various knobs and controls on the panel. "You see," says Mr. Sooy, "he is squirting in the right sound at the right time so that the finished film recording will seem just as though the sound had been recorded out on location." It seems to us like a good trick if it can be done—and apparently it is being done every day right here in this strange building which once was a House of God, and is still a House of Miracles.

We pass on into the next studio, where we hear an organist performing at the console of the great pipe organ, located at the far end of this large room. "Today," Sooy tells us, "the various ranks of organ pipes are in separate compartments located behind those groups of swell-shutters, any of which the organist can open and close at will through the manipulation of toe and heel pedals at the console. Thus he controls the volume of sound for gradual volume shading effects, or for sudden changes, as desired. In the old days of mechanical recordings, we had each rank of pipes out here on the floor, mounted on rubber-tired casters, with flexible wind tubing. We had dozens of porters here who, at given signals, would roll these groups of pipes up close to the recording megaphone or back away from it. Sometimes they would be called upon to move very slowly—other times they would have to rush back and forth to keep in synchronism with the performance of the organist. They used to get in each other's way; collisions would occur, and the recordings would be spoiled. Today, thanks to electrical microphones, modern amplifiers, and the whole High Fidelity electrical recording system, those antics are just memories that make us smile. But," he added, "they were milestones along the path of progress that has led up to the present perfection of the art."

Here, in the same atmosphere where for years the great stars have always recorded, the Rudy Vallées, the Paul Whitemans, the Lawrence Tibbetts, the Guy Lombardos, and the rest of the famous and popular artists of the day, now record their performances for posterity, and here may be found Raymond Sooy, directing the recording activities of these artists of today, just as in years gone by he directed recordings by the immortal Caruso, Victor Herbert, Sousa, and countless others who will record no more, but whose art, thanks to Raymond Sooy, will live on for us and for the generations that are to come.

Terrestrial Magnetism and Short-Wave Radio

Predictions of magnetic activity helpful in scheduling successful programs. While radio telegraph service is only slightly affected, magnetic storms seriously influence the reception of voice and music

By H. H. BEVERAGE, Chief Research Engineer, R. C. A. Communications, Inc.

FOR many years, it has been known that a relation exists between Terrestrial Magnetism and the Propagation of Short-Wave Signals. Reception of distant short-wave signals becomes difficult during a severe magnetic storm.

Back in 1928, R. C. A. Communications, Inc., and the National Broadcasting Company inaugurated a joint program for regularly receiving foreign short-wave broadcasting stations at Riverhead, L. I. In addition to the data obtained from the Riverhead observations, reception reports were received from the General Electric Company and the Westinghouse Electric and Manufacturing Company. During 1928 and 1929, a considerable number of reception reports were also received from the British Broadcasting Corporation of England and Philips Radio of Holland, and during 1929 and 1930 from the Reichs-Rundfunk-Gesellschaft of Germany. These foreign reports covered reception primarily in those three countries of North American stations.

These data were carefully studied by the National Broadcasting Company, and the correlation of magnetic activity with reception yielded some very interesting information which was published by Messrs. R. M. Morris and W. A. R. Brown of the National Broadcasting Company in the Proceedings of the Institute of Radio Engineers for January, 1933, in a paper entitled "Transoceanic Reception of High Frequency Telephone Signals."

One of the most interesting conclusions reached by Morris and Brown was that the magnetic disturbances which influence short-wave reception tend to occur at intervals of approximately 27 days, thereby making it possible to predict reception conditions with a sufficient degree of accuracy to be very useful.

R. C. A. Communications, Inc., has a great volume of data in the form of radio telegraph logs taken over a period of years, and a study of some of these data in relation to magnetic disturbances was undertaken by Mr. H. E. Hallborg. This study showed a useful degree of correlation confirming and extending the studies of Messrs. Morris and Brown.

It seemed evident that predictions for short-wave reception conditions similar in accuracy to the usual weather forecasts might be expected. Since the weather man seems to miss his predictions occasionally, we believe we are justified in thinking that we can predict the conditions for short-wave reception two to four weeks in advance with about equal accuracy.

The predictions are based on the repetition of magnetic storms in a cyclic sequence. The disturbances are more or less related to sun-spot activity, and the rotation of the sun apparently provides the cyclic sequence of magnetic storms.

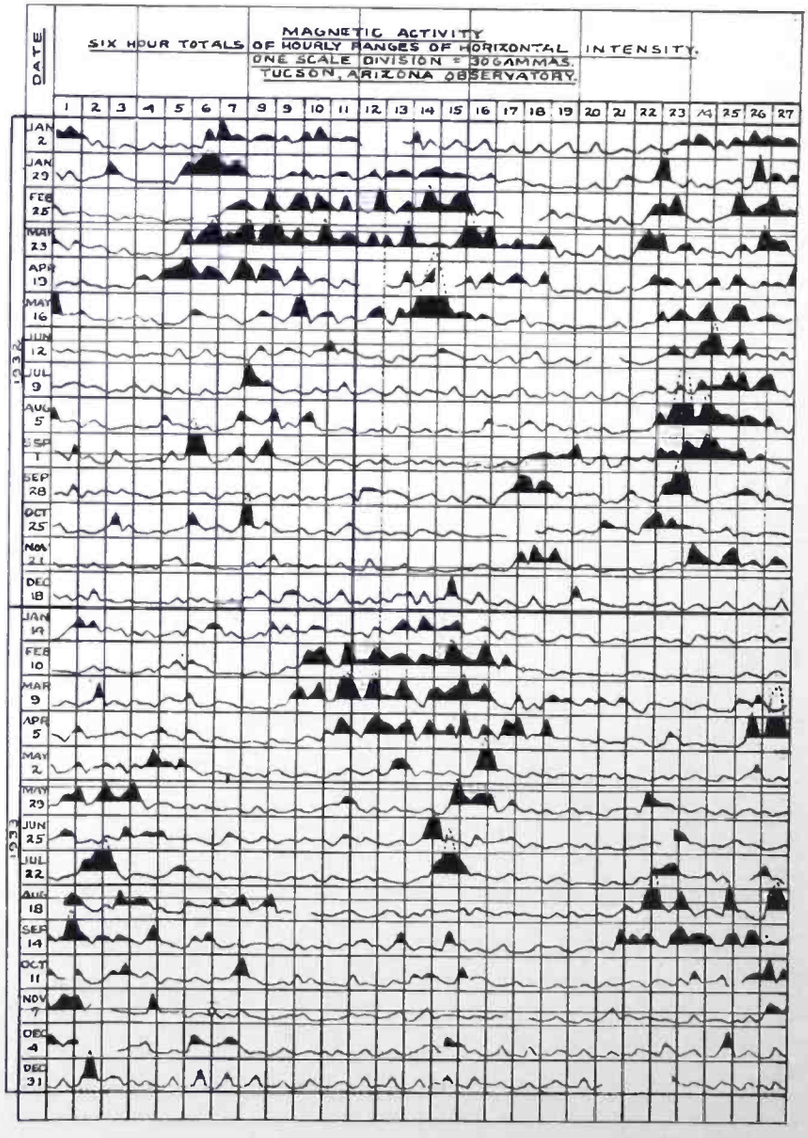


FIGURE 1

Perhaps the best way to explain this repetition of magnetic storms is to refer to Figure 1, which shows one of Mr. Hallborg's charts of magnetic activity taken from magnetograms furnished by the Government Observatory at Tucson, Arizona.

On this chart, ordinates are magnetic range, one scale division representing 30 gammas. If the magnetic range extends beyond 60 gammas, we have found by experience that this range is sufficient to disturb the reception of short-wave signals. Accordingly, all ranges above 60 gammas have been filled in with black ink to make it instantly apparent, in looking at the chart, where the disturbing magnetic conditions lie.

It may also be noted that the abscissa extends from 1 to 27, indicating that the magnetic ranges are plotted on the basis of a 27-day period. Astronomers tell us that the polar regions of the sun rotate once in approximately 34 days, while the equator rotates once in approximately 24 days. Since the magnetic disturbances tend to repeat themselves on the average of every 27 days, it seems probable that the sun spots, or other conditions on the sun, which have the greatest effect on the magnetic conditions on the earth, are located at such a latitude on the sun that the average period of rotation is approximately 27 days.

This is the basis of the prediction service, that is, if we have a magnetic disturbance on a certain day, say November 7th, we would expect this disturbance to appear again 27 days later, or on December 4th, as indicated on the chart for 1933.

In general, this repetition tends to occur for several cycles, although it is not an invariable rule, particularly if the magnetic storm is a very severe one. For example, on August 5, 1933, an unusually severe magnetic storm occurred, but this disturbance did not repeat 27 days later, although it did appear again 54 days later with much less intensity than on August 5th.

In this case we predicted disturbed conditions on September 1st, but actually found no disturbance. Thus, it is not possible to be sure of the accuracy of the predictions, but, in general, it is possible to predict the times which are subject to disturbance and the times which are reasonably certain to be free from disturbance.

We have found good co-ordination between subnormal signals and magnetic range, so that wherever a black peak occurs on the chart, the effect has almost invariably been noticeable on signal transmission, especially from Northern Europe. Of course, there are many factors to consider, such as distance, direction, season, time of day, frequency, etc. For example, if a frequency is too low for a given circuit at a certain time of day, a moderate magnetic disturbance might actually increase the intensity of the signal above normal

(Continued on Page 51)

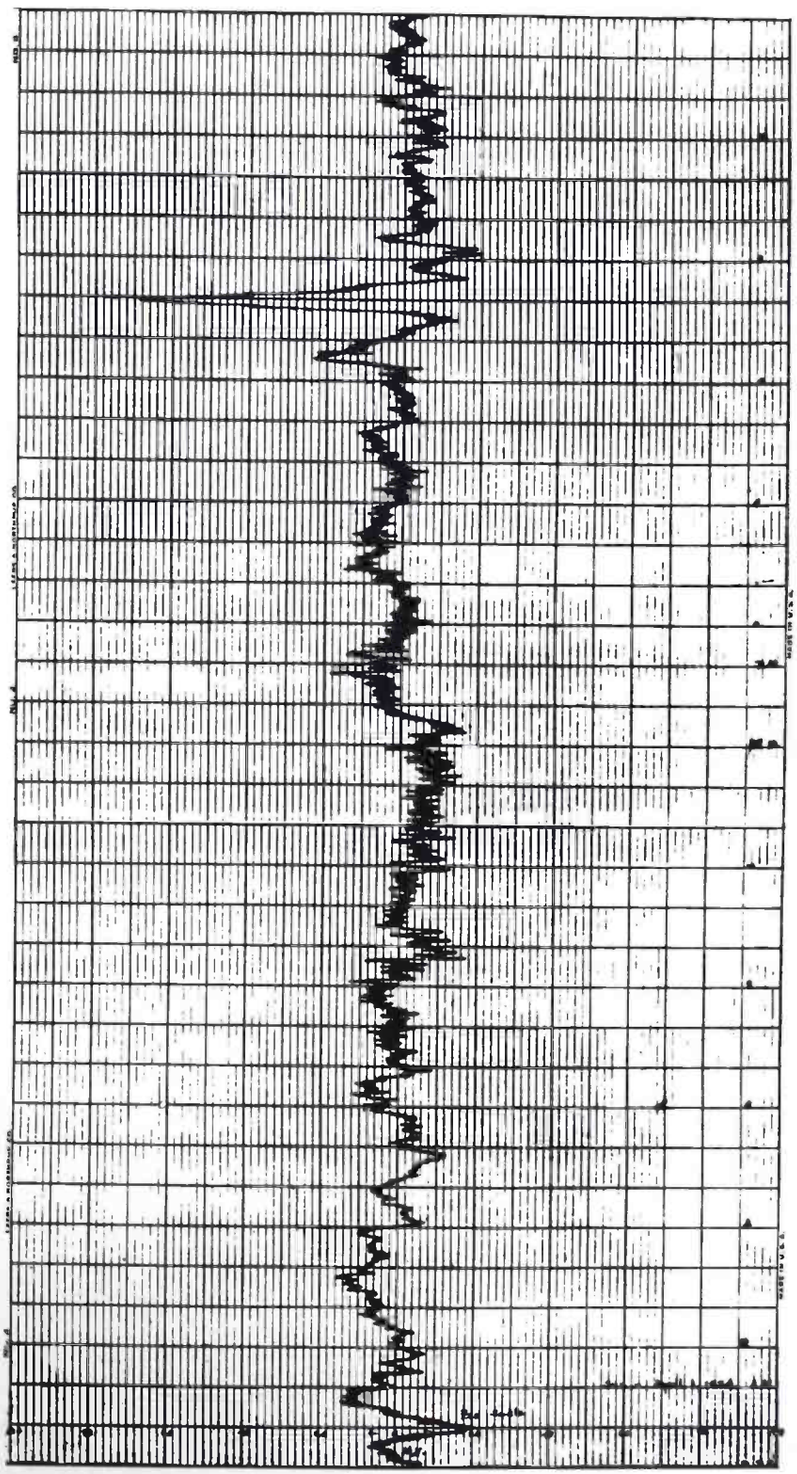


FIGURE 2

The Operation of Mercury Vapor Rectifier Tubes

By J. B. EPPERSON, Chief Engineer, WNOX

IT HAS been stated that broadcasting stations are satisfied with a life of approximately 1000 hours from a mercury vapor rectifier tube, and that if the equipment designers could be persuaded to design their equipment around the tube instead of forcing the tube into an improperly designed device, tubes could be furnished with a life up to 5000 hours.[1] In connection with this statement, the writer wishes to point out some of the conditions under which mercury vapor tubes of the 872 type have been operated where a fairly consistent life of from 4500 to 6200 hours is obtained even though the tubes are operated practically at their maximum peak voltage limit. The references to tubes throughout this article refer to the de Forest type 572, although other makes have been used with equally good results. The maximum peak plate voltage of this tube is 7500, and the maximum d-c output (theoretical) that can be obtained without exceeding the peak voltage rating is 7170 volts.[2]

The rectifier circuit used was that of the familiar three-phase full-wave voltage doubling or bridge type. The average d-c output from this rectifier is 7000 volts at a current load of .6 amp.

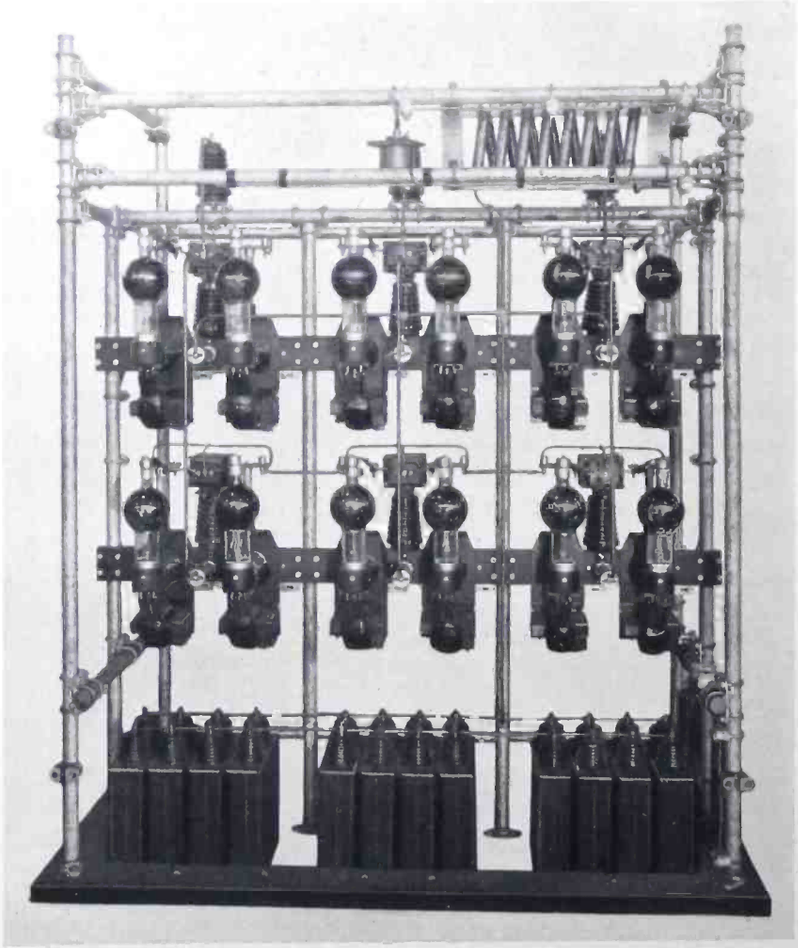
One of the largest single factors in the life of mercury vapor tubes is that of the operating temperature. Most manufacturers of these tubes specify an ambient temperature of from 0 to 50 degrees Centigrade (32 to 122 degrees Fahrenheit). Some manufacturers give no other caution than that just mentioned. Too much emphasis cannot be placed on the importance of operating these tubes within the correct temperature limits. With the data sheet accompanying the de Forest 572, the manufacturers have this to say: "It is well to remember that in the operation of mercury vapor rectifiers, the temperature of the audion is of major importance and that the cooler the tubes are kept the better the service that is to be expected." Similarly from the RCA instruction sheet: "Forced ventilation may be necessary to prevent exceeding the maximum allowable temperature under all conditions. In any case an adequate circulation of air is necessary and forced ventilation may be desirable from the standpoint of tube safety and life."

Mercury vapor tubes, where the circulation of air is restricted, and the temperature in the vicinity of the envelope is allowed to reach approximately 100 degrees Fahrenheit, have a tendency to flicker or rectify in spots which dance about around the center of the tube. This condition is brought about by the high temperature and can be cured instantly by means of a circulating fan so directed as to set the air in motion about the tubes. If the temperature is allowed to rise very much in excess of the point where this unstable operation begins, and if the affected tubes have been used more than from 1000 to 1500 hours,[3] a flash will occur within the tube near the anode cap. Tubes which are

1. "Mercury Vapor Rectifier Tubes," by Paul G Weiller. Electronics, April, 1933.

2 Applies to the three-phase full-wave circuit only.

3 Depends on characteristics of individual tubes.



TWELVE TYPE UV-869 RCA RECTIFIER TUBES IN A TYPICAL ARRANGEMENT. THE RECTIFIER SHOWN CONSTITUTES PART OF A 40 KW SHORT-WAVE TELEGRAPH TRANSMITTER

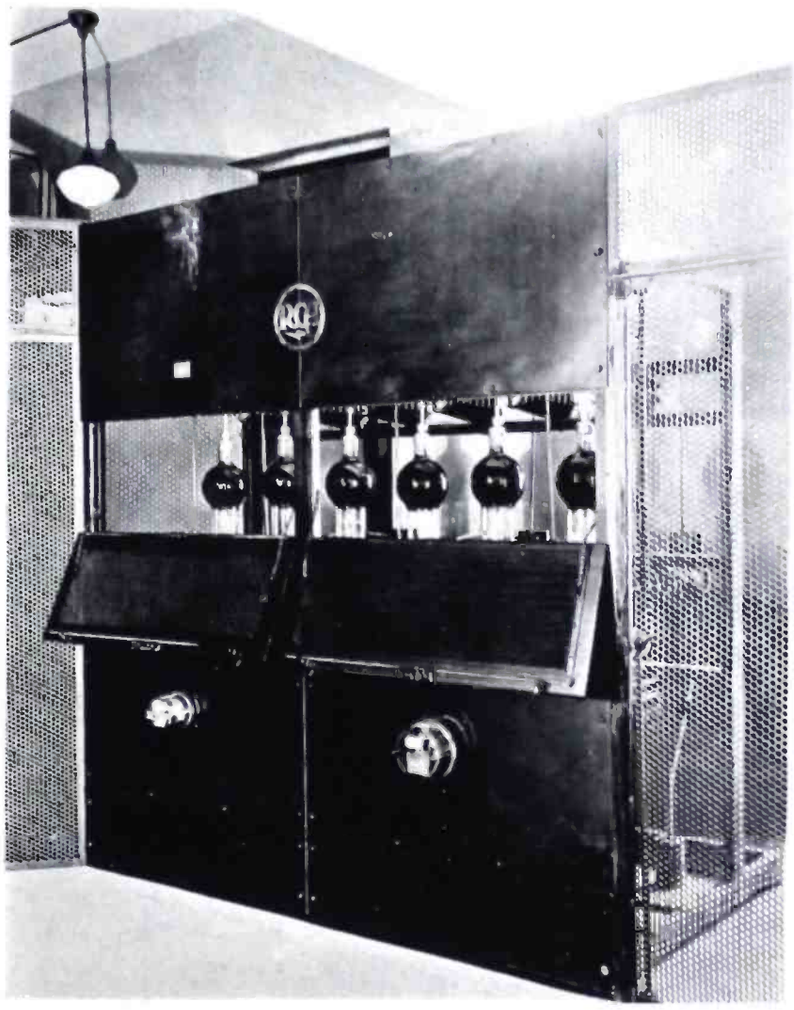
not properly ventilated will often flash at intervals throughout their operating life. Some of the earlier tubes had a tendency not only to flash, but to break down completely in the lead which connects the anode to the anode cap, the arc-over occurring about midway along the distance between the plate and the top of the tube. The writer became interested in the peculiar nature of this breakdown, and after making an examination and study of the conditions under which breakdown occurred, sent a report of the investigations to the audion engineer of the de Forest company. Experimental research was carried on in the de Forest laboratories, and a reply was later received in which their explanation of the cause of breakdown was given. An extract from this letter, which was dated June 17, 1931, is reproduced in the following paragraphs:

"Some time ago you very kindly wrote to us about certain weaknesses you had noted in our Audion 572. Upon receipt of your letter we closely checked the matter and after several months of experimental effort we report as follows:

"Your diagnosis of the cause of failure is well founded and quite accurate. The cause of the trouble, which can be described as breakdown at the anode seal, is the building up of a high intensity charge on the glass bead which breaks down accompanied by heat. The heating effect tends to liberate gases from the weld of nickel and tungsten and this reaction is usually followed by an arc-over fracturing the glass bead and often the envelope. Your suggestion concerning the possibility of a high resistance just between the nickel and tungsten developing on life is well taken.

"We have changed our design to eliminate the weld at the anode stem and now only a single piece of tungsten is used to support the anode. This change will help eliminate quite a few troubles."

With this change in the construction of the 572, the average operating life was increased from approximately 800–1000 hours to 1500–2500 hours.



SIX TYPE UV-857 MERCURY VAPOR TUBES IN A TYPE 50-B 50 KW TRANSMITTER

The arc-over mentioned in the letter is different from that described as a flash. This flash has been described as a clean-up of gas within the tube.[4] As the tube ages, and evaporation of the filament continues, gases are released which form compounds of mercury and which settle on the inner wall of the glass envelope surrounding the tube, causing the tube to darken with use. A small part of this gas also finds lodging within the glass itself. As long as these gases are not free at the normal operating tube temperature, they can have no part in causing breakdown effects in the mercury vapor. When the tube is new, therefore, the effects of these gases are small, and the temperature of the air around the envelope of the tube is not so critical. However, as the filament ages and the gas content grows, it becomes increasingly difficult to hold these gases in the compounds, and a better circulation of air must be provided. From observed data, it appears that for long life this temperature should not exceed 85 degrees Fahrenheit. With temperatures greatly in excess of this amount, providing the tube has been in service a considerable length of time, a flash occurs at the top of the tube and thereby cleans up the gas that has been released by the high temperatures. This flash, which is a pronounced characteristic of tubes which have begun to age, is only of very short duration, and seems to cause no damaging effects to the tube as long as the flashes are sufficiently intermittent. As the temperature increases and the flashes become more frequent, a complete breakdown of the mercury vapor takes place which results in a ruined tube. The remedy for this flashing is an increased circulation of air.

4 "Mercury Arc Rectifiers and Circuits." Prince & Vodges.

(Continued on Page 63)

Police Radio Protection

What radio police work has done with conspicuous success in the cities must now be duplicated by state radio police work so co-ordinated as to cover the nation

By GEORGE E. ANDERSON

(By Courtesy of The American Bankers' Association Journal)

IF the state of Indiana had possessed an adequate state police force equipped with modern police radio service, would Dillinger have escaped? Possibly he would; probably not; certainly not so easily or with so little trace.

Another question: How does the number of bank robberies in states with an adequate radio police service compare with the number in states not so equipped—population, geography and all things considered?

This question cannot be answered off-hand. Information is incomplete, and perhaps a satisfactory answer cannot be given until more states are so equipped and more experience has been had. One fact can be stated with certainty. No one appreciates the effectiveness of such police protection any more than the professional criminal. Few robberies are committed without careful calculation of all factors of danger, detection and punishment. The semi-military, highly trained state trooper in instant communication with, or under orders of, a central state authority in constant touch with all parts of a commonwealth is a formidable opponent for any criminal.

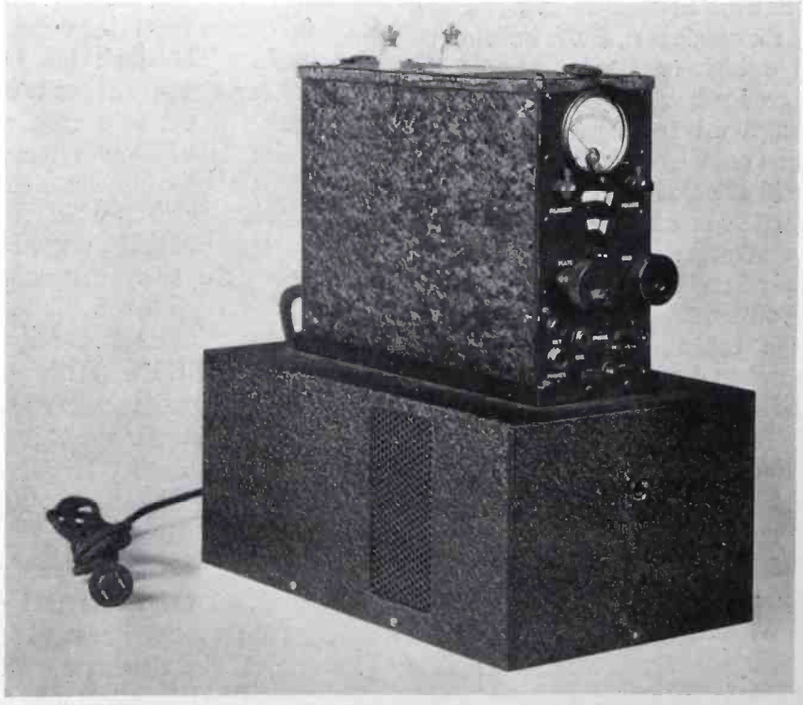
State police systems are logical developments of the motor age. Most of them, in fact, have had their genesis in traffic regulations governing the modern systems of magnificent highways—great gridirons of the concrete and macadam era. These very highways, however, have so improved the means of individual travel as to introduce new elements in crime and the habits and practices of criminals. It was the bank robber and holdup man who first discovered the possibilities of crime and escape in the automobile on good roads. Government made the discovery later, rather too late to stop the thief in the heyday of his calling, but it has made the discovery and is finally stopping him. State traffic officers developed into troops of state police for the detection and prevention of crime. State police, like their municipal confreres, are calling in the radio to increase their efficiency. Nowadays even the telegraph and telephone are slow when it comes to catching a thief.

IT IS in the protection of rural communities against major crimes such as bank robberies that state radio police systems are especially valuable. The number of bank robberies, payroll holdups and similar crimes in the larger cities is high enough in all conscience, but the greater number occur in communities where the protective force is comparatively small and where the getaway is comparatively easy.

Last year 76 cities reported 232,022 emergency calls transmitted and the average time for officers to appear on the scene was two and a quarter minutes. Fifty-six cities reported 15,604 arrests as a result of their emergency calls. Applying the system to states, one can readily appreciate the effectiveness of a service which, upon notice of a bank robbery in any place, however isolated, can instantly set in motion a troop of state police converging upon the scene of the robbery from every direction over every road, covering all highways en route with an encircling net through which few criminals can escape even in the modern means of transport which are making such statewide and interstate systems of protection and detection an increasing necessity.

Three factors enter into the establishment of this new means of preventing crime and catching the criminal. The first, from a Government standpoint, is the matter of expense; the second, from a general standpoint, is the development of efficient systems suited to local and state needs; the third is the elimination of technical difficulties.

Naturally, an adequate state police system is expensive and radio equipment adds to the cost. Crime, however, is much more expensive, and the indications are that comprehensive state systems of combating crime will be found more economical in the long run than the expensive machinery heretofore maintained for the purpose in each locality. Naturally, also, the development of an efficient adaptation of new means of dealing with crime and the criminal requires time and experience. The use of the radio in police work in the



COMPACT **RCA VICTOR** "TERRA-WAVE" POLICE TRANSMITTER WITH POWER-SUPPLY UNIT IN BASE, AS SUPPLIED TO PORT JERVIS, NEW YORK. THESE POLICE RADIO TRANSMITTERS ARE PRODUCED IN A VARIETY OF SIZES, DESIGNED TO MEET THE REQUIREMENTS OF ANY SIZE TOWN OR CITY

cities has extended over a long enough period. It gives governments and the public a good idea of what the radio can do in the protection of life and property and how it does it.

Technical difficulties have been more serious than has been generally appreciated. Their elimination has occupied the attention not only of local authorities but of the entire world. As a matter of theory, if a police station in some small town equipped with a radio broadcasting apparatus decides to proclaim to the world that someone has stolen Squire Jones' yellow dog, there would be nothing to stop the message from reaching Mars if the broadcaster were strong enough and conditions were favorable. So with all broadcasting stations.

Hence the Government long ago started regulation. It confined each station to a wavelength which, with limitations on the power of each station, would confine the message of the latter to a limited territory in such a way as to interfere with other stations as little as possible or not at all. Commercial broadcasters early pre-empted most of the wavelengths in the radio wave spectrum with the result that when police radio came into practical being its operations were limited to a very few lines in the spectrum. Radio messages also have a way of spilling over national boundaries, and it was found necessary to divide up the spectrum so as to give neighboring nations a chance to do some broadcasting—not much of a chance, at that, in view of the number and power of stations in the United States, but perhaps enough to give them the service they can actually use.

Out of this need of reasonably good neighborliness came international regulation by treaties between the nations concerned. The first regulation was embodied in an international agreement reached in a conference in Washington in 1927. That was found insufficient and another agreement was reached in Madrid in 1932. Still there was interference with resulting friction, and international negotiations cul-

(Continued on Page 44)

RCA VICTOR TERRA-WAVE POLICE RADIO INSTALLATION IN PATROL CAR OF THE HAVERFORD, PA., FORCE. CONTROLS ARE ON THE STEERING COLUMN

Radio Police at Englewood Get Two Notorious Criminals

RCA Victor Police Radio System Proves Invaluable in Suburban New York Territory

THE Police Department of Englewood, N. J., has twice distinguished itself recently—first, in the capture of a million-dollar jewel robber who was making his getaway from the scene of his crime in New York City; second, in the apprehension of Alec Bishop, who murdered a sixteen-year-old girl.

In both cases, the new RCA Victor Police Radio equipment played an important part in bringing about prompt and highly organized police action. So successfully did the local police operate with this latest scientific aid that they earned the sincere commendation of the New York City Police Department.

Police Chief Charles A. Peterson and Police Captain J. A. Abrams, of Englewood, are justly proud of the accomplishments of their force. They have subsequently been visited by representatives from the police forces of other New Jersey municipalities who are anxious to learn the details in connection with the modern radio system installed at Englewood. Stanley McIntosh, Sr., a visiting columnist from the Roselle (N. J.) *Spectator*, reports as follows:

"The transmitter set is enclosed in a case about the size of a parlor radio. It is kept locked in a ventilated closet, and on the Sergeant's desk is a mike which resembles a telephone mouthpiece. It was just my luck to witness some real action. The telephone rang; I could hear the excited voice of a woman reporting a grass fire. Desk Sergeant L. C. Datson immediately called Police Car No. 4, giving location, to investigate, and within four minutes, Car No. 4 reported from a call box. The fire was small, and it was out. The operation was merely pressing a button, and the Sergeant did not move from his chair. Captain Abrams explained that the radio car at times can save the calling out of the fire department, which means the saving of dollars.

"It sounds like a fairy tale, but in six minutes there was a real fire, calling the fire department to a different section of the town. In that case a police car was notified where the fire was located. The Desk Sergeant handled everything with dispatch and with no apparent effort on his part.

"I fired many questions at the police boys. Englewood has about the

same area as Roselle. Police force, 38 men; 5 radio cars, 3 operating in the day and 4 at night; population, 18,000. . . . Maximum cost to operate radio station, including replacements, twenty cents a day, or under seventy-five dollars a year. The station has never failed to function since it was installed last August. . . . The Chief explained that early in 1933 the department asked for two additional men, believing it was necessary, but the radio system has eased up the work so efficiently that the two extra men are not needed at this time. . . . The Captain had arranged with the Sergeant to make some call tests. While we were out (in one of the radio cars) the reception could not be better, and it is not affected while passing through an underpass, as is the radio in a private car. While we were touring, the Captain received the call that he was needed at the station, and inside of two minutes we entered the driveway."

The local press, in commenting upon the two recent outstanding accomplishments of the Englewood Police Force, says in part: "It is reassuring to know that this city is protected by a police department that is at the same time ingenious and courageous."

POLICE RADIO PROTECTION

(Continued from Page 43)

minated in the most recent international conference, held at Mexico City last summer.

Sorting Wavelengths

Important international differences also have been eliminated or minimized by an exchange of diplomatic notes between the United States and Canada, with which country, naturally, our radio relations are especially close. In neither the Washington nor the Madrid agreement was police radio given any wave allotments as such, but in the Mexico City agreement police radios in all nations were given a band in the spectrum. In this allotment police radio enthusiasts can envision an international system of police co-operation, starting from a single municipal station in some obscure city and ranging up to a world-wide system embracing all nations concerned in the detection and prevention of crime. Such a system is a long way ahead, but the nations are on their way.

Previous to the Mexico City agreement police radio services in the United States were allotted only 11 wavelengths—eight for municipalities and three for states. Since the agreement of August 9 last, however, 30 wavelengths have been assigned police work—eight for the states and 22 for municipalities.* This means that if and when all states have state police radio systems each wavelength must be assigned to six states. It will probably be several years at best before all the states have such services, but in the meanwhile the national authorities must make their arrangements on the assumption that all states will have them.

The Radio Commission, accordingly, has tentatively divided the United States into six combinations of checkerboard zones. States using the same wavelength are separated as widely as possible, the distance between the centers ranging between six and seven hundred miles. In the office of the Radio Commission in Washington is a map of the United States showing these chains or checkerboard zones of states in colors. For example, a combination such as New York, Iowa, Montana, California, Texas and Florida may be designated as a blue network; Vermont, Virginia, Illinois, Oklahoma, Utah and Washington a red chain, and so on. The actual combinations are yet to be determined. Working in with these state chains are allotments of wavelengths to various municipalities.

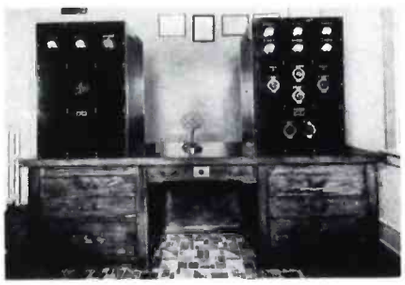
Twenty-two wavelengths divided among all the cities in the United States using police radio systems means that many cities must use the same wavelength. They are separated as widely as possible, and interference between them, as well as between state systems, is further reduced by limiting the maximum power each station can use to five kilowatts by day and one kilowatt by night, thus making allowance for the day and night difference in broadcasting conditions. The commission also is following the policy of encouraging the use of several transmitting stations in each state on the same wavelength rather than one powerful central station. Engineering limitations and experience have shown that several low power stations give less interference and more complete coverage than one master station.

* The FRC has subsequently allocated a total of 12 frequencies for state police.—Ed.

New Police Transmitter at Kansas City

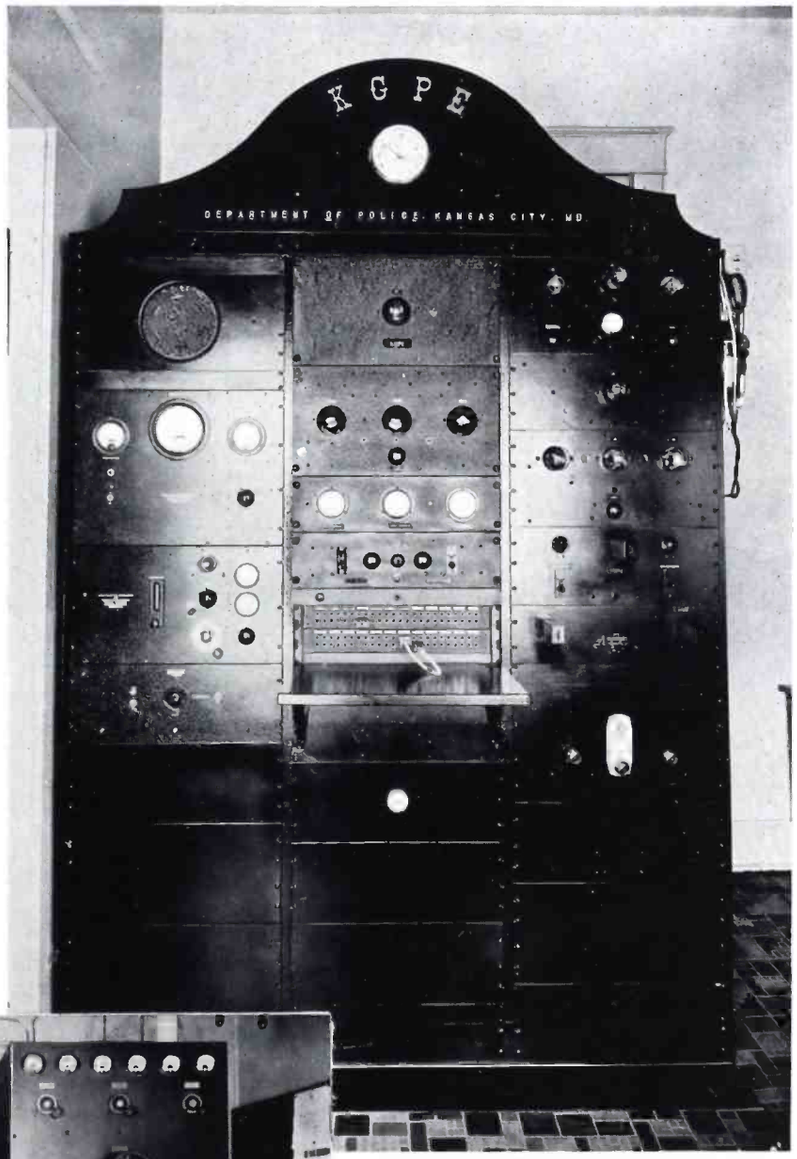
Lt. ROY De SHAFFEN, Sr., Director of Radio for the City, reports increased signal strength exceeds hopes and expectations

When the new 500-watt RCA Police Radio Transmitter was switched on by City Manager McElroy at Kansas City, Missouri, the old transmitter was taken off the air to be retained as an auxiliary. The new installation has resulted in much better intelligibility to the police cruiser cars and the improvement is considered well worth the additional investment.

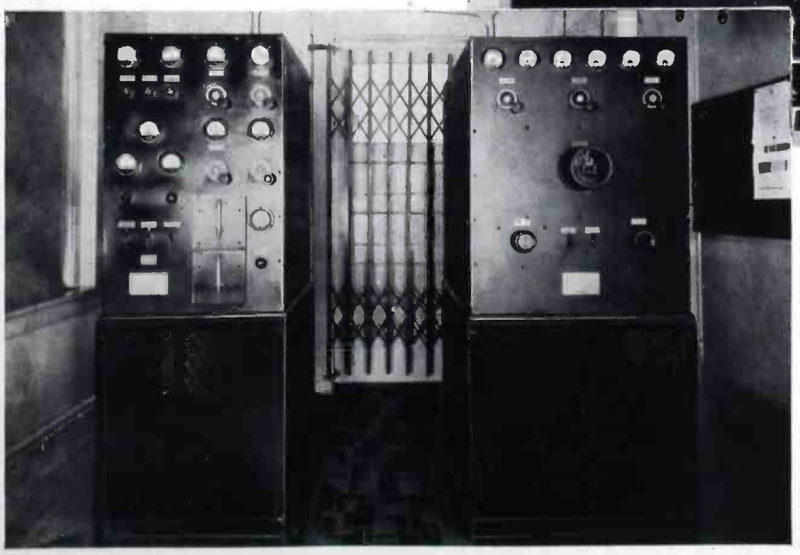


THE OLD POLICE TRANSMITTER EQUIPMENT OF KGPE, WHICH IS NOW BEING RETAINED AS AN AUXILIARY

The new transmitter as supplied by the RCA Victor Company consists of an ET-3670 exciter unit and a UT-4199 five hundred watt amplifier which utilizes Class B high level, high efficiency, 100% modulation. A view is also shown herewith of the neatly arranged speech input and associated equipment which provides for speedy dispatching.



THE NEATLY ARRANGED SPEECH INPUT AND ASSOCIATED EQUIPMENT AT KGPE



NEW 500-WATT RCA VICTOR POLICE RADIO TRANSMITTER AT KANSAS CITY, MISSOURI. (WE NOTE, WITH APOLOGIES, THAT THIS ILLUSTRATION WAS ERRONEOUSLY REFERRED TO IN OUR PREVIOUS ISSUE AS BEING LOCATED AT GRAND RAPIDS, MICHIGAN, WHERE A SIMILAR INSTALLATION IS ALSO IN OPERATION)

The staff of KGPE includes Lt. Roy De Shaffen, Sr., Howard Hart, Jack Scroggin, William Devine and Lowell Croysdale, who are all under the direction of E. C. Reppert, Director of the Kansas City Police. Reports indicate that this is one of the nation's outstanding police radio installations, and the staff should be justly proud not only of the fine appearance but also of the excellent performance of this station.

. . . LET'S GET ACQUAINTED . . .

F. R. DEAKINS, WHO RETURNS TO THE **RCA VICTOR CO.** IN CHARGE OF THE ENGINEERING PRODUCTS DIVISION, AFTER TWO YEARS' ABSENCE, DURING WHICH HE WAS EXECUTIVE VICE-PRESIDENT OF THE VICTOR TALKING MACHINE CO. OF CANADA

P. A. ANDERSON, IN CHARGE OF THE POLICE RADIO SALES SECTION, **RCA VICTOR CO.,** WITH HEADQUARTERS AT CAMDEN, N. J. HIS EXPERIENCE IN RADIO TELEPHONE TRANSMITTER AND RECEIVER ENGINEERING GIVES HIM A VALUABLE FOUNDATION FOR THIS WORK

WITH the publication of this issue, we welcome back to "Radio Headquarters" one of our old friends who, for the past two years, has been located in Montreal as Executive Vice President of the Victor Talking Machine Company of Canada. We refer to none other than F. R. Deakins, who is now in charge of the Engineering Products Division of the RCA Victor Company, Inc., at Camden, N. J.

Mr. Deakins has an unusual background of experience in the electrical and radio industries. Having completed his course in Electrical Engineering at the Alabama Polytechnic Institute in 1914, he entered the Test Department of the General Electric Company at Schenectady. Later he was transferred to the Central Station Department, becoming active in the sale of power equipment. When the Radio Department of the General Electric Company was formed in 1921, Deakins was transferred to this attractive activity, and subsequently became Assistant Sales Manager. In 1928 he was

appointed Sales Manager of the General Electric Company's radio department.

On January 1, 1930, Mr. Deakins was transferred to the RCA Victor Company, in charge of Export Sales, at Camden, New Jersey, and in 1931 he was appointed Sales Manager of the Engineering Products Department. In 1932 he was appointed Executive Vice President of the associated Victor Talking Machine Company of Canada, Ltd., with headquarters in Montreal.

During these past two years in which his headquarters were in Montreal, Deakins has not been exactly a stranger, as his business activities have included several visits to Camden, which, together with considerable correspondence, has kept him in close touch with us. It will seem like old times to see him in his customary office again.

PIERSON A. ANDERSON was born in 1888 at Brooklyn, New York. At the ripe old age of 18, he was Wire Chief of the Southern New England Telephone Company at New Haven, Conn. In 1913 he entered the Engineering Department of the Western Electric Company (later the Bell Telephone Laboratories) as Engineering Inspector. He was commissioned a Second Lieutenant, Engineers' Reserve Corps, on April 2nd, 1917. War was declared on April 6th, and he was one of the first reserves called to active service. After completing a course at First Officers Training Camp, he was assigned to Company F, 301st Engineers, at Camp Devens, and began training newly drafted men. In November he was sent to France, where he was assigned to Staff Duty as Assistant Regulating Officer at Is-sur-tille. He served on the G-4 section until July, 1919.

Re-entering the Bell Laboratories as an engineer in the Physical Laboratories, he later became Assistant Com-

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BROADCASTING PERSONALITIES

I. R. Baker, Manager of the Transmitter Sales Section, Engineering Products Division, of the RCA Victor Company, Inc., was recently removed to the Temple University Hospital in Philadelphia for an emergency appendix operation. Fortunately, the case was taken in time and Bake is doing very well and is in splendid spirits. Those of us who had the pleasure of visiting him found it difficult to convince Baker that he must remain confined to his cot while recuperating, as he repeatedly showed evidence of impatience to be up and around. The world-wide radio set at his bedside, however, helped considerably to keep him contented in his temporary quarters, as did the very appropriate cartoons which were sent to him by John Vassos and Dr. Seuss. Now Bake is back in his familiar surroundings at "Radio Headquarters," a bit tamer for the time being.

Major I. E. Lambert, until recently Vice President and General Counsel of the RCA Victor Company, Inc., at Camden, N. J., has transferred to the Keith–Albee–Orpheum Corporation as Vice President and General Counsel of that organization, with offices located on the 12th floor of the RKO Building, Rockefeller Center, New York. Needless to say, all of the Major's friends in Camden will miss him, but join us in congratulating him. R. P. Myers, who was his assistant in Camden, goes with Major Lambert to the new post at the same address.

L. B. Morris, better known to his associates as "The Judge," becomes the new General Counsel of the RCA Victor Company at "Radio Headquarters."

Edgar Kabok was recently elected Vice President in Charge of Sales of the National Broadcasting Company, with headquarters at the RCA Building, Rockefeller Plaza, New York City. His wide experience in creating and selling advertising makes him particularly well adapted for developing and co-ordinating the various

TANYA GARTH, POPULAR RADIO AND CONCERT SOPRANO. HAVING ACHIEVED FAME IN ROXY'S ORIGINAL "GANG," MISS GARTH ENTERTAINS THE VAST AUDIENCES OF WIP AND WCAU, AND IS ALSO POPULAR ON THE CONCERT STAGE

sales and advertising activities of NBC. It is said that he thinks and acts swiftly and is a great believer in teamwork. Moreover, he is very human and derives much enjoyment from his official activities. His sense of humor is contagious and it is obvious that the co-operation and support of his associates will be of mutual benefit to him and to the company.

Both C. L. McCarthy, recently in charge of the operation of KPO and KGO, NBC stations of the West Coast, and W. S. Hedges, recently President of WMAQ, Chicago, and a member of the Board of Directors of the NAB, have been appointed assistants to Donald Withycomb, with headquarters in the offices of NBC, 30 Rockefeller Plaza, New York City. Mr. McCarthy will be Manager of the associated stations section of the Station Relations Department, and Mr. Hedges will be Manager of all NBC managed and operated stations.

Clayte Randall reports that the last of the original complement of tubes has just been removed from WTIC's transmitter. It was a UV-203-A, which has been in continuous service *since July, 1929.*

WSGN at Birmingham placed their "inquiring microphone" on the busiest corner of the city every day at noon for the purpose of obtaining comments on timely subjects from passersby. This feature suddenly became very popular when Steve Cisler happened to be at his "inquiring microphone" when the recent three-million-dollar fire broke out across the street from his pickup point. A complete description of the fire was broadcast over a period of eight hours following its outbreak. Steve Cisler is the new manager of WSGN and is making that station a great asset to the fine radio facilities of which Birmingham has always been able to boast.

Robert S. Miner and Fred Edwards have been added to the operating staff of WTIC.

Mr. H. Duke Hancock, now Assistant Manager of KGFJ in Los Angeles, recently related to your reporter the story of the *City of Honolulu* which burned and sank in the Pacific in 1922. No one can tell the story better, for he was there, in the capacity of Radio Officer on the ill-fated liner. Mr. Hancock received numerous citations for his conduct.

WNEW, in New York, boasts two unusual features—one of the highest field intensities at one mile. A survey just concluded by Jansky and Bailey indicates that the 424-foot tower produces 219 millivolts per meter with 1-kilowatt power. The other feature is the latest commercial program in the East. It is a Philip Morris announcement at 3 A. M.

A. R. Marcy, of WFBL, in Syracuse, is busy changing his antenna to a vertical radiator.

E. K. Cohan, Technical Supervisor of CBS, has returned recently from an engineering inspection of Mid-West Columbia stations. He was aided and abetted by Frank Falkner, of the network's Chicago headquarters.

L. L. Watson is the new manager of WIBX, Utica.

Ask F. Knaack, of WMCA, how he likes elephants as a means of locomotion. During the broadcast of the circus, clad in Oriental costume, he operated a u. h. f. transmitter while an announcer described the sights. He says that the motion of a ship at sea is preferable to that of the largest beast.

Mr. L. C. Miller, formerly chief engineer of KRGV, Harlingen, Texas, recently moved to Houston, where he joined the technical staff of KPRC.

WTAG, in Worcester, Mass., moved its transmitter to a new location atop the newspaper building, going on the air April 30th.

Recent changes made in the operating personnel of WFAA, Dallas, resulted in Mr. Raymond Collins being made chief engineer, and Mr. Wm. C. Ellis being made production manager. Mr. Olin Brown, formerly of KPRC, Houston, has also joined the operating staff of WFAA.

Joe Eiselein, chief engineer of WDOD in Chattanooga, has just completed rebuilding his 5,000-watt transmitter and now boasts of excellent performance. WDOD couldn't be satisfied until they were certain that their transmitter was capable of doing justice to the RCA high fidelity audio equipment recently installed in their studios in the Patten Hotel.

A. W. Marshall, Jr., engineer and manager of WKEU in La Grange, Georgia, attributes the excellent coverage being obtained from his 100-watt transmitter to the fact that he uses a half-wave horizontal antenna with a zeppelin feed system. His transmitter utilizes high-level Class B modulation.

Louis J. Link, engineer of radio station WSUN in St. Petersburg, Fla., is technical adviser to the City of St. Petersburg for their new RCA Victor "Terra-Wave" police system. The system was recently completed and Commissioner of Public Safety Wiltberger claims that crime has been greatly reduced during the short time that it has been in operation.

Mr. Conrad Harington, formerly of the Transmitter Engineering Department of the General Electric Co., was recently made chief engineer of the new Little Rock, Ark., police station.

Dave Brinkmoeller, formerly of WJTL in Atlanta, is now manager of WGST, the Columbia outlet in Atlanta.

J. M. Burke, engineer of WRGA in Rome, Georgia, and J. H. Quarles, manager, are making elaborate plans for their contemplated move to new quarters. They are putting most of their efforts into the design of an efficient antenna system.

Mr. M. H. Clack, chief engineer of KGRS, Amarillo, Texas, recently called at the Dallas office of the RCA Victor Co.

During a recent visit to the RCA Atlanta office of Dr. W. T. Knight, Jr., and James R. Donovan of WTOC in Savannah, we learned that plans are being made in Savannah for reconstructing their studios in the De Soto Hotel and improving the modulation characteristics of their transmitter.

Mr. Roy Flynn, chief engineer of KRLD, Dallas, recently made a trip to Washington for the purpose of being present at a hearing in the interest of an application for full-time operation of his station.

Mr. Fred Sterling, chief engineer of WOAI, San Antonio, Texas, recently visited WFAA, Dallas. While in Dallas, Mr. Sterling also paid a visit to the RCA Victor district office.

THE 1934 CHAMPIONS OF THE **RADIO CITY BOWLING LEAGUE** WHICH INCLUDES **RCA, RKO, WESTINGHOUSE, WESTINGHOUSE INTERNATIONAL, ROCKEFELLER FOUNDATION** AND **NBC.** STANDING—**RUDOLPH TEICHNER, Jr., STEERE MATHEW, GEORGE McELRATH** AND **C. W. HORN.** SEATED—**JOSEPH D'AGOSTINO, P. G. HOUSE, G. O. MILNE** AND **MAGNUS OPSAL**

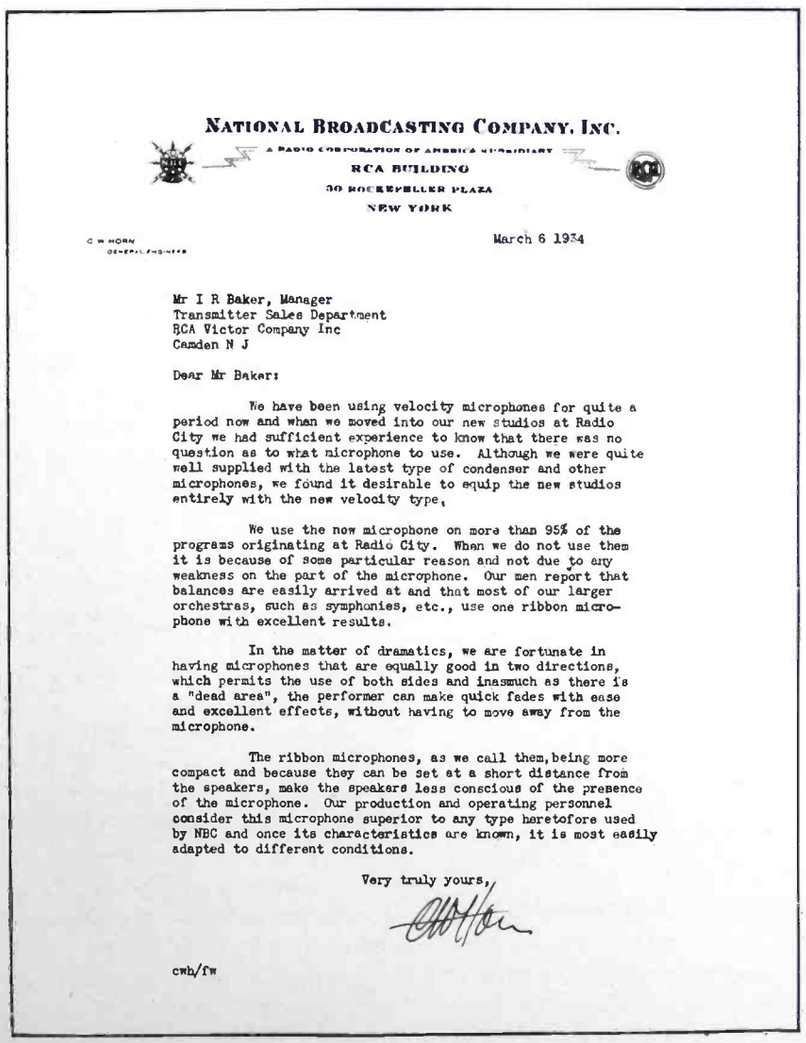
William A. Goldsworthy, Organist

ONE of the daily programs broadcast at the world-famous Waldorf-Astoria Hotel in New York City is that furnished by William A. Goldsworthy, popular concert organist. Not only is he the concert artist at the Waldorf-Astoria but he is also the organist of the famous St. Mark's-in-the-Bouwerie in New York City, and the First M. E. Church of Mt. Vernon, New York. For nine years he was also the recitalist for the Board of Education of New York City, during which time he played to thousands at his weekly organ recital.

He has developed a highly orchestral style of playing which is never pedantic and always entertaining. With brilliant technique and uncanny sense of tone color, coupled to a truly poetic nature, his playing imparts refreshing enjoyment to his audience.

At the Waldorf-Astoria there are two up-to-date Moller organs—one in the studio drawing room and a larger and more elaborate installation in the main ballroom, at the console of which Mr. Goldsworthy is shown herewith. It is interesting to note that both consoles are of the "detachable" design, each being flexibly connected to the organ proper by cables in which literally thousands of conductors are enclosed—and these cables are equipped with *separable connectors*. This feature alone would probably be considered quite a problem to the average designer of broadcast studio equipment.

The organ concerts of the Waldorf-Astoria not only are distributed to all the guest rooms and the various public spaces by means of a multi-channel centralized sound system, but these programs are also often broadcast over the larger radio networks to the outside world. The reproduction thus furnished is considered exceptionally fine, and much public interest is displayed in this feature.



NATIONAL BROADCASTING COMPANY, INC.
A RADIO CORPORATION OF AMERICA SUBSIDIARY
RCA BUILDING
30 ROCKEFELLER PLAZA
NEW YORK

C. W. HORN
GENERAL MANAGER

March 6 1934

Mr I R Baker, Manager
Transmitter Sales Department
RCA Victor Company Inc
Camden N J

Dear Mr Baker:

We have been using velocity microphones for quite a period now and when we moved into our new studios at Radio City we had sufficient experience to know that there was no question as to what microphone to use. Although we were quite well supplied with the latest type of condenser and other microphones, we found it desirable to equip the new studios entirely with the new velocity type.

We use the new microphone on more than 95% of the programs originating at Radio City. When we do not use them it is because of some particular reason and not due to any weakness on the part of the microphone. Our men report that balances are easily arrived at and that most of our larger orchestras, such as symphonies, etc., use one ribbon microphone with excellent results.

In the matter of dramatics, we are fortunate in having microphones that are equally good in two directions, which permits the use of both sides and inasmuch as there is a "dead area", the performer can make quick fades with ease and excellent effects, without having to move away from the microphone.

The ribbon microphones, as we call them, being more compact and because they can be set at a short distance from the speakers, make the speakers less conscious of the presence of the microphone. Our production and operating personnel consider this microphone superior to any type heretofore used by NBC and once its characteristics are known, it is most easily adapted to different conditions.

Very truly yours,

cwh/fw

Who's Who at "Radio Headquarters"

G. W. "CHIPS" CARPENTER, IN CHARGE OF ENGINEERING ACTIVITIES, RCA VICTOR COMPANY, INC., CAMDEN, N. J.

MR. G. W. CARPENTER, better known to his associates as "Chips," has been in the radio game since he was an amateur wireless operator back in 1911. In 1914 he received his degree of B.S. in E. E. from the State University of Iowa, and then entered the employ of the Minnesota Steel Company at Duluth as foreman of Electrical Maintenance, where he stayed until 1916. In the following year he did considerable development work on the Hall Radio Relay at Rock Island, Ill., and later became instructor in Electrical Engineering and Radio in the Highland Park College, Des Moines, Iowa.

In 1918 he was called to Washington, D. C., where, in the United States Navy Yard, he developed and designed radio receivers for all types of naval craft. The radio-frequency amplifier used on the direction finders of the NC planes was developed by Mr. Carpenter, as well as many other important radio devices used by our government forces during the World War. In 1921 he resigned his position as Acting Radio Aide on the government staff, to enter the employ of the Federal Telegraph Company of Palo Alto, Calif., where he developed, designed and installed all the receiving equipment used in their coastwise communication channels.

In 1922 Mr. Carpenter entered the employ of the General Electric Company at Schenectady, New York, where he undertook circuit development work, and in 1923 he was placed in charge of the mechanical design of all broadcast receivers—the first assignment of which was the semi-portable superheterodyne (handle and all). From 1926 to 1930 Mr. Carpenter was in charge of the development and design of all broadcast receiving equipment being built by the General Electric Company, and in 1930, when the manufacturing activities of the newly formed RCA Victor Company were centralized at Camden, he was transferred to this new "Radio Headquarters," where, from 1931 until the present time, he has been manager of all engineering activities of the RCA Victor Company.

J. B. COLEMAN has been actively engaged in radio work since 1914 and, until graduating from Carnegie Institute of Technology in 1923, followed development work more as a hobby. He served a short time as Radio Operator for the Marconi Company and in 1918, and until the close of the War, served as an instructor at the Air Service School for Radio Mechanics at Carnegie Tech. He was also associated with Mr. Conrad, of the Westinghouse Company, in the early development of broadcasting and short-wave communication at his experimental station. He was employed at the Westinghouse Company during the summer months in the Radio Development Laboratory

J. B. COLEMAN, IN CHARGE OF RCA VICTOR GOVERNMENT TRANSMITTER ENGINEERING

and as an operator at KDKA when the first broadcast transmitter was installed with the open roof of the building as a studio under a canvas cover.

After graduating from school in 1923, Mr. Coleman joined the Radio Department of the Westinghouse Company and spent two years as Chief Engineer at Station WBZ at Springfield and Boston, Mass., taking charge of the installation and operation of a new 10 KW. transmitter and installing studios in Boston. It was at this point that synchronizing experiments were first conducted between the Springfield and Boston Stations. During the period from 1925 until 1930, he was mainly associated with the development of high-power communication transmitters for the Navy and Commercial applications, and was in charge of high-power transmitter design and development work from 1927 until 1930.

Mr. Coleman joined the Transmitter Section of the RCA Victor Company in 1930, and until 1932 covered coordination of the design and performance of communication and broadcast transmitters. From 1932 until the present time, he has been in charge of the Transmitter Section and his activities have included work on special receivers, commercial, government, broadcast and police transmitters. Mr. Coleman is now devoting all his time to the design and development of transmitters for the U. S. Government.

P. A. ANDERSON

(Continued from Page 46)

mercial Engineer. His knowledge and experience in speech input and public address systems were such that he was returned to the Engineering Department and supervised a number of the largest public address demonstrations. In 1927, he transferred to the Commercial Engineering Division of the RCA Sales Department to effect the sales of broadcast transmitting equipment. While there he negotiated the sale of some of the early transmitters sold by RCA, supervising the design and installation of many stations in this country and in South America. When the Engineering Products Division was organized he became assistant to the Manager of that section, where his engineering experience and his foresight led to his being assigned to the development of new sales fields. He started experiments with Transceivers in the ultra high frequency field, on planes, autos, trains, subways, etc., and as a result of his experience and faith in the enormous possibilities of these frequencies, our engineers have developed the "Terra-Wave System" of Police Radio, which is revolutionizing Police Radio.

Anderson is now cooperating with Engineering in the development of Train Communicating Systems, Gun Detectors, and Facsimile Transmission equipment. It is said that the Engineering Department is afraid to mention any new developments because he generally starts selling them before the ink is dry on their reports. Police Radio Sales activities were placed in his hands last June, and today over 48 cities are equipped with RCA Victor apparatus. If he were a postman, Andy would probably take a walk on his day off,—for his hobby in his spare moments is "Radio."

Mr. C. H. Maddox, chief engineer of KTBS, Shreveport, La., made a recent visit to Dallas and inspected WFAA. While in Dallas, Mr. Maddox also visited the Dallas office of the RCA Victor Co., and placed an order for a new Type 4194-B High Fidelity Monitoring Amplifier and Loudspeakers for his studios.

TERRESTRIAL MAGNETISM

(Continued from Page 39)

An examination of the chart indicates that November, December and January are usually fairly free from magnetic disturbances, and that definite disturbed periods do not tend to build up until February, March, or even later in some years. Until definite groups do build up, it is obvious that the predictions are not likely to be very accurate.

Magnetic storms also manifest themselves by relatively large changes in the potential between points on the surface of the earth. This potential is sometimes sufficiently high to seriously disrupt telegraph and cable circuits which use a ground return.

A continuous record of earth potential is useful in the preparation of prediction charts. Figure 2 is a record of earth potential between two points 6 miles apart near Riverhead, L. I. This record was made on March 24, 1934, and is an interesting example of an unpredicted disturbance. It will be noted that the voltage line was fairly constant until about 6 P. M. Shortly after, a rather violent fluctuation of voltage occurred. The Byrd program from Little America was interrupted by this disturbance until about 10:20 P. M., at which time conditions recovered so rapidly that it was possible to obtain fairly good reception from Little America.

On a day which is magnetically quiet, only a uniform line is recorded.

At the present time, we are coordinating these earth potential records with the Tucson magnetograms in order to determine whether a useful relation exists between earth potential and magnetic range.

These predictions are of considerable value for scheduling program service events, or for determining in advance the periods of best reception for short-wave broadcasting stations. The reception of voice and music is relatively sensitive to magnetic disturbances, largely due to the detrimental effects of selective fading. The telegraphic services, on the other hand, are affected to a relatively minor degree, and only the most violent magnetic storms impede the flow of traffic to any substantial extent.

Did You Know?

By W. S. FITZPATRICK, RCA Institutes

THAT the Gegenschein has been accurately localized by scanning with a photocell? And did you also know that the Gegenschein is that faint glimmer in the night sky opposite the sun's position? (*Electronics.*)

That the fastest elevator in the world is elevator No. 40, in the RCA Building in Radio City? Its speed is 1,400 feet a minute.

That, while it's a clever trick, there is nothing mysterious about the broadcasting magician blowing out matches held in front of thousands of loudspeakers? It is simple—a certain shrill sound made in the studio will do it.

That there is now an RCA Victor paging-announcing system?

Good News

That outstanding good news in radio merchandising is the new sales policy covering Cunningham Tubes and RCA Radiotrons? The appointed dealers may now carry a full assortment of types on consignment and enjoy complete price protection, security in the redemption of obsolete types and elimination of worry and expense in relation to insurance and transportation.

That on April 26, 1934, R. C. A. Communications, Inc., inaugurated the first of its inter-city radiotelegraph services between Boston, New York, Washington and San Francisco?

That the entire population of Chicago could, at the same time, walk around in the Merchandise Mart, the building in which are located the extensive studios of National Broadcasting Company and the Chicago School of RCA Institutes?

That an RKO celebrity not on the stage or screen is the man who officially stopped the World War? Major George Beaumont, who dispatched the "cease firing" message to all U. S. Army commanders on November 11, 1918, is a watchman

W. S. FITZPATRICK

at the RKO lot in Hollywood. (*Feg Murray in King Features Syndicate.*)

So-o-o-o!

That the New Jersey state automobile license plates on the car of Ed Wynn, NBC humorist, read, "S-0000"?

That night visitors to the observation tower atop the 70-story RCA Building may now recognize visible planets and important stars through the aid of a working model of the universe known as the astrophane, a new idea of a planetarium? (*Scientific American.*)

That NBC's Easter Sunday presentation was a marvel in ingenuity? An observer in an automobile cruising along Fifth Avenue, New York, discussing the style parade, conversed on the subject with another observer in an automobile on the same mission along Michigan Boulevard, Chicago, and the two cars in turn talked with a fashion reporter in Paris and then with another in London, while listeners heard a musical background from Radio City, making five points in all.

That the sizable figure 70,000,000,000,000,000 represents the ratio of the power output of the new 500,000-watt transmitter of WLW to the power delivered to the microphones in that station's studios? The equipment to provide this stupendous increase in power is the result of five years of research and experimentation on the part of Crosley Radio Corporation and RCA Victor engineers. (*Radio Industries.*)

That the first vacuum tubes to bear the RCA Radiotron trademark were the UV-200 and UV-201?

That you may send more words in messages via the R. C. A. Communications' inter-city radio service at the rates charged by the wire-line systems? Fifteen words via RCA is at the rate of ten on the wire lines and sixty lettergram words at the usual price of fifty.

That in a competitive examination for civilian radio engineer posts of an Eastern city police broadcasting system, the first two successful candidates were graduates of RCA Institutes, one of them the first to complete the recently - introduced RCA Institutes General Course, while the acting chief, after filling a temporary appointment for several months, attained fifth place?

South Sea Bolero

That the popular Carioca, now sweeping the country, is to be supplemented by another mad musical highlight called "South Sea Bolero"? Dave Gould, responsible for the staging of the Carioca in "Flying Down to Rio," is now training 24 girls at the RKO lot in Hollywood for the new dance number to be filmed in a coming RKO production to be called "Down to Their Last Yacht," in which the comedy team of Mary Boland and Polly Moran will be featured.

That, while New York newspapers treated the subject in a humorous vein, stating the number of police requesting transfers to the particular precinct, there is scientific interest in the tuning coil action of the framework of the Federal Court Building? It seems that police cars while passing—or slowly cruising or parking—near the building under

construction in the lower end of Manhattan, hear commercial musical broadcasts, which the equipment will not reproduce elsewhere in the greater city.

That nothing—not even a heavy wrench—dropped from the mouth of a deep pit, can fall to the bottom? The wrench, or a marble, will fall a few hundred feet and then lodge against the sides, due to the earth's rotation, as proved by the Michigan College of Mines.

Even a Radio Store!

That about fifty classifications of retail trade and service facilities are represented in the shops located in the RCA and other buildings of Radio City?

That in 1933, R.C.A. Communications handled 209 foreign radio programs, 139 of which were broadcast by NBC? Counting two United States and seven British possessions, thirty countries furnished the broadcasts, included in which were Russia, India, Japan and Australia.

That there were over a million more radio sets sold in 1933 than in 1932 and eleven million more radio tubes? (*Radio Retailing.*)

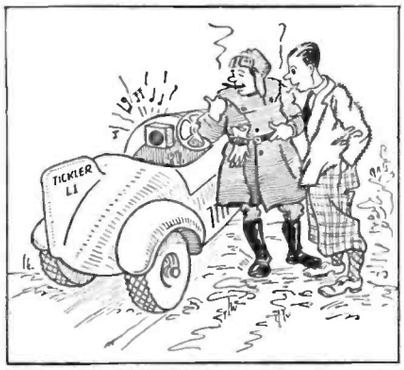
That Chicago and New Orleans are the next two cities to be added to the R. C. A. Communications domestic radio telegraph service? Seattle, Los Angeles and Detroit are scheduled to follow.

That there has been such popular response to the Radio Mathematics courses at RCA Institutes that the Institutes may extend the subject to its Home Study instruction?

That the last eclipse of the sun began on Wednesday, February 14, and ended on Tuesday, February 13, the official ending time being more than 12 hours before the beginning, due to the eclipse path crossing the international date line?

That a government post office, known as the Rockefeller Center Station of the New York Post Office, is now located on the concourse level of the RCA Building?

That any of the numerous NBC studios, or any local or distant station on the air, may be dialed by a device similar to the telephone dialing system—into several NBC executives' offices in Radio City?



"How long did it take you to do the trip, old man?"
"Er—about, er—two Bach cantatas and a couple of fox-trots!"
(Courtesy—English Periodical, Unknown)

That while R. C. A. Communications in its domestic radio service will be entirely independent of the telegraph companies, Western Union Telegraph offices in certain designated cities will pick up and deliver the traffic routed "via RCA"?

Cruising Radio Service

That this year RCA Institutes celebrates its silver anniversary? During its 25 years of service it has been known successively as "Marconi School of Instruction," "Marconi Institute," "Radio Institute of America" and RCA Institutes, Inc.

That in connection with the New York City police radio system there are five repair cars which service the radio equipment of the cruising automobiles in their respective sectors, making it rarely necessary to take a patrol car to a shop for such servicing?

That the world's 1,444 broadcasting plants expend 6,424,000 watts or about 8,600 horsepower? (*Radio Retailing.*)

That to simply go window shopping along the shops in Radio City would result in a walk of one mile?

That John S. Young, NBC announcer, one of the youngest LL.D.'s in the country, was the fourth person to receive that degree at the seventy-five-year-old college where it was recently conferred upon him?

That the transmitter of WLW is the most powerful ever built and involves a total cost of about $400,000? (*Radio Industries.*)

That a sudden stop of the new Union Pacific radio-equipped streamlined flyer while traveling 100 miles an hour would develop energy of 26,880 foot-tons? (*Everyday Science and Mechanics.*)

That on the RKO ranch an entire town is being constructed in minute detail for the purpose of filming a picture to be called "Vergie Winters," which promises to be one of the most interesting RKO productions of the year?

That the world's largest music library, comprising 500,000 pieces of music, is in the National Broadcasting Company's headquarters in New York? The symphonic section is valued at $100,000 and the operatic section is more complete than that of the Metropolitan Opera.

That throughout a week U. S. Government postage stamps were printed and sold in the RCA Building, New York, while the National Stamp Exhibition was being held there?

—Or in a Morris Chair

That radio applications have put an end to the old simile of "Like finding a needle in a haystack," for such a needle may now be located instantly?

That according to Popular Mechanics, there were 2,188 airports and landing fields in the U.S. on January 1—an increase of 71 in a year?

That American manufacturers sold over $9,000,000 of radio sets abroad last year—a $2,000,000 increase over 1932? France, Belgium and Spain were the principal European buyers.

That it is amusing to observe old-time seasoned radio operators, who once looked upon amateurs from lofty perches, now joining the amateur ranks? Imagine, for instance, Mortimer O. Smith, NBC engineer at San Francisco, who has held several big radio assignments, communicating from his station W6HSC, at Oakland, with station W9PJQ, operated by Chester R. Underhill, RCA Victor representative at Kansas City, and a man so long in radio that he is credited with being one of the first to outline radio service procedure. Wonder if they communicate amateur fashion or revert to their navy or marine operating days? And get this from M. O. Smith's card: "Wud app ur crd om, Tnx, Vy 73, Hpe 2 C U agn." (—To which we might add * (/ ? = ¾ ! " z & $; PHT 30.)

The Columbia Radio Playhouse

By HOWARD ALLAN CHINN, Columbia Broadcasting System

THE Columbia Radio Playhouse is a theatre devoted entirely to producing performances for broadcasting purposes and is located in the heart of New York City's theatrical district. This theatre, which was recently opened to the public by the Columbia Broadcasting System, has a seating capacity of over one thousand, a glass-enclosed control room, a clients' booth of similar construction, and is completely equipped with the latest type of alternating current operated, high-fidelity speech input equipment. It is the purpose of this article to describe the facilities of this "studio."

The entire box sections on each side of the orchestra floor were enclosed with double-glass panels, thus providing two sound-proof booths. One of these has been made into a clients' observation booth and the other serves as the control room.

The clients' booth is equipped with a loudspeaker connected with the monitoring equipment in the control room. A convenient control provides for adjustment of the volume to suit the auditor's fancy. In addition, a high-fidelity radio receiver is provided so that direct reception from the broadcasting station may be effected.

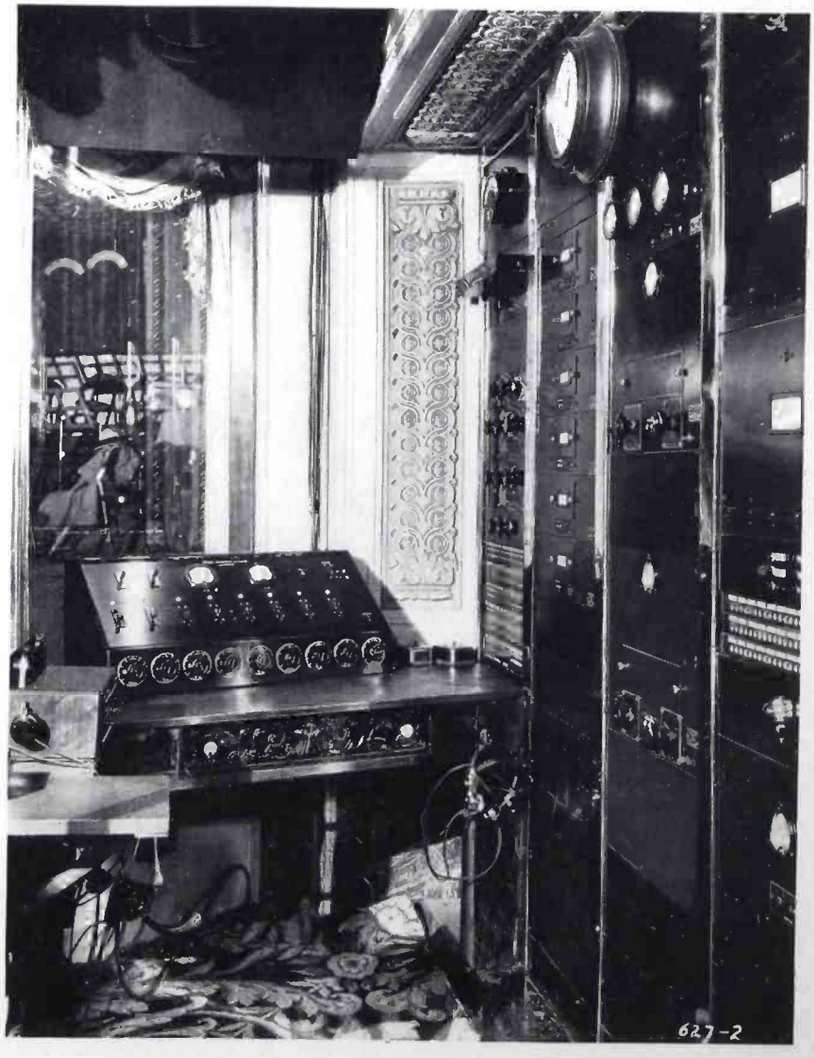
Provisions have been made in the theatre for more than a dozen microphone outlets distributed throughout the stage, backstage, wings, boxes and clients' booth. In this particular installation RCA Victor Type 44-A velocity microphones are in use.

Six of the microphone outlets are normally connected to RCA Victor Type 41-B pre-amplifiers, as indicated in the accompanying block diagram. The outputs of these amplifiers are then connected to six positions of an eight-position mixer. One of the remaining mixer positions is used in conjunction with an incoming remote line for which suitable terminating equipment is provided. This consists of an equalizer, coil and variable attenuating pad, connected as shown. The eighth and last mixer position is a spare which may be used for special or emergency purposes.

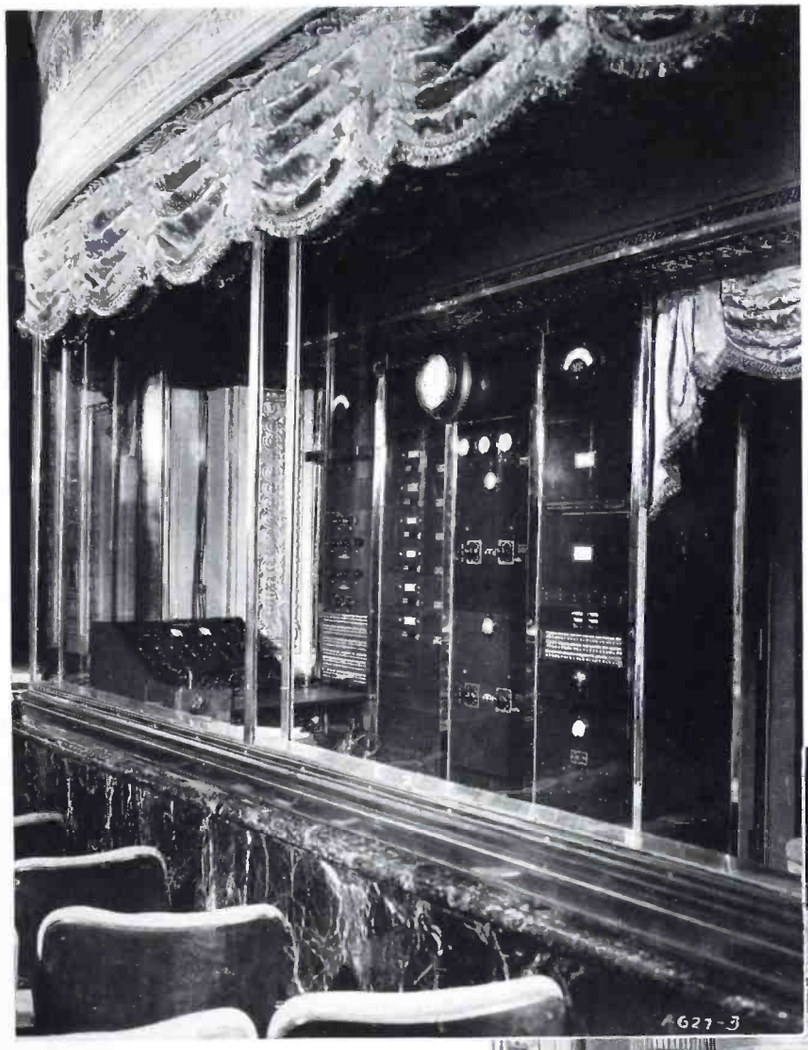
The remaining microphone circuits and the incoming remote lines are terminated on jacks and may be connected as required by means of patch cords. In order to facilitate rapid switchings to these circuits, should such be necessary, two double-pole, double-throw utility switches are provided with all terminals connected on jacks as indicated. By effecting the necessary connections with patch cords the input of any pre-amplifier may be instantaneously switched to either one of two microphones. In actual practice it has been found that an eight-position mixer is adequate for all purposes, and such switching is not necessary.

A switch, with associated signal light, is connected between the output of each pre-amplifier and its mixer volume control. Suitable resistors are wired into the switch circuit so that the impedance presented to the mixer control is essentially constant, regardless of whether the pre-amplifier is connected through or not. The mixer controls are 250-ohm, constant impedance, variable pads.

The eight mixer controls are connected in a series-parallel arrange-



A CLOSE-UP IN THE CONTROL ROOM OF THE **COLUMBIA RADIO PLAYHOUSE** SHOWING THE MIXER CONSOLE AND EQUIPMENT RACKS. **RCA VICTOR** STUDIO EQUIPMENT EMPLOYED

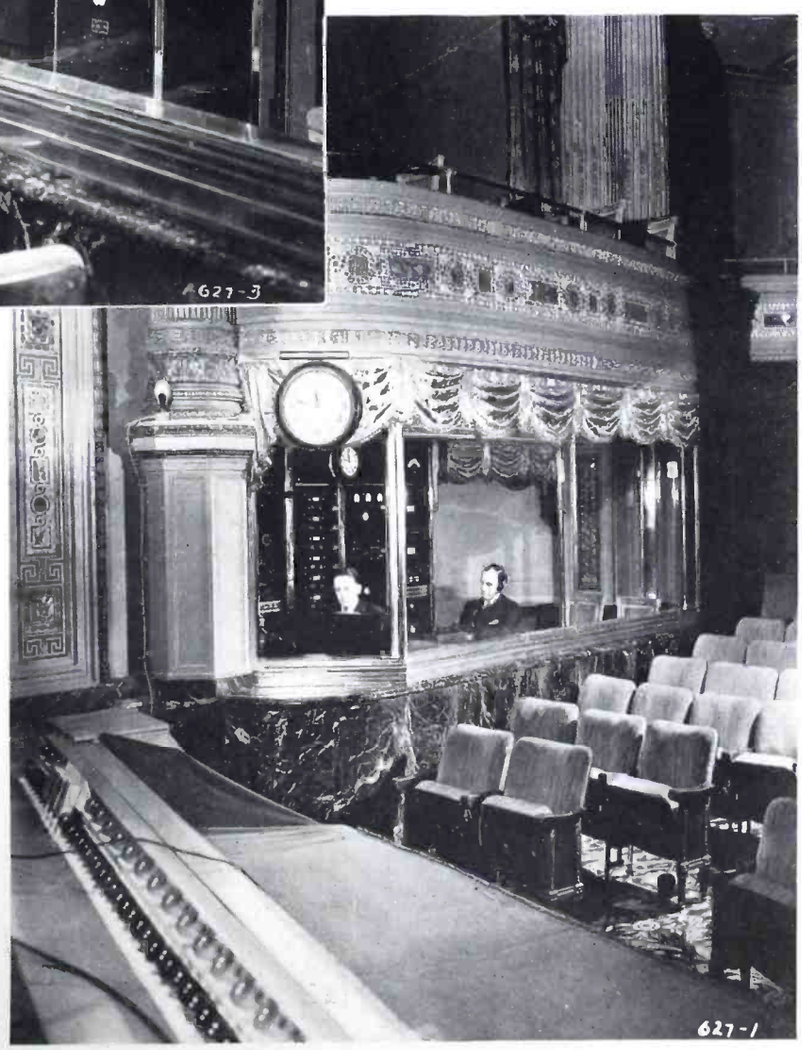


A VIEW OF THE CONTROL ROOM OF THE **COLUMBIA RADIO PLAYHOUSE,** SHOWING THE MIXER CONSOLE AND EQUIPMENT RACKS. **RCA VICTOR** STUDIO EQUIPMENT USED THROUGHOUT

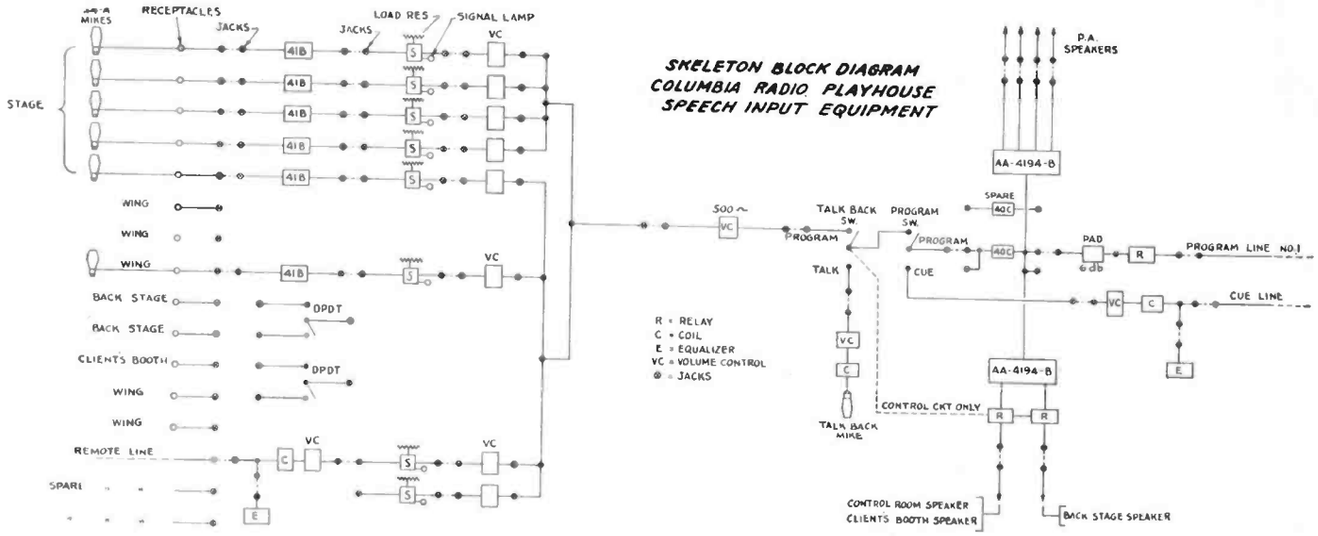
ment and are succeeded by a 500-ohm master gain control. The output of this variable pad passes through a "talk-back" switch, a program switch and finally into an RCA Victor Type 40-C program amplifier. The output of this amplifier passes through a 6-db. fixed pad, a switching relay and thence to the line connecting the Playhouse with the master control room in the Columbia Broadcasting System building a mile or so away.

A spare type 40-C program amplifier is wired into the circuit through jacks so that when the jacks are in their normally closed position, the spare amplifier is in parallel with the regular program amplifier. During normal operation, however, blank plugs are inserted in the jacks and thus the spare amplifier is lifted from the circuit. In the event of failure of the regular program amplifier, these plugs are removed and the spare is then dropped into the circuit. The blank plugs may then be inserted in the input and output jacks of the regular amplifier and it is lifted from the circuit. Although this operation may sound complicated, it can be performed very quickly and permits the connection of spare equipment and the removal of defective apparatus from the circuit without the use of patch cords.

In addition to providing programs to the radio line, the 40-C amplifier supplies two RCA Victor Type AA-4194-B monitoring amplifiers. One of these units is used to energize two Type UZ-4209 loudspeakers, one of which is placed in the control booth and the other in the clients' booth. The second monitor amplifier



CONTROL ROOM OF **COLUMBIA RADIO PLAYHOUSE,** BUILT INTO THE ORCHESTRA BOX SECTION AND BEHIND DOUBLE-GLASS PANELS. THE EQUIPMENT RACKS ARE SEEN IN THE BACKGROUND, THE MIXER CONSOLE IN THE FOREGROUND. **RCA VICTOR** STUDIO EQUIPMENT INSTALLED THROUGHOUT



energizes four loudspeakers in the theatre proper, which serve as a public-address system in order that the audience may readily hear the performance being broadcast from the stage.

The "talk-back" equipment consists of a microphone in the control booth, a suitable input coil and volume control. This equipment is wired through a switch so that the occupants of the control room can, during rehearsals, cut the program coming from the stage, energize the talk-back microphone and converse with the performers by means of a loudspeaker located back-stage. When the switch operating the talk-back circuit is closed, a relay automatically disconnects the monitor speaker in the control booth and thereby prevents any possibility of a feed-back between the speaker and the microphone.

The function of the program switch previously mentioned is to connect the input of the program amplifier, and hence the monitor amplifiers and their attendant speakers, either to the output of the stage microphones or to a cue circuit from which the air program preceding and succeeding the theatre presentation may be heard. The incoming line upon which the cue is received from the master control room of the Columbia Broadcasting System studios is provided with an equalizer, a suitable matching coil and variable pad, as indicated in the block diagram.

All equipment is connected to the other circuit elements through jacks which, when normally closed, complete the circuit in the desired manner. This is clearly shown in the accompanying sketch showing the layout of the equipment. This arrangement provides a jack strip free from all patch cords during normal operation. However, in the event of the failure of any circuit element it may be jumped out of the circuit by a patch cord or another similar element may be "patched" in the circuit. This liberal use of "normal through" jacks provides for maximum flexibility, minimum of program interruptions and for ease in locating defective equipment.

The control room contains four racks of equipment, a mixer console, a talk-back microphone, and regular telephone facilities. The equipment contained on the first rack to the left consists of, from top to bottom, relays, variable line pads, equalizer, and low-level jack strips. The second rack contains six type 41-B pre-amplifiers.

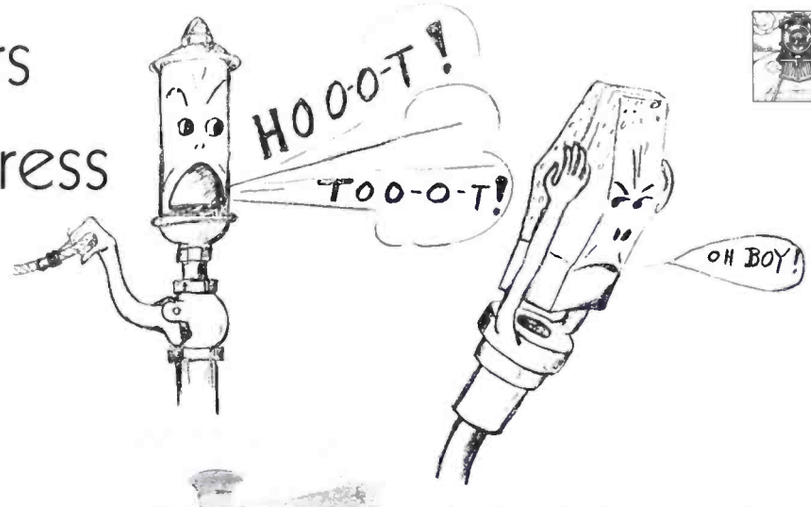
The third rack contains a meter panel and two 40-C program amplifiers. The fourth and last rack contains two Type AA-4194-B monitor amplifiers, volume-control buttons, high-level jack strips and rectifiers for providing direct current for relays and loudspeaker fields.

The entire installation was effected in a week's time under the direction and supervision of Mr. E. K. Cohan, Technical Director, and Mr. A. B. Chamberlain, Chief Engineer, of the Columbia Broadcasting System.

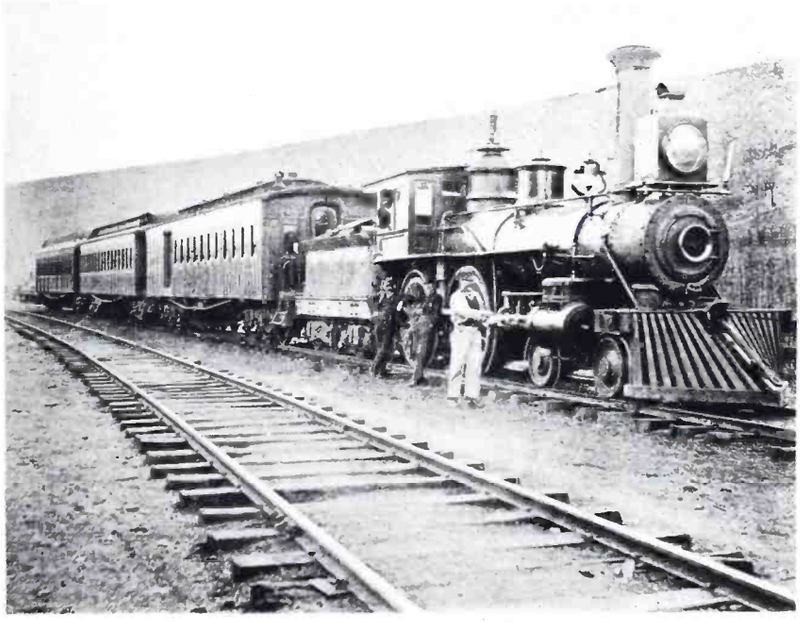
PERILS OF THE CAMDEN FRONTIER

AN INVITATION TO STAY FOR DINNER IN THE JUNGLE IS CORDIALLY REJECTED BY ONE WHOSE APPETITE IS CHIEFLY FOR NEWS—**RCA VICTOR** "GLOBE TROTTER RADIO" PUBLICITY STUNT WHICH NEVER FAILS TO ATTRACT ATTENTION AND USUALLY WINS A LAUGH

Fifty Years of Progress



Today WSM broadcasts to the world the whistle of a speeding express train, which in days gone by could not be heard beyond the surrounding hills



ENGINE NO. 912 OF THE LEXINGTON AND OHIO RAILROAD, PHOTOGRAPHED IN 1884, AT WEST FRANKFORT, KENTUCKY

THE feature broadcast every day at the same time by WSM, including the whistle and the roar of the Pan-American Limited as it passes the broadcasting station, has proven very gratifying to the sponsors. Not only has interest been expressed by listeners over all the United States through correspondence received, but mail continues to come in from more remote parts of the world, such as Canada, Cuba, Central and South America.

There is something spectacular, something dynamic and inspiring about the modern express train, hauled by a giant steam locomotive —something that is altogether missing in the bouncing progress of a motor bus, the doodle-bug drone of an airplane, or even in the stealthy hum of an electric train, and the sponsors of the Pan-American broadcast have been keen in seizing this opportunity to bring to the attention of an entire nation this ever prompt, reliable, comfortable and safe method of travel.

Whereas in the early days of railroad history the whistle of a passing

THE MODERN **"PAN-AMERICAN"** LIMITED OF THE LOUISVILLE AND NASHVILLE RAILROAD, THE WHISTLE OF WHICH IS A DAILY FEATURE BROADCAST BY **WSM**

train could not be heard beyond the surrounding hills, now an entire continent hears the passing of the modern express train, and the publicity stunt appears to be a very good investment.

The conventional whistle signal employed by locomotive engineers at the "W" marked whistle posts, as advance warning in approaching a crossing or intersection, might readily be interpreted by radio operators as the international code for the letter Z (— — · ·), but temperament and artistry in the profession have produced certain popular variations of this signal, so that often it becomes Q (— — · —) and sometimes M E E (— — · ·). However, the two most often used forms are found in the long drawn out "Hoot, Hoot, Boot, Hoo-o-o-o" and the more snappy "Hoot, Hoo-o-o, Boot, Boot"!

Deft fingers on the whistle cord operate the steam valve so that it opens and closes sometimes suddenly and sometimes gradually, producing variations in volume and pitch so that, like the many voices of a pipe organ, the combination tubes of a chime whistle can be made to play all kinds of tunes. Now the notes slur or scoop up and down the musical scale — again they crack sharply into second or third harmonics—all by the manipulation of the same hand which pulls the throttle.

Thus we find melodic reflections of temperament or momentary mood of the engineer, who, underneath his oily dungarees and grotesque goggles, is very often an artist of the first order. Just notice this yourself, the next time you hear him roaring through the night on his steel juggernaut, giving voice to his soul through the warning calliope calls.

The little old-fashioned train shown herewith, drawn by Engine No. 912, was photographed in 1884, and was the pride of the original Lexington and Ohio Railroad. This line was the first one built west of the Alleghenies, and later became known as the Louisville, Cincinnati and Lexington, which eventually became part of the Louisville and Nashville.

Fifty years of progress since then in railroad transportation has resulted in the modern train on the Louisville and Nashville shown below. Drawn by the big Pacific locomotive No. 267, it is a fitting coincidence that this Pan-American express should be the subject of what is actually a Pan-American broadcast.

RCA Frequency Measuring Service

OF special interest to those in the engineering departments of broadcast stations is the announcement by Mr. Arthur A. Isbell, Manager of the Commercial Department of R.C.A. Communications, Inc., which is located at 66 Broad Street, New York. This organization offers accurate frequency measuring service to broadcast stations, which fulfills a long-felt and important need.

The exacting requirements of the Federal Radio Commission covering frequency variation of any radio transmitter make imperative a close supervision of the frequency of its emitted energy.

Present day transmitters are stable and reliable when skillfully operated and maintained. However, occasional frequency drifts may occur and it becomes important to correct these before they assume a wide variation. Local checking equipment is of considerable value to this end, but cannot be relied upon unless occasionally calibrated against standards of unquestioned accuracy. To meet this need the laboratories of the R.C.A. Communications, Inc., offer an unexcelled measuring service.

Periodic measurements by an independent, impartial source have a distinct value, because they supply extremely accurate frequency checks and also set up a performance record which often proves of great advantage. There is no better means available for calibrating a station's local checking equipment than the service offered by the R.C.A. Communications, Inc.

Many broadcasting, police and commercial stations throughout the United States rely with confidence upon this RCA service and call on it in emergencies for measurements to aid in adjusting their crystal controls and calibrating their monitors.

The RCA method of scanning the frequency bands permits its laboratories to keep a close supervision of the accuracy of its subscriber's transmitter operation, wherever signal strength and freedom from interference allow. This permits, by application of certain schedules, immediate notification to a station in the event that its frequency is discovered out of band or within ten cycles per second of the band limit. There is no charge to subscribers for this service unless conditions necessitate reports of faulty operation, in which case the value of the service justifies the small charge.

R.C.A. Communications, Inc., who offer this routine service, have offices located as follows:

New York, N. Y.
66 Broad Street
Phone: HAnover 2-1811

San Francisco, Calif.
28 Geary Street
Phone: Garfield 4200

Riverhead, N. Y.
Phone: Riverhead 2290
Telegraph: R.C.A. Communications, Inc.

Point Reyes, Calif.
Phone: Inverness 9-W
Telegraph: R.C.A. Communications, Inc.
Point Reyes Station, Marin Co., Calif.

The latter two addresses listed are laboratories which are open day and night. This organization offers an instructive folder listing the various types of service available, which will be sent upon request.

New Studio Equipment for KOMO-KJR

BARNEY GOODMAN, AT THE PIANO IN STUDIO A OF STATION KOMO-KJR

THE spacious studios of KOMO-KJR in the new Skinner Building, Seattle, are one of the sights of the "town." "We're playing to a capacity house. People who never knew how a radio program began are being given an education," Birt Fisher, forceful manager of the big Seattle stations, declared today.

A reporter made a quick trip through the stations yesterday. This is what he said about them:

The two stations have four studios, lettered A, B, C and D, each one having RCA channel amplifiers, velocity microphones and speakers. The A studio is the largest, being able to accommodate an orchestra of 70 pieces. B studio is slightly smaller, but it can handle an orchestra nearly as large. C and D are smaller.

Each studio has its own monitor booth and each monitor booth has its own monitor-announcer. Incidentally, whether you are listening to KJR or KOMO, your program is coming through these same studios in the same building. If KOMO is transmitting an NBC program, KJR would have a local program on the air; and vice versa.

Studio A never fails to thrill the visitors. It is large and very high. It is rich-looking and impressive; being on the top floor of the building and having a big skylight, it is light and airy. The linoleum floor, floated on six inches of balsam wool, is set off with rugs in contrasting colors. The studio and booth walls are insulated with balsam wool and the ceilings are covered with a "Nu Wood" wallboard in a pattern representing granite masonry.

The technician or announcer in the monitor booth has full control of the programs' technical portions. He can select incoming chain or remote-control programs, either station KOMO or KJR, and either of the outgoing chain systems.

The selection of incoming and outgoing chain programs is automatically interlocking. That is, if a studio has a program on the air, it is absolutely impossible, for instance, for the monitor in B studio's booth to take the program from A. It is impossible too, if A studio has a program on the air, for B studio to interrupt or supersede A studio. A studio's booth must release its program before B studio may come on with its program. That is why there is never any confusion in programs.

All four studios are controlled from a master control room, the operator of which can control any program in any one of the four studios on either KJR or KOMO, or both. Numerous original and ingenious features were engineered into the control system of these studios. The entire layout was conceived and executed by Mr. F. J. Brott, chief engineer of KOMO-KJR.

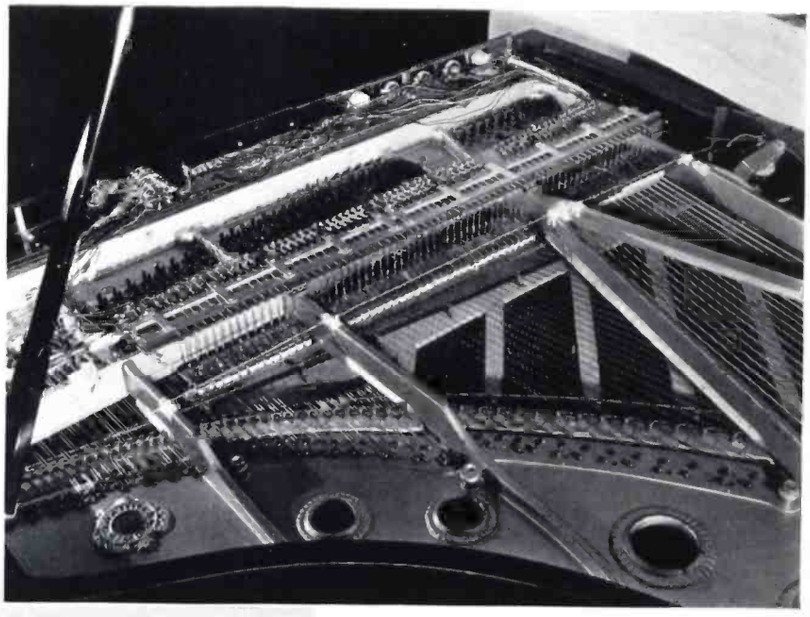
ONE OF THE SPACIOUS STUDIOS AT KOMO-KJR, SHOWING THE RCA VICTOR VELOCITY MICROPHONE SET UP TO BROADCAST THE TWO-MANUAL PIPE ORGAN, BUILT IN THE FORM OF A GRAND PIANO SO THAT IT MAY BE READILY MOVED ABOUT AS REQUIRED

The Electronic Piano

By GEORGE P. HOPKINS

AT a recent demonstration, in the auditorium of the RCA Victor Company at Camden, N. J., Anton Rovinsky rendered a most interesting performance on the new Miessner Electronic Piano. After quickly running through the various "voices" made possible in this new instrument while the inventor, Benjamin F. Miessner, described the effects and how they were produced, Rovinsky played a diversified program of classical and popular numbers.

In the opinion of this writer, the Miessner Electronic Piano considerably expands the scope of the piano beyond the limitations which we have for years associated with the "standard" piano. In addition to giving the piano a great variety of voices and increasing its volume to any desired extent, it permits the combined use of organ and piano technique. However, this is not meant to imply that the Miessner instrument in its present form is capable of equalling pipe-organ performance.



CLOSEUP OF THE INTRICATE MECHANISM OF THE MIESSNER ELECTRONIC PIANO

BENJAMIN F. MIESSNER (STANDING), THE INVENTOR OF THE MIESSNER ELECTRONIC PIANO, AND **ANTON ROVINSKY**, PIANIST

If, as the inventor claims, many of the cumbersome constructional features of the piano can be dispensed with in his instrument, including the large and heavy cast-steel frame and the long strings under great tension, it appears that a very light and compact model could be built with two or three manuals, a pedal keyboard, and various controls in keeping with standard organ console design. The artist could then, for example, carry the melody on one manual, a countermelody on a second manual, an accompaniment on the third manual, while the pedal keyboard could be employed for the bass,—each of which could be set up in different voicing and with any desired combination of percussive or sustained tone effects, and the relative volumes

(Continued on Page 63)

The Electronic Organ

By KENNETH B. STOWMAN

DR. LEON LEVY, President of WCAU Broadcasting Company, Philadelphia, who during the past six years has devoted much of his time to the development of radio broadcasting, has authorized the construction of an electronic organ in the experimental laboratories of the station.

This new instrument is being designed and built by Ivan Eremeeff, Russian inventor and experimenter, in conjunction with John G. Leitch, Technical Supervisor of WCAU. This electronic organ will produce organ music of known and hitherto unknown tone qualities electrically. It is an accepted fact that conventional pipe organ music has never been broadcast in an absolutely satisfactory manner, due to the difficulties in sound distribution, resulting in inefficient "pick-up" by the microphone.

FIGURE 1

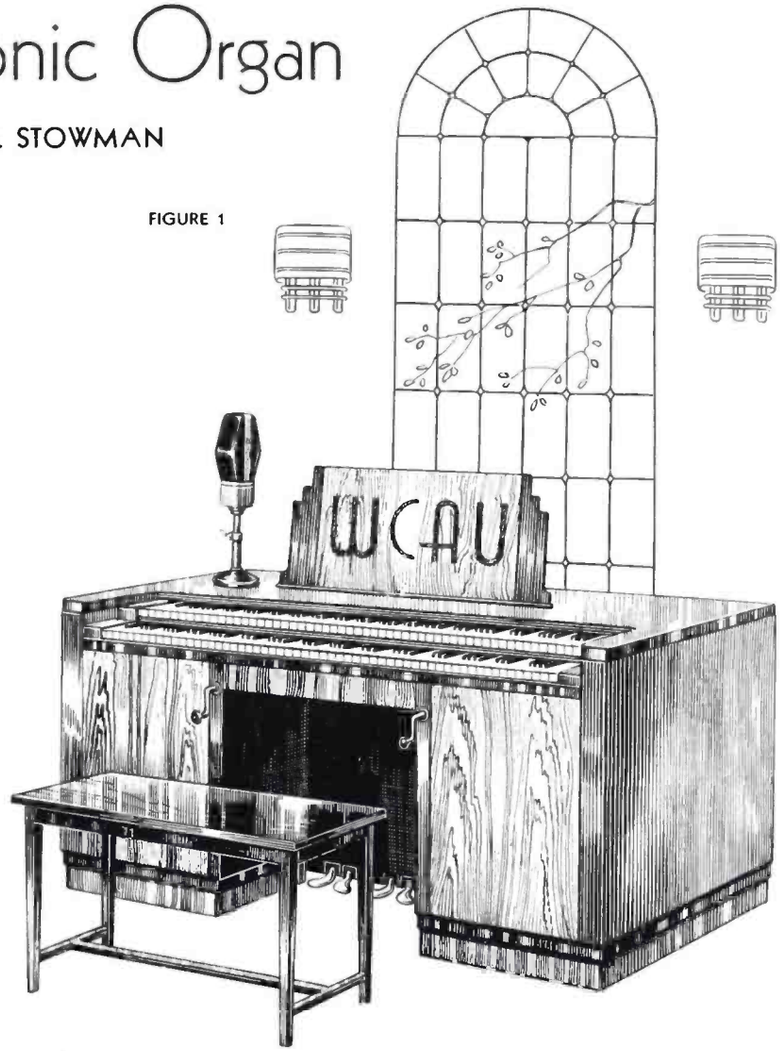


Figure 1 illustrates the electronic organ, which, in size, can be compared to the average office desk. The complete instrument is comprised of two individual units, each operating with its own keyboard. Cranks are provided for changing the tone quality of the sound for each keyboard, in place of stops. The conventional bass organ pedals are omitted to alleviate bulkiness, and such notes are included in the full scale keyboards, so that a pianist, as well as an organist, can play the instrument without further training.

The compactness of the electronic organ is an advantage over the cumbersome pipe organ, and it is easily moved about through the standard size studio doors. This instrument has a self-contained standard amplifier and speakers of high and low frequency range, with microphone outlets for announcing, and for the purpose of utilizing the instrument outside of the studios if necessary. Ordinarily, however, the output of the organ is plugged into the studio mike outlets and the sound is heard only as it comes over the air.

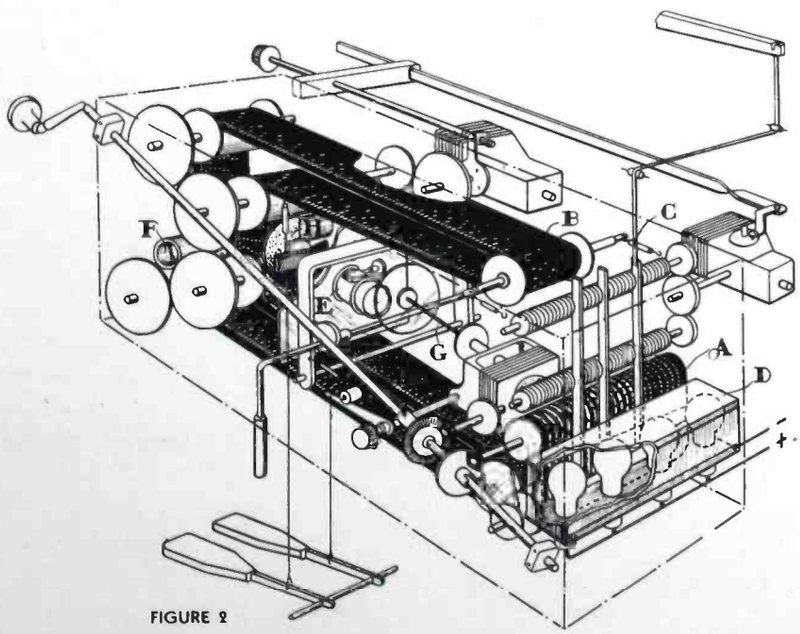


FIGURE 2

Figure 2 depicts a diagrammatic illustration of a single unit. This comprises the quality film A, which is stationary excepting at intervals when reset as desired by means of the cranks mentioned above. B represents

(Continued on Page 63)

RCA Globe Trotter Program Popular

THE mysteries of short-wave reception, plus the thrill of receiving programs from England, France, Germany, Australia, South America and other foreign countries, are now being told in a nightly series of five-minute talks by John G. Leitch, Technical Supervisor of WCAU, in the interest of the new RCA Globe Trotter "All-Wave" radio.

In these intimate discussions Mr. Leitch opens the programs with code transmission and then he takes his listeners on a mythical tour of the world and describes the workings of different foreign stations which are clearly heard in the United States. He also answers questions from the fans which are baffling the distance seekers.

Leitch, for the past six years, has been in charge of engineering for WCAU and supervised the installation of the new RCA 50,000-watt transmitter at Newtown Square, and the construction of the new 1,000-watt short-wave transmitter W3XAU, which has been heard in every country of the world. He also supervised the construction of the WCAU Building, the first structure of its kind to be designed for broadcasting purposes exclusively. During his travels on the sea, Leitch visited many of the countries from which programs are now received, thus giving him first-hand information on the different types of programs heard by the listeners.

These foreign short-wave stations operate differently from our American-owned stations, and thus these intimate discussions are becoming quite popular with the listener who desires to know more about the station he receives. If a station has unusual characteristics these are brought out by Mr. Leitch to help the Globe Trotter fan in his identification of the programs, as call letters are rarely given, which sometimes makes it impossible to distinguish the location of the station.

An RCA Globe Trotter receiver has been installed in the master control room of WCAU and, during some of the broadcasts, Mr. Leitch will give a demonstration of reception by the set. A foreign station will be picked up and rebroadcast over WCAU, so the fans sitting at home will be able to hear the wonders and thrills of short-wave "DX" hunting.

JOHN G. LEITCH, TECHNICAL SUPERVISOR OF WCAU, WHO NIGHTLY ADDRESSES AUDIENCES OVER THE AIR CONCERNING THE NEW "ALL-WAVE" RECEPTION

Five years ago the thrill of "DX" chasing faded when the broadcasting stations increased their power and the receiving sets were taken from the experimental class. But now this thrill of seeking programs from Europe is replacing the old school of distance seekers, and thousands of short-wave fans are able to sit by their Globe Trotter and enjoy programs from Europe with perfect reception. It is not an unusual event to sit in your armchair at home of an evening and pick up programs from the country's finest police broadcasting stations transmitting emergency calls to their bandit chasers. Then, with a twist of the dial, you can listen to the conversation between airplanes traveling at the speed of two hundred miles per hour in mid-air.

Another side of short-wave reception which has been made possible by the excellent reception of foreign stations on the "Globe Trotter" is the educational value. Their schedule of broadcast includes talks on international affairs, lessons in different languages, news, educational musical programs, etc. All these different things are now available to the listeners in America for the first time.

MERCURY VAPOR TUBES

(Continued from Page 41)

It has been found that where the room temperature is in excess of 60 degrees Fahrenheit, forced ventilation must be used if long tube life is to be expected. With temperatures very much below 60 degrees Fahrenheit, it is inadvisable to use a forced blast of air because the mercury is made to condense on the tube walls, and an internal short circuit may be the result. It is evident, therefore, that where the room temperature varies over wide limits, the cooling blasts must also be varied to keep the tubes within the correct temperature range.

From the foregoing actual operating facts with respect to the temperature operation of mercury vapor tubes, the conclusion is that proper attention must be given to the cooling of the tube envelope as well as to the ambient or base temperature.

Another interesting factor in obtaining long life from this type of tube is that of the time delay between the application of filament and plate voltages. For aged tubes, it has been found that more consistent operation is had when the filament is lighted for approximately five minutes before the application of the plate voltage. Any attempt to apply the plate voltage within the usual 30 seconds or even one minute results in much flashing and a damaged tube if the plate voltage is left on. If it becomes necessary to apply the plate voltage within a shorter delay period, it can be accomplished without injuries to the tubes providing the following procedure is used: Apply the plate voltage for approximately one second, and remove for 3 or 4 seconds. Reapply the plate voltage for approximately 2 seconds, and remove for approximately 6 seconds. This process is continued using increasing lengths of time and successive alternations of the application and removal of the plate voltage.[5] This procedure usually need not be carried further than three applications and removals of the plate voltage. In any case, the above outlined procedure appears to aid the life of the tubes, and is used regularly for applying the plate voltage to the rectifier described in this paper.

In closing, it might well be said that, apart from the operating conditions mentioned in this paper, the following additional factors must be taken into consideration if long tube life is to be obtained:

1. Purchase tubes only from reliable manufacturers.
2. Use rated filament voltage.
3. Keep radio frequency fields away from the tubes.
4. Use efficient plate radio frequency chokes.
5. Use rectifier sockets with low contact resistance.
6. Use a correctly designed choke in a choke input filter system.
7. Do not exceed the maximum ratings of the tubes.

[5] The RCA 872 booklet describes a similar process for breaking in new tubes.

THE ELECTRONIC PIANO

(Continued from Page 60)

of these divisions of the music could be controlled at will. Thus the instrument would be capable of rendering music as written for pipe-organ performance in addition to music as written for the pianoforte.

A distinct advantage is found in the ability of this instrument to be connected directly to the input of a broadcast transmitter, eliminating the microphone and its objectionable characteristics and limitations. The strings of the Miessner piano operate as armatures, but their acoustic effects are completely shielded from the ears of the audience, while powerful audio-amplifiers and loud-speakers reproduce the tonal effects.

Should this instrument be produced ar a modest price comparable with that of the popular brands of pianos, it seems likely that it might enjoy a fairly large market, as it can certainly be made a very versatile musical instrument. One of the distinct advantages of this device is to be found in the fact that the sound source can be remotely located from the position of the performer, so that he may enjoy the same effect as the audience.

In its present form it appears probable that the Miessner Piano will become a familiar feature in the concert hall, the theatre, and the broadcast studio.

THE ELECTRONIC ORGAN

(Continued from Page 61)

the uniformly running endless pitch film, and C is a key-operated shutter or light valve, which forms a part of the motorized diminishing device provided for the purpose of producing a "fading" effect of the tones when desired. Such diminishing takes place when the springs of the shutters are held against the moving diminisher rollers.

When staccato and organ effects are desired, the springs are released, and the diminishing rollers do not return the shutters to normal position, but allow them to fall back by their own weight. The light source D selectively illuminates predetermined tracks of the wave patterns of the quality film A when the cooperative shutters are raised by key action. Lens E focuses the images of illuminated wave patterns on corresponding tracks of the pitch film B, whose running slits scan said wave patterns, permitting the passage of light to the tubular photo-sensitive element F. The current of F is later amplified to the level which is suitable for studio microphone outlets.

The tremolo device G, with pedal shown, produces a variable speed tremolo beat. When the pedal is depressed, the translucent disc dips and cuts off a small percentage of the intensity of the light beam passing through lens E.

The volume control H, also shown with its pedal, consists of a graduated translucency disc, placed in the path of the light beam as it issues from the other side of lens E, for the purpose of dimming the image falling on the pitch film B, thus controlling the volume of the output.

PIONEER BROADCASTING

(Continued from Page 15)

Perhaps a few words of description of the station itself, "which abounds in chic and cozy atmosphere," would not be amiss. The studio, which was located in the station building, was a hexagonal-shaped little room, artistically finished with draperies of blue and gold. A large hanging lamp in the center of the room was reflected in the bright colors of the Oriental rugs, the wicker furniture, the red glow of the electric heaters. On one side of the room was a Knabe-Ampico piano, and opposite it stood an Edison Re-creation phonograph. (Apologies to Nipper!) No pick-up mikes were visible, until one looked closer and noticed a tiny disc suspended by a thin wire. The general appearance of the studio was gay and friendly.

In the foyer hung a large map of the United States, with colored tacks indicating reports of reception. Eastern Canada and Cuba were the up-and-down limits, and westward the station reached as far as Omaha. This was not bad for five hundred watts at 360 meters.

Coming to crude technical data, the transmitter was rated at 1000 watts C. W., 500 watts 'phone. Four 250-watt tubes were used, two as voice modulators and two as oscillators. A 50-watt tube served as voice amplifier. A multiple tuned antenna swung above, from the old Marconi towers. The antenna current varied between eight and ten amperes. This was the equipment which drew the rating of "giant broadcasting station" from the press of the day! Shades (shadows cast before) of WLW!

The last program of WDY was, appropriately enough, a local one in part. The "first radio dance ever given in Roselle" was scheduled for February 24th, in the Robert Gordon school, the dance music to be provided by WDY. This is the last recorded offering of the station on the air. WDY signed off for eternity.

Roselle Park was, thus, only a transition station, almost the equivalent of a tryout of a Broadway play in the provinces. Its handicaps were many, but in overcoming them the RCA engineers learned many valuable things. There was the inaccessibility of the station, making it hard to obtain—and retain—entertainers. There was the variable condenser formed by freight trains of the Lehigh Valley and the C. R. R. of N. J., which, passing almost directly under the antenna, changed its capacity and made unescapable variations in the radiated output. Finally, there was the insulation problem, for these same engines coated the antenna insulators with carbon, making leakage and not insulation the major characteristic of the overhead system. It is a wonder that even two months of this was endured.

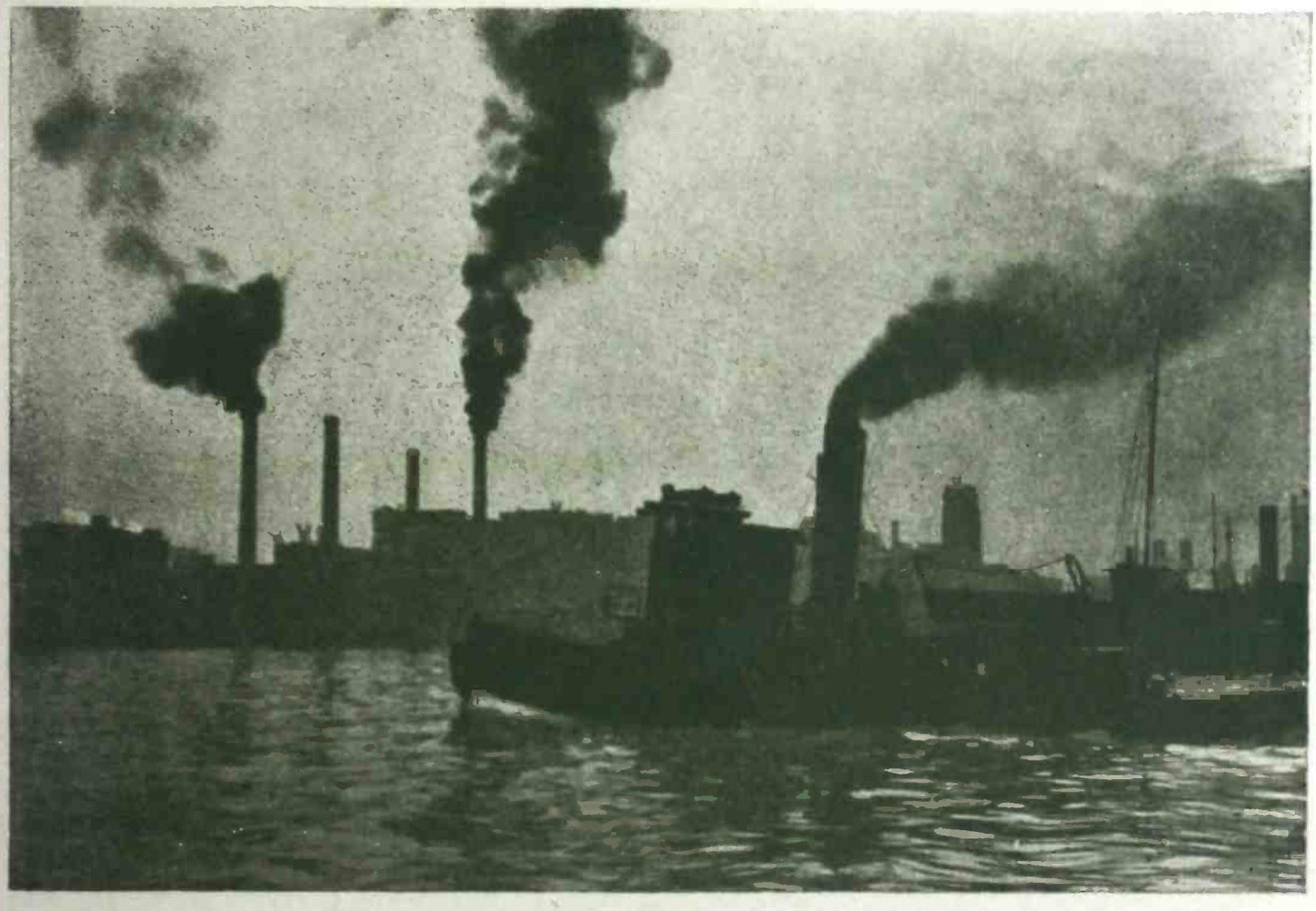
Nor were these two months wasted from the standpoint of popularity. WDY made, and kept, its friends. As one fan wrote: "Allow me a wave-length. . . . Let us have a look at you, the first real radio actor. Is there not some window we can look into? Have two doors and let the public file past the studio. . . . Hail to the Radiant Radio Rajah of Roselle!" If the writer of this happens to be reading me at this moment, I wish he would drop me a line, so I could get him a pass for one of the broadcasts in Radio City.

Not long after the demise of WDY, RCA became the father of twins, WJZ-in-New-York, and its sister WJY (*not* named after the Hoboken experiment!). And now, as I said before, it is over a hundred times a grandfather, and has to divide its grandchildren into different colors in order to tell them apart. In the nomenclature of today, when WJZ heads the blue clan and WEAF the red, I suppose that we could be retroactive and, recalling the carbonizing action of the locomotives, say that WDY was the key station and associated stations all in one of the black network.

KDKA, WJZ-in-Newark, WJZ-in-New-York, spell, in the call letters of the Department of Commerce, the early progress of broadcasting, but between the last two there must remain, if only for a moment, the name of "Baby 'DY'," RCA's first broadcasting station.

WORLD-WIDE TOURS IN YOUR OWN ARMCHAIR, WITH THE NEW **RCA GLOBE TROTTER** "ALL-WAVE" RADIO. THE ENTIRE RANGE OF FREQUENCIES IS AVAILABLE ON ONE DIAL. A GLOBE IN THE LIVING ROOM HELPS ONE TO VISUALIZE THE SOURCE OF EACH FOREIGN PROGRAM

INDUSTRY ON THE DELAWARE



THERE is something fascinating about the kaleidoscopic panorama which is unfolded before the eyes of the observer on the deck of a ferryboat leaving Philadelphia for the trip across the Delaware River to Camden.

In the distance, the waterfront is lined with the various units of the *RCA Victor Plant*, which is known the world over as *"Radio Headquarters,"*—close at hand a tugboat strains at the hawser of a coal barge . . . . more fuel for the boilers at the factory,—and the ferries continuously transport the new shifts over the river and bring back those who have just been relieved.

Vessels, trains, trucks move in to unload their cargoes of raw materials,—and speed out and away with their shipments of finished products. It is a veritable *symphony of industry*.

NEW BULLETINS ISSUED

Just off the press—and available to those interested, upon request to the Transmitter Sales Section, RCA Victor Company, Inc., Camden, N. J.

Bulletin 40—Field Intensity Meter
Type TMV-75-B

Bulletin 41—Regulated S.P.U.

Bulletin 42—Chronograph and Chronoscope

Bulletin 43—Curve Recorder and Sound Pressure Measuring Equipment

Bulletin AVB-5—Aircraft Communication Receiver, Model AVR-3

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