BROADCAST NEWS

REG. U. S. PAT. OFF.

IN THIS ISSUE

A VISIT TO THE NEW WLW
By I. R. Baker

BYRD ANTARCTIC EXPEDITION PROGRAMS FROM SOUTH POLE
By H. A. Chinn

ADMIRAL BYRD BROADCAST PICKUP
By D. B. Templeton

NEW ART IN RADIO
An Outline of John Vassos

PROGRAM AMPLIFIER 1934 DESIGN
By Edmund Frost

IMPORTANCE OF FIELD STRENGTH SURVEY
By William L. Foss

POLICE RADIO NEWS

—And a Dozen Other Interesting Features

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

RCA Victor Company, Inc.

A Radio Corporation of America Subsidiary

Camden, N. J.

"RADIO HEADQUARTERS"

DAVID SARNOFF, Chairman

E. T. CUNNINGHAM, President

W. R. G. BAKER, Vice-President and General Manager

G. K. THROCKMORTON, Executive Vice-President

P. G. McCOLLUM, Comptroller

J. D. COOK, Treasurer

I. E. LAMBERT, Vice-President and General Counsel

G. HAROLD PORTER, Vice-President in Charge of Pacific Coast Activities

F. S. KANE, Secretary

HARRY SADENWATER, Manager
ENGINEERING PRODUCTS DIVISION

TRANSMITTER SALES SECTION
(OF ENGINEERING PRODUCTS DIVISION)

I. R. BAKER, Manager

S. W. GOULDEN, Commercial Engineer

J. P. TAYLOR, Sales Engineer

T. A. SMITH, C. B. S. Contact

C. L. BEACH, N. B. C. Contact

T. W. ENIS, Power Radiotron Sales

PIERRE BOUCHERON, Advertising Manager

1 EASTERN DISTRICT—T. A. Smith, Manager, 153 E. 24th St., New York City; R. P. May, Assistant

MAINE	RHODE ISLAND	NEW JERSEY	WEST VIRGINIA
VERMONT	CONNECTICUT	PENNSYLVANIA	DELAWARE
NEW HAMPSHIRE	NEW YORK	MARYLAND	VIRGINIA
MASSACHUSETTS	PUERTO RICO	NORTH CAROLINA (Broadcast)	

2 CENTRAL DISTRICT—H. C. Vance, Manager, 111 North Canal St., Chicago, Ill.; D. A. Reesor, Assistant

NORTH DAKOTA	MISSOURI	ILLINOIS	OHIO
SOUTH DAKOTA	IOWA	INDIANA	MICHIGAN
NEBRASKA	MINNESOTA	KENTUCKY	KANSAS CITY (KANSAS)
WISCONSIN			

3 WESTERN DISTRICT—W. H. Beltz, Manager, 235 Montgomery St., San Francisco, Calif.; Edmund Frost, Assistant

WASHINGTON	IDAHO	UTAH	MONTANA
OREGON	NEVADA	ARIZONA	WYOMING
CALIFORNIA	HAWAII (Police)	ALASKA (Police)	

4 SOUTHWESTERN DISTRICT—W. M. Witty, Manager, Santa Fe Bldg., Dallas, Texas.

TEXAS	ARKANSAS	KANSAS (Except Kansas City)	NEW MEXICO
OKLAHOMA	LOUISIANA (Except New Orleans)	COLORADO	

5 SOUTHEASTERN DISTRICT—B. Adler, Manager, 144 Waltón St., N. W., Atlanta, Ga.

TENNESSEE	SOUTH CAROLINA	ALABAMA	FLORIDA
NORTH CAROLINA (Police)	GEORGIA	MISSISSIPPI	NEW ORLEANS (LA.)

BROADCAST TRANSMITTERS — **POWER RADIOTRONS**

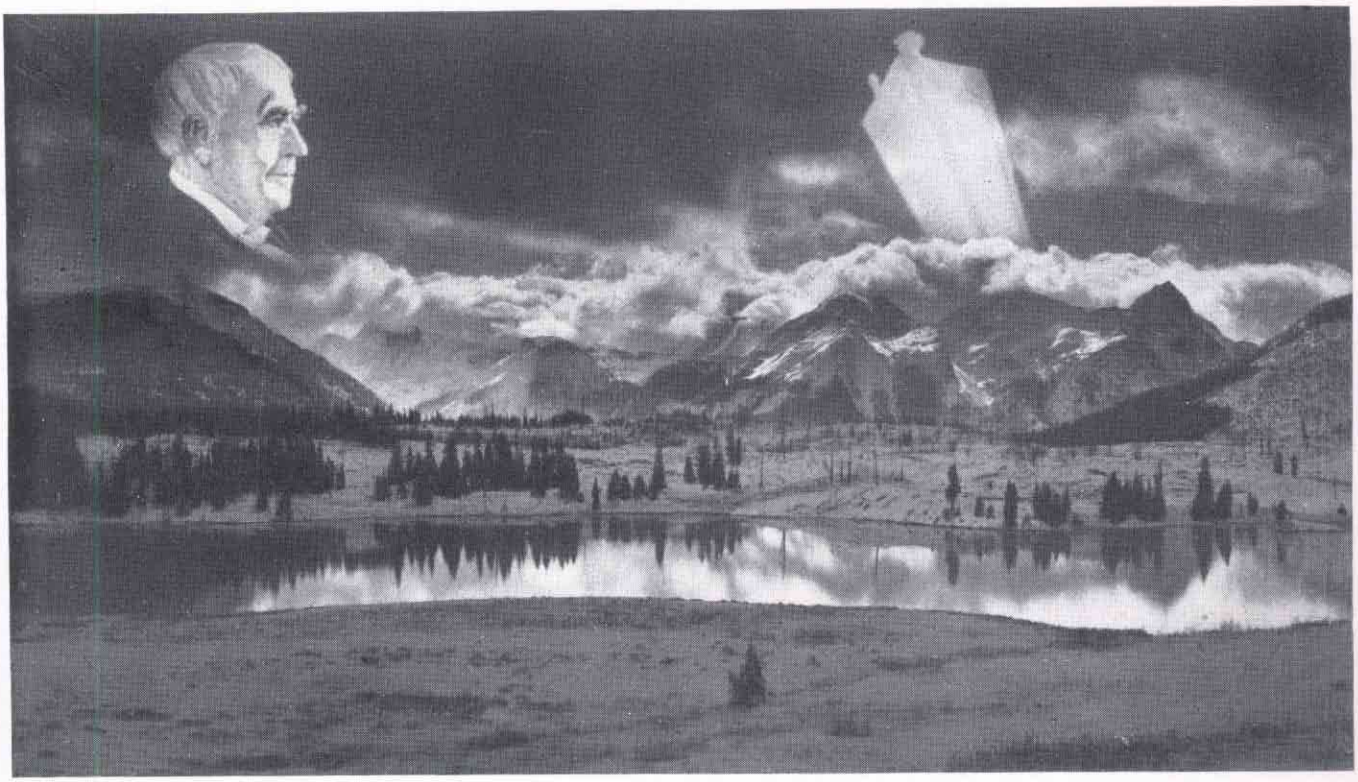
POLICE TRANSMITTERS — **POLICE RECEIVERS**

SPECIAL COMMUNICATION EQUIPMENT

BROADCAST NEWS

Edited by
E. JAY QUINBY

NUMBER 10 FEBRUARY, 1934



GOLD, SILVER, LEAD IN THEM THAR HILLS . . .
BUT PLENTY OF ATTENUATION

(SEE ARTICLE ON PAGE 31 BY WILLIAM L. FOSS, ON "THE IMPORTANCE OF FIELD STRENGTH SURVEY")

THIS REMARKABLE PHOTO, ENTITLED **"THOMAS A. EDISON—HIS VISION—HIS STRENGTH,"** WAS CONTRIBUTED TO "BROADCAST NEWS" BY **HAMMOND MATHEWS** OF SILVERTON, COLO., AND IS THE WORK OF THE PENNINGTON STUDIOS AT DURANGO. **MR. MATHEWS'** WORK IN MAINTAINING TRANSMISSION LINES IN THIS RUGGED MINING COUNTRY TAKES HIM UP AND OVER MANY OF THE HIGH PEAKS, AND HIS EXPERIENCES WITH RADIO EQUIPMENT IN THIS TERRITORY ARE NO LESS SURPRISING THAN THE PICTURES HE TAKES

Published Occasionally and

A Visit to the New WLW

By I. R. BAKER, Sales Manager, Transmitter Section, RCA Victor Company, Inc.

J. A. **CHAMBERS,** TECHNICAL SUPERVISOR OF **WLW**

LOREN JONES and I arrive in Cincinnati in the early morning, on one of our periodical inspection trips to the new super power WLW. A hurried breakfast, a call to Joe Chambers, Technical Director of the Crosley Radio Station.

"Sure, I'm in. Come out any time," Joe replies.

Loren and I marvel at his stamina —he's working day and night, missing but few test periods, and still on the job in the daytime. We wade through the mass of details that accompany the job, and in a few hours we are on our way to Mason, the transmitter site. We are nearing the station. The vertical radiator stands out very distinctly against the cloudless sky. I check Joe again.

"Yes, it's approximately 840 feet high—are you going to climb it this trip?" he asks, looking amused. He remembers several of his previous attempts to get me to climb the tower. We had never gotten together,—I had calculated my price in terms of foot pounds of work done. As we draw nearer, the tower the dural pole on the top sway gently in the wind. I mentally double my price. Joe, reading my thoughts, assures me:

"It's quite safe—it's stressed for A HURRICANE."

"Not feeling so well," I reply; "besides, I have to catch the four-six back to Camden."

As we drive in the station gates, we note the substation is completed. It's a huge affair, reminding one of a substation for a small city.

"Have you ever calculated the size city this would supply?"

"Yes," Joe replies, "it would supply the average city of 10,000 inhabitants."

We are attracted by a sudden rush of water in the spray pond. Joe continues:

"And the water circulated in that spray pond is equivalent to 1,440,000 gallons per day, or enough to supply the average size city of 35,000 inhabitants."

As we enter the building we note the transmitter is practically complete. The 50-kilowatt set on our

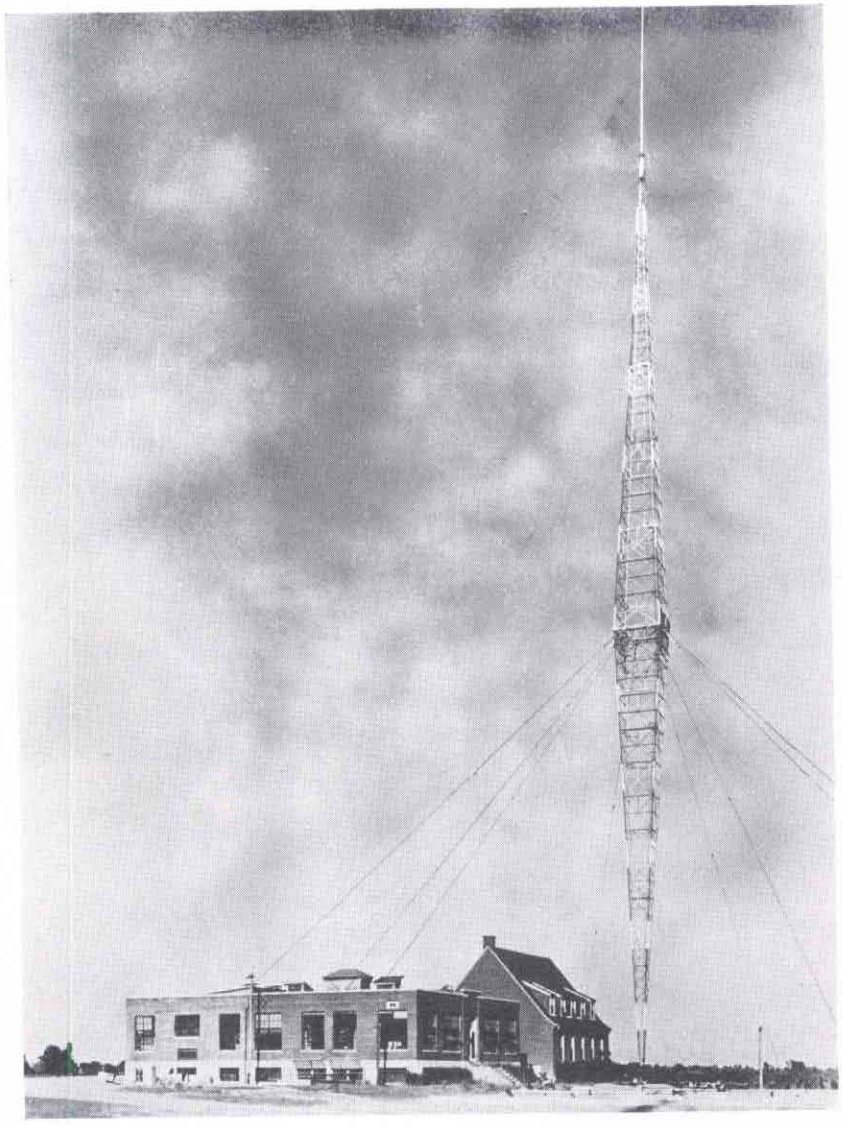
POWELL CROSLEY, JR., PRESIDENT AND FOUNDER OF THE CROSLEY RADIO CORPORATION, FOR WHOM THE NEW 500 KW **WLW** INSTALLATION HAS BEEN MADE

left is carrying the regular WLW programs. We greet the engineers and in the same breath:

"How much power have you had out?"

"Several hundred kilowatts," they reply casually; "we hope to show

MEMBERS OF THE **IRE** AND **AIEE** INSPECTING THE NEW 500 KW **WLW** PLANT. J. A.



THE NEW 830-FOOT VERTICAL RADIATOR, AND THE STATION BUILDINGS AT **WLW**

you some real power tonight—perhaps modulation."

I think of the conference in Camden tomorrow, my necessity for returning, weaken, and finally decide to stay over. Loren remarks:

"Too bad Andy Ring and Jack Young are not here now."

Memories. . . . Our thoughts turn to the development work the four of us had done on the then super power of 50 kilowatts. Pioneering into a new field is not easily forgotten. Long hours of after-midnight tests and adjustments, and finally the thrill of a perfected unit. Our thoughts are interrupted with:

"Yes, I think we will be able to show you considerably more than 500 kilowatts tonight."

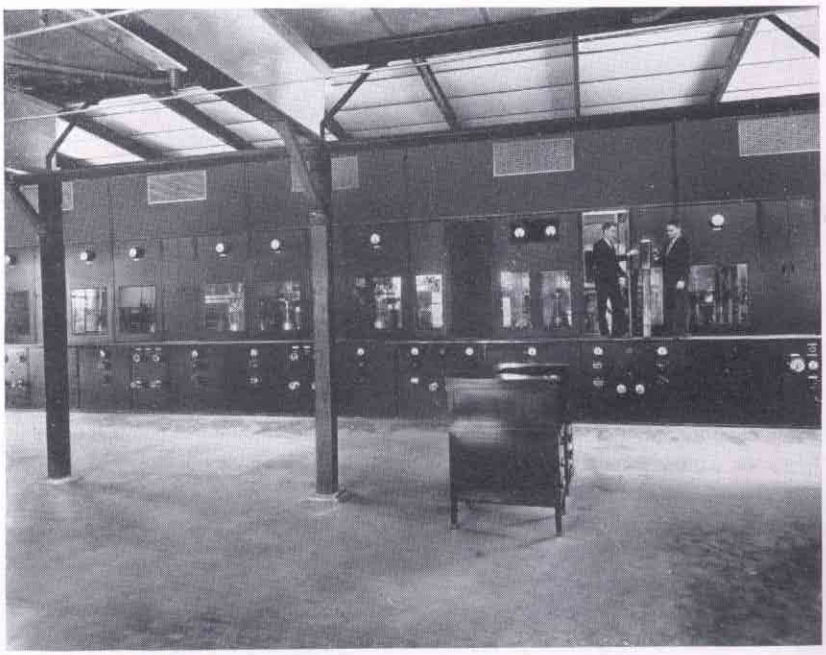
Five hundred kilowatts—that's a long way in accomplishment from 50 kilowatts. We inspect the installation carefully, look at curves and other test data and find the job very nearly completed. The day passes rapidly. We return to Cincinnati.

In a few hours, we are on our way back to the station. We're impatient to be at the scene of action. The tower hazard lights are visible long before we reach the station,—as we go nearer, we note the huge Neon WLW, approximately half way up. We stop near the station gates. There's a ghostly whistle of wind through the tower. The concentric tube transmission line has been transformed by the moonlight into a long ribbon of gleaming silver. Hazard lights from other antennae dot the sky. A good stage setting for the scene about to take place.

We hear the radio in the car—WLW is just signing off. That means it's just about time to start the tests. We hasten toward the building. As we enter we find the engineers changing over in preparation for the 500-kilowatt tests.

Promptly at 1:00 A. M., power is supplied. An impressive sight—twenty 100-kilowatt tubes, with filaments lighted. A tremendous expanse of panel, too,—it's a full sixty feet long. On the right of the

(Continued on Page 24)



TRANSMITTER BUILDING IN THE NEW 500 KW. **WLW** INSTALLATION

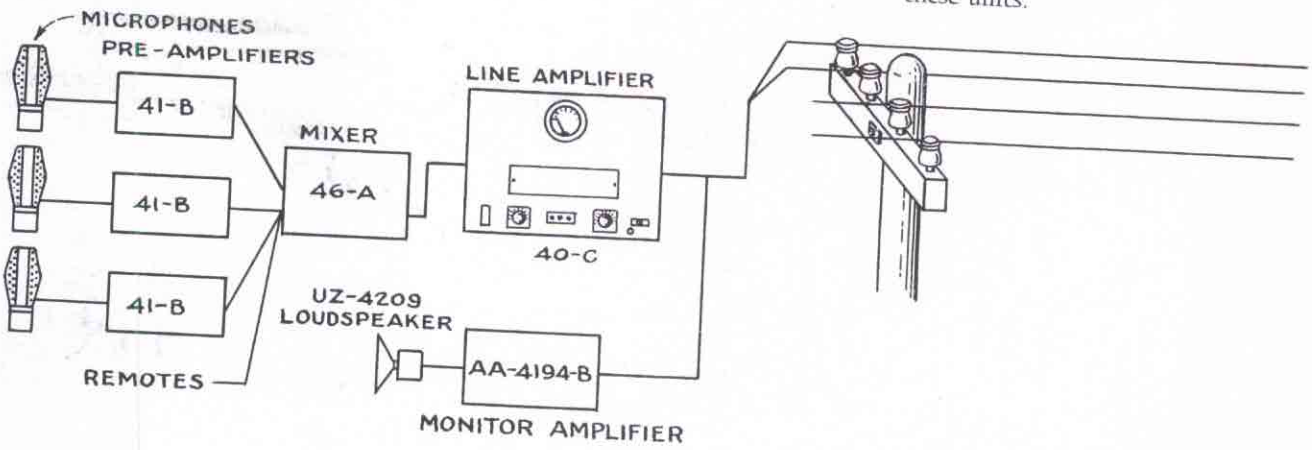
Program Amplifier—1934 Design

By EDMUND FROST, Sales Engineer, RCA Victor Co., Inc.

IT would be interesting to submit a questionnaire to representative broadcast station engineers asking for requirements on an ideal speech input and control room equipment. The answers received would undoubtedly uncover a great deal of novel information regarding the broadcast engineers' dreams for new apparatus to be put in service in 1934. It is safe to say that all would agree on a few of the most important features. The entire system must be capable of "high quality" in its every function. It most emphatically must be all "AC operated." It must be efficient, economical and mechanically simple and reliable. . . . It is a well-known axiom that progress means change. And progress in the right direction necessitates a constantly changing program of development which will put into form the wishes and desires which fashion the requirements for new equipment. As has been its custom in the past, the RCA Victor Company, in recognition of this need, offers the broadcast world a complete line of equipment which will meet the broadcasters' ever advancing standards and which will at the same time be simple and economical. One of the most fascinating, most useful and necessary of the new line is the type 40-C Program Amplifier.

This new amplifier is really three units built into one. It takes the place of the studio amplifier, the volume indicator and the plate supply unit. In size and weight, however, it is scarcely larger than any of the older DC operated amplifiers. In electrical characteristics and in appearance and mechanical construction, it is a finer product than any program amplifier or combination of speech input units ever built. It may be used either singly or with others in parallel channels as the backbone of the audio amplification system at the studios and control room. And when the transmitter is by necessity located at a distance, this amplifier will serve as remote line amplifier and volume indicator and will, in conjunction with the frequency monitor, line equalizer, jack panel and a type AA-4194-B Monitoring Amplifier, just about complete the equipment required on the control rack at the station. Of course, with transmitters of the latest type for 100, 250 and 1,000 watts output, facilities for monitoring are built into the transmitter, and hence it is possible to economize on space and equipment and get along very nicely with only the 40-C amplifier and the frequency monitor. Another practicable use for this amplifier is at a more or less permanent remote pickup point. Its function in this case is to amplify the output of a velocity microphone and pre-amplifier or a carbon microphone, as well as to furnish power for all of these units.

A TYPICAL STUDIO CHANNEL RACK ASSEMBLY OF **RCA VICTOR** HIGH QUALITY A.C. OPERATED SPEECH INPUT EQUIPMENT. THIS SHOWS THE TYPE 40-C PROGRAM AMPLIFIER USED IN CONJUNCTION WITH TYPE 41-B PRE-AMPLIFIERS, TYPE 46-A MIXER PANEL AND TYPE AA-4194-B MONITORING AMPLIFIER



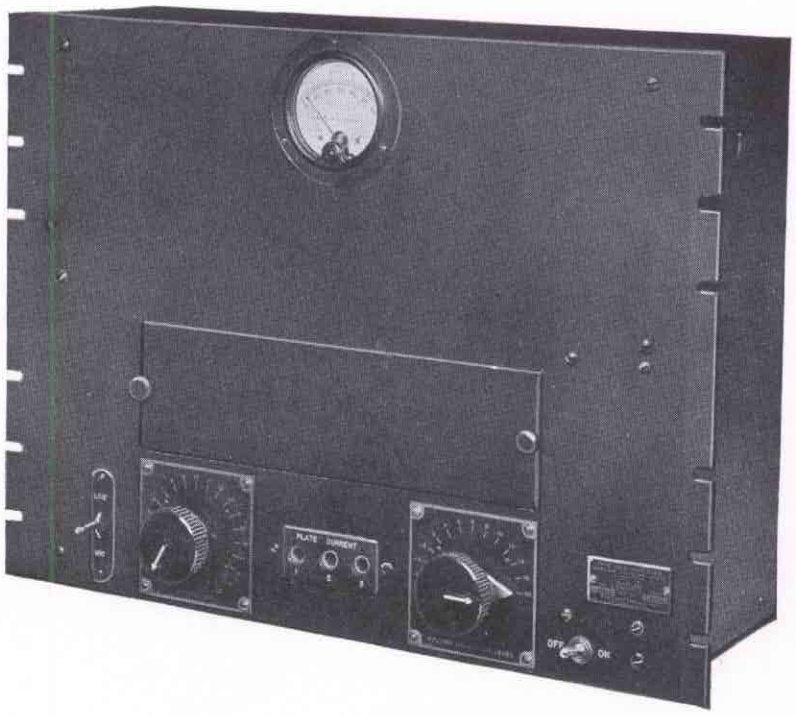


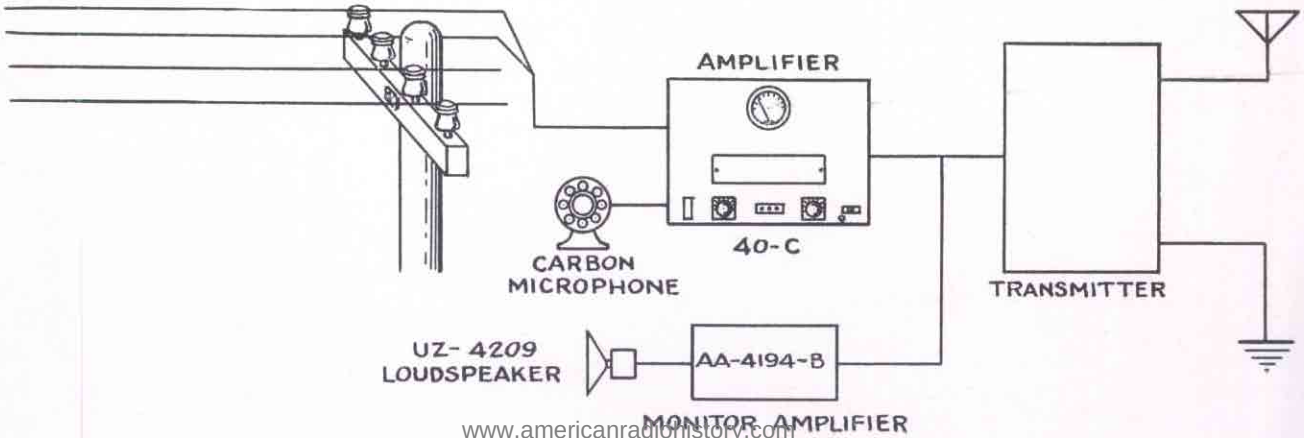
FIGURE 1

High Quality Performance

For years now transmitter and receiver engineers have vied with each other for the superiority of their own type of equipment. Through it all the transmitter engineer has usually had the lead. It is fundamentally easier to transfer sound into electrical energy than to reproduce it again into sound waves with equal fidelity. Then, too, the economic situation for the past year or two has been against the receiver man. The public has demanded a cheaper set and such demands invariably have hindered the manufacture and sale of real "high quality" receivers. . . . But now, all that is past. The demand for natural and realistic sounding programs is going to make it more and more important that both transmitter and receiver manufacturers meet the new requirements. Receivers can and will ultimately be built which will have a better overall fidelity and a greater volume range than present day equipment. Telephone lines, which now limit both of these characteristics, will be improved. . . . And so it will be up to the broadcast station engineer to show that his pick-up, amplifier and transmitter equipment will cover this increased frequency range and will have a volume range sufficient to adequately express the varying sound levels actually existing in the studio. The 40-C amplifier has a useful frequency range from 25 to 15,000 cycles, being substantially flat in response between 30 and 10,000 cycles. Its volume range is better than that required for full realization of the variations in sound intensity and color in a well-balanced program. Although completely AC operated, the circuit design and transformer shielding have been so thorough that the resultant hum in the amplifier output is reduced to an inaudible point.

General Specifications

What must this amplifier do in the way of voltage amplification, what are the input and output requirements and what other specifications must it meet, you ask, if it is to be truly an advancement in design? It must first of all be the equivalent of previously designed amplifiers in providing an overall gain of around 65 decibels. It must match the conventional 500 ohm input and output circuits and provide for switching to and correctly matching the 250 ohm input from an auxiliary carbon microphone. It must have an undistorted output of approximately plus 16 decibels, or a little more than that required to feed a telephone line or the input circuit of the average transmitter. It must mount on the standard speech input rack and it should be interchangeable with existing apparatus. It should also operate from any 105–120 volt, 50–60 cycle power supply and should require a minimum number of standard tubes. All of these requirements are fulfilled and, in addition, the type 40-C



Amplifier offers several more novel features. It will furnish 180 volt plate supply for three type 41-B microphone pre-amplifiers and the current required for one carbon microphone. The volume indicator furnished, together with an associated tap switch, will indicate the output level at any value between minus 8 and plus 20 decibels. The gain control provided is logarithmic and has twenty steps with an attenuation of 2 decibels per step.

Circuit and Tube Complement

The 40-C Amplifier utilizes the latest type Radiotrons, resulting in higher amplification per stage, uniform frequency characteristics, and low hum level. An RCA-77 tube is used in the first and in the second stages, and two RCA-89 tubes in push-pull in the output stage. The RCA-77, six-element tubes are connected as triodes. Because of the low plate impedance combined with high amplification, efficient operation is obtained without cut off of high frequency response. The RCA-89 tubes in the output stage permit an undistorted level of plus 16 db. to be secured. The rectifier employs one 25Z5. Because of the use of this tube, no plate transformer is required and the chance of AC hum being introduced by magnetic coupling is further reduced.

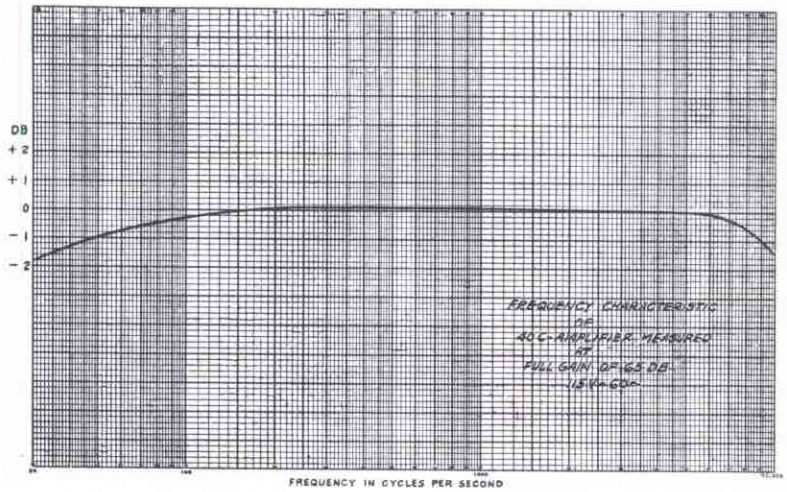


FIGURE 3

Mechanical Features

The 40-C Amplifier is mounted on a standard speech input panel, 19″ x 13 31/32″. A heavy dust cover is provided for the back. This cover is instrumental in providing adequate electro-static and magnetic shielding against stray power line and radio frequency fields. The front panel is without projection other than the knobs of the gain control and volume indicator switch. Tubes are mounted horizontally in a shielded chamber covered with a metal plate and held in place by two thumb screws. Although the amplifier is necessarily compact, parts are easily accessible. Each transformer, condenser, or inductance is mounted in a metal case with the circuit diagram, part number and electrical constants printed thereon. Each is readily accessible and removable from the back of the panel. All parts as well as the back of the panel and inside of the dust cover are finished in silver gray

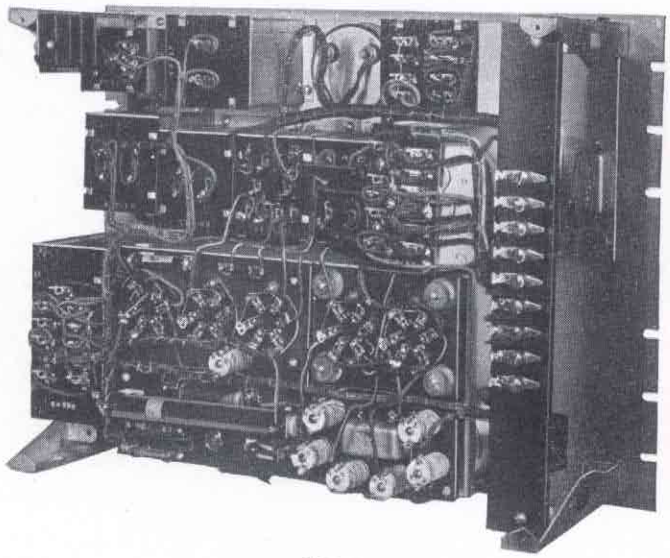


FIGURE 2

lacquer, providing a stylish appearance as well as a durable finish. An AC power switch is located on the panel and breaks both sides of the line. Fuses are located within the amplifier to protect against accidental shorting of the power supply. As a result of the use of heater type cathodes, no filament rheostat is required. The tubes will operate satisfactorily without adjustment of voltage within the normal limits of variation in line voltage. Jacks are provided for measuring all plate currents. A key switch on the panel changes the input from line to local microphone for emergency or local announcements.

Your Next Investment

Here then is a highly valuable piece of equipment—a beginning on that complete "high quality" system so earnestly desired for fulfillment of 1934 development. Here is a unit admirably suited as a studio amplifier for your audio channel or at your remotely located transmitter

(Continued on Page 51)

WBRE at Wilkes-Barre is Modernized

STARTING at scratch in 1924, with one improvised office as a studio and a staff of two persons, station WBRE, Wilkes-Barre, Pennsylvania, celebrated its tenth anniversary during the week of January 12th, by opening its completely modern studios which occupy the entire fourth floor of the Liberty State Bank Building. The 100-watt, 100 per cent modulation station is now provided with two studios, an audition room and an observation gallery and has increased its staff to eleven members.

Louis Baltimore, general manager of WBRE, in his effort to make this station as fine as the best of those serving communities, similar in population to Wilkes-Barre, has spared neither effort nor expense. Each studio covers 660 square feet, while the observation gallery is 15 x 45 feet in size. The studios are of the live end and dead end type and are treated with Acoustex in the modernistic manner. Velocity microphones and indirect lighting complete the picture.

STUDIO B OF STATION **WBRE**, LOOKING INTO THE "DEAD END." NOTE THE CLEVER MODERNISTIC PATTERN WORKED INTO THE ACOUSTIC WALL TREATMENT. THE WALL SURFACING MATERIAL ITSELF, IN DIFFERENT COLORS AND SHADES, HAS BEEN EMPLOYED TO FORM THESE MOSAIC PATTERNS

Considering the character of the surrounding country, the coverage that WBRE is able to obtain in this location is quite remarkable.

The visitor, approaching Wilkes-Barre from the east over the line of the Lehigh Valley Railroad for example, pauses for a moment at Mauch Chunk, while the usual type of passenger locomotive is uncoupled and a specially designed mountain climber is substituted. Then the train proceeds at reduced speed, climbing upward over the eastern side of the range of mountains, and having gained the crest, the passenger is afforded a very impressive view of the valley below, where lies the city of Wilkes-Barre. The stranger who has never before made the trip is likely to start putting on his hat and coat and collecting his paraphernalia preparatory to disembarking from the train at this moment. However, the experienced visitor to Wilkes-Barre continues to recline in his seat and to enjoy the view which is unfolding before his eyes.

For half an hour or more the train continues its descent of the western slope of this mountain range, weaving back and forth around horseshoe curves and figure-eight loops, with a view of Wilkes-Barre now on the right and again on the left. The train continues its descent, with

STUDIO A OF STATION **WBRE**, LOOKING INTO THE "DEAD END." VELOCITY MICROPHONE, ACOUSTIC WALL TREATMENT, AND INDIRECT LIGHTING HAVE CONTRIBUTED TO BRING THE LAST WORD IN MODERNIZATION INTO THESE STUDIOS.

(Continued on Page 10)

Byrd Antarctic Expedition to Originate Weekly Programs From South Pole

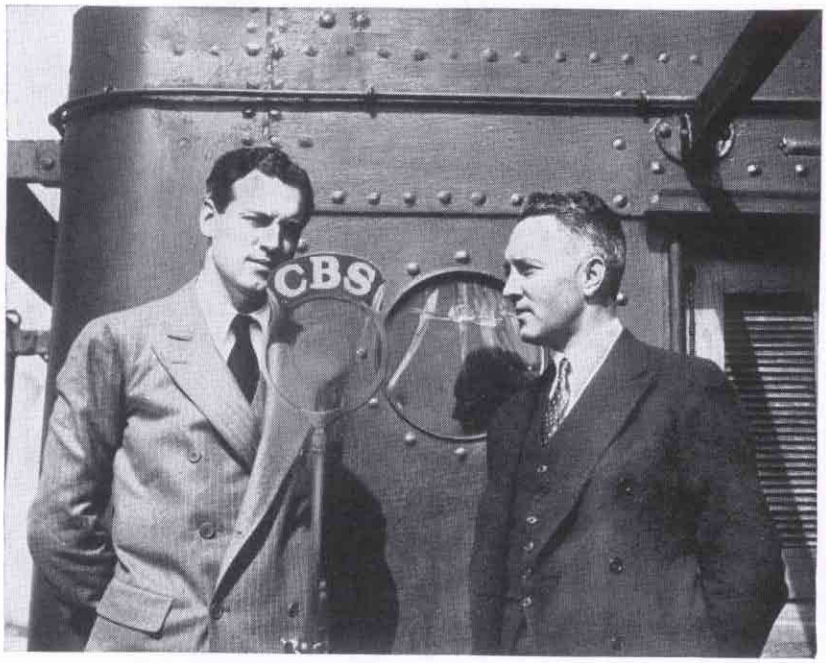
By HOWARD ALLAN CHINN, Columbia Broadcasting System

THE Columbia Broadcasting System has undertaken the task of bringing a sponsored program to their network's audience each week from Little America, the base in the South Polar regions of the second Byrd Antarctic Expedition. In order to accomplish this pretentious broadcasting enterprise, a CBS engineer and a combination announcer-production man are accompanying the expedition on its two-year sojourn to those bleak, barren but fascinating wastes where temperatures of 70 degrees below zero are by no means uncommon.

The expedition has been provided with radio transmitting and receiving equipment for their main base at Little America, for a forward sub-base to be established at the foot of the polar barrier (some three hundred miles closer to the South Pole than the main base), for the many airplanes and for the dog-sled parties that will take to the field.

Rather than attempt a direct transmission over the 9000 miles from Little America to New York, it is planned to relay the program through existing facilities between Buenos Aires and New York. A directional antenna will be used at Little America to concentrate the radiated energy towards Buenos Aires, at which point another directional antenna will be used for receiving purposes. The reception is being undertaken by R.C.A. Communications and it is through the regular radio channels maintained by this organization that the programs are relayed to New York.

The transmitter to be installed at the main base in Little America consists of a 1000-watt, crystal-controlled transmitter having a frequency range extending from 3 to 22 megacycles. The transmitter is capable of 100 per cent modulation and, in spite of its relatively low power, it is confidently believed that, with the aid of the directional antennas that are to be used, entirely satisfactory programs will be transmitted to the key station of the Columbia network in New York.



ADMIRAL RICHARD E. BYRD, AT THE RIGHT, COMMANDER AND INSTIGATOR OF THE WORLD'S MOST AMBITIOUS AND SCIENTIFIC EXPEDITION, AND **CHARLES J. V. MURPHY, C. B. S.** ANNOUNCER-PRODUCTION MAN, WHO WILL DO THE HONORS AT **KFZ**, LITTLE AMERICA, THE MOST REMOTE UNIT OF ANY NETWORK

Elaborate and careful plans have been made in order to insure the success of this undertaking, which is far from a mere technical stunt. The problem of establishing and equipping a complete broadcasting studio and transmitting station, capable of unfailing operation for a two-year period, without benefit of supplies and replacement parts from a convenient warehouse, is one which required rather careful consideration. The extreme temperatures and unusual operating conditions that will be encountered in the Antarctic regions make it extremely difficult to anticipate the reaction of each piece of equipment that is necessary for the operation of this most remote unit of any network.

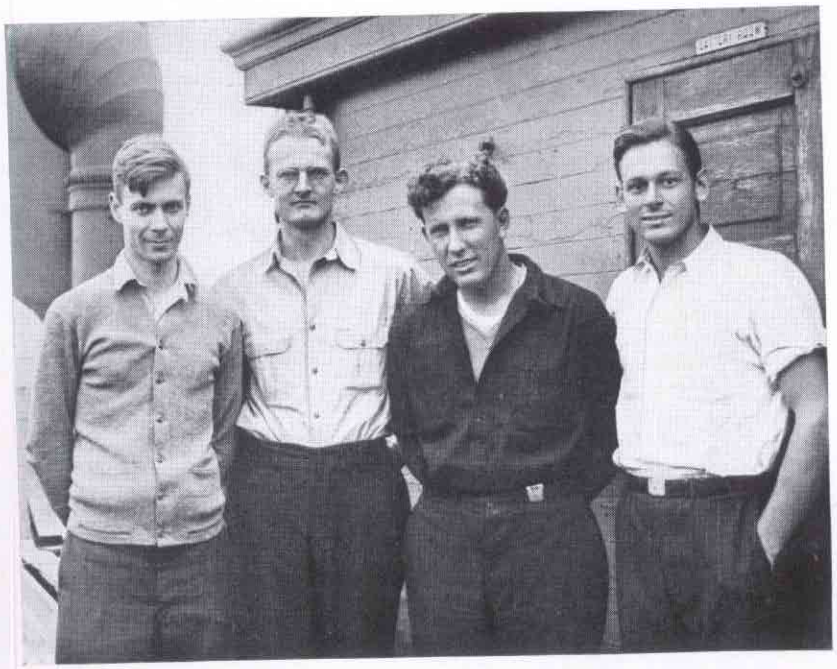
Among the thousands of radio items that have been sent with the expedition there are included: Complete building materials, fabricated but unassembled, for the construction of a suitable broadcasting studio, 50-odd single and double button carbon, magnetic, condenser and crystal microphones, 30,000 feet of wire, 70-foot wooden poles for antenna structures, almost 200 quartz crystals, 500 vacuum tubes ranging from miniature receiving tubes to 500-watt air-cooled transmitting tubes, transmitters and receivers for airplanes, sledge parties and field parties, hundreds of electrical meters, phonograph reproducing and recording equipment with 600 record blanks, gasoline driven generators from which all electrical power supply (excepting batteries) will be obtained, etc.

As an example of the unusual operating conditions that have to be contended with it is of interest to note that, while some of the quartz crystals were calibrated for use at the usual crystal oven temperature of 120 degrees Fahrenheit, others to be used in the portable dog-sled transmitters will be required to operate at temperatures as low as 50 degrees *below* zero. It is not often that a manufacturer is asked to calibrate crystals for use at such *uncomfortable* temperatures!

Much of the equipment, including the main transmitter, has been undergoing a severe test during the voyage of KJTY, the S. S. Jacob Ruppert, from Boston to Little America via New Zealand. Every Saturday night, at 10 P. M., E. S. T., ever since the expedition's flagship cleared the Panama Canal, programs have been originated in an improvised studio under the poop deck of the "Ruppert" and brought to the radio audience via the Columbia network.

During these broadcasts the ship was continually on the move and each week found it in a new position, resulting in a game of radio hide and seek. Not only did the distance to the receiving stations vary but the direction of the ship from the receiving points constantly change, the time of the broadcast was different aboard ship each week, even the day of the week changed for those aboard the "Ruppert," and the path of transmission, which was at first over an entirely dark path, shifted to a partly dark and partly light path and, finally, was over an entirely daylight path.

JOHN N. DYER, A MEMBER OF THE **C. B. S.** FIELD ENGINEERING DEPARTMENT, RADIO ENGINEER IN CHARGE OF BYRD'S ANTARCTIC EXPEDITION'S COMMUNICATION FACILITIES



JOHN N. DYER, RADIO ENGINEER, IN CHARGE OF THE EXPEDITION'S COMMUNICATION FACILITIES. **STANLEY PIERCE,** ELECTRICAL ENGINEER FOR THE EXPEDITION AND RELIEF RADIO OPERATOR. **CLAY BAILEY,** CHIEF RADIO OPERATOR. **GUY HUTCHESON,** RADIO OPERATOR, S. S. RUPPERT

These rapidly changing conditions made the use of directional antennas out of the question and, by pressing into use their receiving facilities at Riverhead, San Francisco, Honolulu and Buenos Aires, R.C.A. Communications were successful in bringing the programs to the CBS network. At times the distances spanned by the 1000-watt transmitter, which radiated its energy to the four winds, was almost 7000 miles. The equipment, after being installed in the temperate climate of New York,

went through the heat and humidity of the tropics, and then into the Antarctic regions, just as a preliminary to its final destination. In spite of all this, successful programs were obtained and, as a result, satisfactory operation from the permanent base in Little America is optimistically contemplated.

Although separated from the network's headquarters by more than 9000 miles, both CBS men carry on the same duties which are the lot of engineers and production men on less remote broadcasts. They supervise each week's program, check voice levels, write continuity and arrange technical details.

John N. Dyer, of the CBS field engineering department, was chosen to accompany the Byrd Expedition as technical supervisor. In addition to his broadcast duties he is also in complete charge of all Admiral Byrd's communication facilities.

Dyer was selected because of his wide knowledge of short-wave transmission and skill as an engineer. He studied radio engineering at the Massachusetts Institute of Technology and received his B.S. and M.S. degrees from this college. A New Englander by birth, his skill on skiis will prove a great asset to him in the South Polar regions.

Charles J. V. Murphy, newspaperman, author and radio announcer, was chosen as production manager and radio announcer of Station KFZ, Little America. As station manager of this remote unit of the Columbia Broadcasting System, Murphy's duties will consist of preparing scrips, introducing the expedition's potential amateur talent, arranging special programs, and coaching all in microphone technic.

Edwin K. Cohan, technical director of the Columbia Broadcasting System, worked out the radio engineering details of the expedition with Dr. T. S. McCaleb of Harvard University, Admiral Byrd's counsellor on radio.

And thus, for the first time in history, an expedition at the "bottom of the world" will report directly to the people of the United States. Once a week the progress of this vastly scientific enterprise to discover, explore and claim a new continent for the United States will be broadcast to the American radio audience. In addition to the value of these programs as a means of keeping the civilized world informed of the real drama being lived 10,000 miles away, they should prove of added interest because of the fact that they will be the first series ever to originate from a point so far from any humanly inhabited portion of the world.

A CORNER OF **KJTY**, THE RADIO SHACK ABOARD THE S. S. RUPPERT, THE FLAGSHIP OF BYRD'S ANTARCTIC EXPEDITION. THE TRANSMITTER TO BE USED AT LITTLE AMERICA WAS INSTALLED IN THIS SHACK AND IN CONTINUAL USE DURING THE VOYAGE TO LITTLE AMERICA

WBRE IS MODERNIZED

(Continued from Page 7)

brakes periodically grinding to slacken the pace as it rounds curve after curve, some so sharp that while the forward end of the train is traveling north, the rear end will actually be traveling south. Eventually the train, with brake shoes smoking, reaches the floor of the valley and rolls into the station, only after the traveler has had ample opportunity to obtain bird's-eye views of the city from many different angles.

Such is the character of this section of the country, and the staff of Station WBRE is to be congratulated on the successful coverage they have been able to obtain.

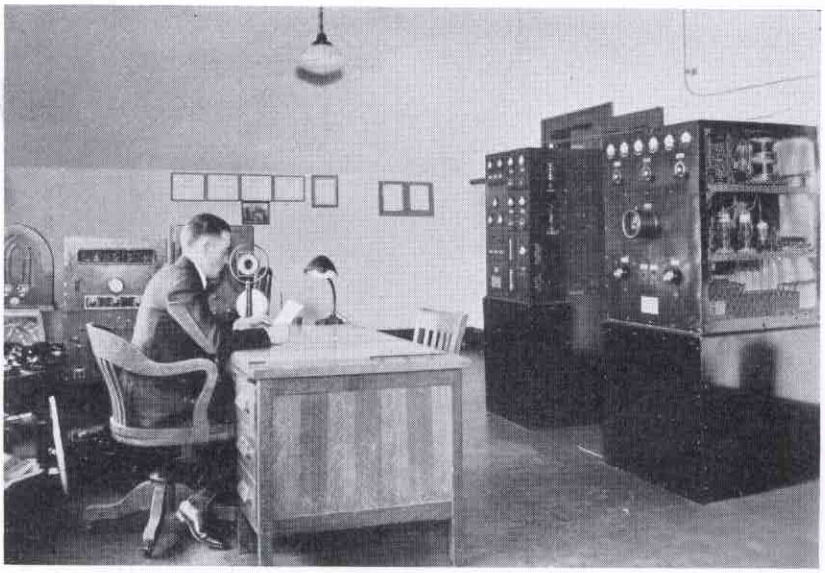
Grand Rapids Police Radio Installation

By A. A. KIRCHNER, Chief Engineer, WPEB

ON Saturday afternoon at 3 p. m., September 26, 1931, the Grand Rapids Police Department transmitted the first radio message to its radio equipped cruising cars, at that time numbering four. In but a short time it was readily realized that the Police Department had entered a new era and had found a most valuable method to use in combating crime.

The transmitter was manufactured by the RCA Victor Company, Inc., adjusted to operate on a wavelength of 122.8 meters at a power of 100 watts. The receivers were made by the Spartan Company of Jackson.

During the first year a total of 15,000 messages were broadcast, not including tests. The total cost of operation and maintenance of the equipment was $2.25 per day. As time went on and the increased efficiency was noticed due to the capability of answering more calls in a given length of time, and rendering better protection to the public, it was found advisable to equip all possible cars with radio so as to be able to cope with the major crimes.



CHIEF ENGINEER **A. A. KIRCHNER,** AT THE GRAND RAPIDS POLICE RADIO STATION **WPEB**

November 2, 1933, an additional amplifier was added to the transmitter giving it a power rating of 500 watts. This was made possible by uniting with the sheriffs of nine counties surrounding Kent County, raising the total population served to 629,000 people, and an area of 6,000 square miles. The Department is now equipped with 14 cruisers, an ambulance, signal truck and 13 emergency cars for major crime patrol. There are 12 cars in the county and East Grand Rapids departments. A total of 41 cars available at all times for emergency purposes. In the year 1933 there were 38,869 messages broadcast, and 1,001 effective arrests. The station is on the air 24 hours, rendering emergency service to nine near-by counties, and relaying dispatches of the Michigan State Police Station, WRDS, to squad cars in Illinois, Indiana and Ohio. In times when a serious crime has been committed, this station, with its cars, joins the State Police station and patrols various sections of the State.

Dispatching is accomplished as follows: Calls of emergency nature are switched direct to radio for car

(Continued on Page 21)

Total of 38,869 Transmissions		*Recovered*	*Arrests by Cruisers*
Relayed State Police Dispatches	1641		
Stolen Cars	530	524	36
Missing Persons	626	323	
Stolen Property	204		26
Hold-Ups	42		9
Burglaries	801		101
Prowlers	440		7
Window Peepers	60		1
Disturbances	749		28
Disorderly Gangs	1445		6
Family Trouble	810		28
Drunks	766		541
Accidents	477		15
Fires	660		
Pick-Ups	462		35
Hit-Runs	81		7
Investigations Made	12863		
Assist Officer	1057		
Suicides	12		
Attempted Suicides	15		
Shootings	13		4
Stabbings	18		14
Murders	4		4
Dispatched Ambulance	133		
Kidnappings	1		1
Total Arrests by Cruisers			863
Arrests Pursuant to Radio Cruiser Investigations			138
		Total "Radio" Arrests	1001

This report, showing messages transmitted during 1933, indicates that WPEB is really doing business.

Police Radio News

FROM NEAR AND FAR

OUR genial representative, Mr. W. M. Witty, from the Southwestern District, recently breezed into the office and we immediately began endeavoring to get the latest news from him about his district. In the usual manner, he denied knowledge of any news whatever, but expressed hope that by the time our next issue appeared, there would be something worthwhile to tell our readers.

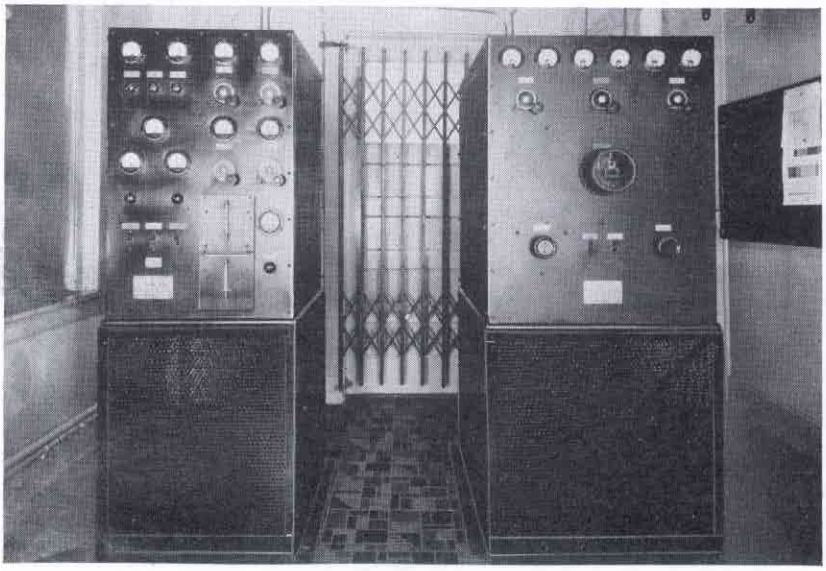
Inviting him to be seated in one of our most comfortable chairs, we very tactfully drew him into conversation and in our most subtle manner we were able to obtain the following items:

Since we last issued *Broadcast News*, a complete RCA Victor Police Radio installation has been placed in operation in the city of Fort Worth, Texas, covering the largest area of any installation utilizing this newly developed type of equipment.

This installation consists of the new High-Frequency Terra Wave equipment and utilizes a transmitter, located on top of a tall building in the metropolitan section. The output of this transmitter is 15 watts, and coverage is obtained for the entire metropolitan section, as well as all of the suburban section, a total area of fifty square miles. 28 high-frequency receivers have been installed in police squad and detective cars which patrol different sections of the above area, and are at all times able to receive communications directly from headquarters.

This system has been in operation since November 1st, 1933, and the authorities are more than pleased with the results already obtained. This installation was sold by W. M. Witty, who tells us that he will give us a more complete story, with photographs, for our next issue.

The call letters of the Fort Worth transmitter are W5XB, and the frequency 34,600 k.c.



RCA VICTOR 100-WATT POLICE RADIO INSTALLATION AT GRAND RAPIDS, MICHIGAN

Another Terra Wave installation is now being made in Amarillo, Texas, consisting of a 15-watt transmitter and 5 high-frequency automobile receiving sets. The area to be covered by this installation will include the city of Amarillo and surrounding suburbs.

* * * *

An RCA Victor Police Radio installation has just been completed in Little Rock, Ark., consisting of a 100-watt ET-3670 Police Transmitter and 35 AR-4160-A automobile receivers. This station is jointly operated by the municipalities of Little Rock, North Little Rock, and Pulaski County. The transmitter is located at City Hall in Little Rock, and official reports indicate very satisfactory results. Mr. Witty, who negotiated this sale, promises us a more complete description of this installation, with illustrations, for our next issue.

* * * *

Other recent RCA Victor Police Radio installations utilizing the ultra-high-frequency Terra Wave equipment include St. Petersburg, Florida, and Miami Beach, Florida, sold by Ben Adler. Contracts have been signed for a similar installation at Durham, North Carolina, sold by Mr. Calvert, of the Home Office, who has recently been demonstrating this equipment throughout the Southeastern District.

All of which reminds us of the story about "No news, but the dog died." We find that most of these field representatives have a wealth of information of timely interest which they unconsciously carry about with them, but it is not always easy to get it down in black and white. So when they chance to call at "Radio Headquarters," we usually sneak up on them and before they realize what has happened (Presto!) we have the dope.

Russell P. May just called us up from New York, and we asked him what he knew that would be fit to print in *Broadcast News*. He too professed total ignorance of anything of the kind. However, before he hung up, we extracted the following interesting item from him:

Huntington, Long Island, is now equipped with RCA Victor

Police Radio of the new 25-watt conventional wave type. The transmitter is located in Police Headquarters, and operates on a frequency of 2,414 k.c. The area covered includes the entire township of Huntington and its suburbs. The system includes five receivers which are installed in police patrol cars. The call letters assigned to this station are WPGO.

And thereby hangs a tale—which we obtained through other channels.

The Huntington job was scheduled to inaugurate service at midnight Sunday-Monday, and as late as the preceding Saturday, the equipment was just arriving on the scene. R. P. May and C. T. Anson were assigned to take care of the installation work, which involved locating an antenna on the top of the city hall building at Huntington, with a quarter-wave transmission line connecting it to the transmitter on the ground floor. Time was getting short, and the City Departments offered complete cooperation, sending over the Fire Department's hook and ladder truck and a battery of huge flood lights so that the work could proceed during the night.

May and Anson scaled to the dizzy heights of the city hall dome, using the extension ladders of the Fire Department, and the work proceeded with the aid of the large flood lights trained upon the top of the building. All of which was working out very nicely until a fire alarm was turned in—and the members of the Fire Company hastily removed their equipment and proceeded to the scene of the conflagration, leaving May and Anson marooned atop the city hall dome.

Quite chilly, and in total darkness, they went into conference with each other, and at length agreed there was very little they could do about it except patiently await the return of the equipment with the ladders and flood lights.

To make a long story short, the installation was finished on time, and the inauguration of the police radio service was properly celebrated by all hands. However, May and Anson have come to the conclusion that some other form of convenience should be provided for going aloft on the next job.

The city of Kansas City, Missouri, recently made a very decided improvement in their Police Radio system when City Manager, H. F. McElroy switched on the new RCA 500-watt transmitter.

Lieutenant Roy De Shaffan, Sr., reports that the new installation provides a greater signal strength and much better intelligibility to the cars than he had even hoped for. The new transmitter equipment is an addition to the existing system, the old transmitter now being used for auxiliary purposes.

The installation consists of the standard RCA ET-3670 Exciter Unit and the UT-4199 500-watt Amplifier. The design utilizes Class B high-level, high-efficiency 100% modulation.

The purchase of the equipment was made under the direction of Mr. E. C. Reppert, Director of Police.

Lieutenant Roy De Shaffan, Sr., is the Director of Radio for the city.

Rise to Occasion

Radio Cars Surround Stolen Yeast Co. Truck Near Scene of Theft

New York World-Telegram, Friday, December 1, 1933

A truck stolen from the Fleischmann Yeast Co. was recovered and the thief arrested early today before it had gone two blocks from the place where it had been parked.

Warren Wheely, driver, was inside the company's building at 140 Perry St., when he heard the motor started and saw the truck driven off. His telephoned alarm brought four radio cars which closed in on the truck at Perry and Greenwich Sts., a block and a half away.

John Barriero, 20, of 370 W. 11th St., who was at the wheel, was charged with grand larceny.

A LETTER THAT SPEAKS FOR ITSELF

CITY OF ASHLAND
KENTUCKY

DEPT. OF PUBLIC SAFETY
CHARLES F. HOWARD
CHIEF OF POLICE

DECEMBER 29, 1933.

MR. J. H. MARTIN,
CHIEF OF POLICE,
DANVILLE, VIRGINIA.

DEAR SIR:

REPLYING TO YOUR LETTER OF DECEMBER 14TH, IN REGARD TO R C A VICTOR RADIO RECENTLY INSTALLED IN OUR POLICE DEPARTMENT, BEG TO ADVISE THAT IT IS THE SAME EQUIPMENT WHICH YOU CONTEMPLATE BUYING. OUR EQUIPMENT HAS FAR EXCEEDED OUR EXPECTATION, HAS INCREASED THE EFFICIENCY OF THE DEPARTMENT AT LEAST 80%, AND IS GIVING US WONDERFUL SERVICE.

OURS IS A HILLY COUNTRY, AND THE RECEPTION ANY PLACE IN THE CITY IS UNUSUALLY GOOD. WE MADE A TEST RECENTLY, AND WENT BACK IN THE COUNTRY FROM THE CITY A DISTANCE OF MORE THAN EIGHT MILES, AND THE SPEAKER COULD BE HEARD UNUSUALLY PLAIN. OUR CITY IS ABOUT THE SAME SIZE AS DANVILLE, AND I FEEL SURE YOU WILL BE DELIGHTED WITH THE EQUIPMENT, AND IT IS A PLEASURE FOR ME TO SAY THAT YOU WILL MAKE NO MISTAKE IN THE INSTALLATION.

YOURS VERY TRULY,
C F Howard
CHIEF OF POLICE, ASHLAND, KY.

CFH S

Solution of Vacuum Tube Problems By the Isocline Method

By I. G. MALOFF, Research Engineer, RCA Victor Co., Inc.

WHEN a simple resonant circuit is connected to a source of electric energy such as a storage battery, there occurs an oscillatory disturbance which dies down sooner or later, depending on the electric losses in the resonant circuit. A circuit of this nature lends itself readily to mathematical analysis. The final differential equation for such a circuit is of a form:

$$a\frac{d^2i}{dt^2} + b\frac{di}{dt} + ci = 0 \qquad (1)$$

which is a linear differential equation with constant coefficients.

The solution of such an equation can be found in most of the text books on calculus, and is of the form:

$$i = Ae^{-\alpha t}\sin(wt + \psi) \qquad (2)$$

that of a *damped* harmonic oscillation.

In case it is desired to get *sustained* electrical oscillations in a resonant circuit, it should be excited again and again and at proper intervals. Devices which can under proper conditions give this kind of excitation are electric arcs, glow tubes, vacuum tubes utilizing thermionic emission, vacuum tubes utilizing secondary emission, and several others. These devices can be said to possess electrical resistance which is variable, depending on either current or voltage magnitude. Moreover, they can be so arranged as to give negative internal resistance between certain limits of current "i" and voltage "e" (across and through them, respectively). In such a case the coefficients of equation (1) and their signs are variable with "i" (or

IOURY G. MALOFF, RCA VICTOR

"e") and therefore contain "i" (or "e") in some form and also $\frac{di}{dt}$ (or $\frac{de}{dt}$). In the majority of cases the relations between the variables are such that they can be best (if not only) expressed graphically. A general solution of such a case is unknown, to say the least. A particular solution may be obtained either by a method of successive approximations or by graphical means. Among graphical methods the Isocline method, especially in a form described by Kirschstein, seems to be one of the most convenient, universal, and useful.

Isocline, as the word itself implies, is a line joining points of equal inclination or slope. In the method about to be described it joins points of equal slope or derivative of a function. This method is a graphical method of solution of two simultaneous non-linear differential equations. It is particularly suitable for solution of performance of oscillators with two reactive elements. A typical problem of this kind is the multivibrator problem, which will be used here to illustrate the Isocline method.

The voltage-current characteristic of any two-terminal device will be here designated as the "terminal" characteristic.

The device may be just a tube, or a tube including batteries and circuit elements, or any combination of tubes, or arcs, or anything with two terminals to which, if one applies a voltage, a current results. Whatever the device may be, consider it concealed in a box with two terminals protruding from the box. The voltage-current characteristic as obtained from these two terminals is what will be called the terminal characteristic.

Figure 4 shows an oscillating circuit connected across the device D. To obtain its characteristic apply a set of values of voltages "e" (or "e_c") across the device and obtain the current entering or leaving the device. By plotting "e" as ordinates and "i" as abscissae, the terminal characteristic is obtained. The terminal characteristic may be obtained experimentally or calculated from the knowledge of the mechanism of the device. Figure 5 shows a device composed of two coupled tubes. It is in fact the well-known unsymmetric multivibrator or relaxation oscillator.

If we remove the oscillating circuit and substitute in its place a battery of variable voltage, with a voltmeter across it and an ammeter in series with it, we can take the experimental terminal characteristic of the arrangement.

If the tubes are of 227 type with 50 volts d.c. on the plates and for the range of voltage across the oscillating circuit between twenty

volts plus and fifty volts minus, the terminal characteristic for the arrangement looks as shown on Figure 6. The same characteristic could be calculated from the static characteristics of the tube. It may be mentioned that the grid current is a very important factor and under no consideration can be neglected; that is, if the knowledge of exact magnitude and shape of the output is wanted.

Let us state the problem we are about to solve:

For a multivibrator as shown on Figure 5 compute the exact current and voltage output as functions of time. This means we want to know the exact shape and magnitude of current and voltage output of the multivibrator. Let the constants be: R equal to 1000 ohms, L equal to one henry and C equal to 10^{-8} farads.

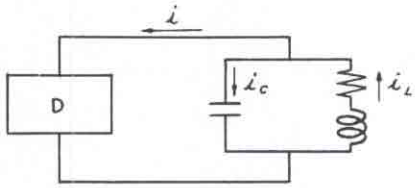


FIGURE 4

The arrangement as shown on Figure 5 can be reduced to one shown below:

The fundamental relations for such a circuit are:

$$i = i_L + i_c$$

$$i = f(e_c)$$

$$e_c + i_L R + L\frac{di_L}{dt} = 0$$

$$i_c = -C\frac{de_c}{dt}$$

The sign in the last equation is taken negative because the assumed direction of i_c is such as to charge the condenser in the opposite sense of e_c. (If the reverse sense were assumed, the isoclines on the following pages would be rotated 180° about the e_c axis.) It is of great importance to have the signs right and this importance cannot be overexaggerated.

The four relations above can be reduced to the following two:

$$i_L = f(e_c) + C\frac{de_c}{dt} \qquad (3)$$

and

$$e_c = -i_L R - L\frac{di_L}{dt} \qquad (4)$$

The equations (3) and (4) show relations between three variables—e_c, i_L and t. Since the process of oscillation depends chiefly upon the changes in the energy content of the system, and since e_c and i_L are measures of the energy stored in the condenser and inductance, respectively, the elimination of the parameter t from the equations (3) and (4) would tell us the story of the manner in which these changes take place. Since the expression for $f(e_c)$ is given graphically, the relation between e_c and i_L is most easily expressed graphically.*

The isoclines offer a means of accomplishing this. The procedure is as follows:

Set up a system of rectangular coordinates with i_L as abscissae and e_c as ordinates, as on Figure 8. The next step is to trace two sets of isoclines or lines of equal derivatives on this set of coordinates.

First, assign to $C\frac{de_c}{dt}$ (equal to $-i_c$)

a number of values like 0, 1, 2, etc., and plot the equation

$$i_L = f(e_c) + C\frac{de_c}{dt}$$

for each of these values of $C\frac{de_c}{dt}$ (see Figure 9). For $C\frac{de_c}{dt} = 0$ the isocline is merely a graph of the terminal characteristics as given on Figure 6.

Each of these curves is an isocline as it joins all the points in e_c–i_L plane for which the derivative $C\frac{de_c}{dt}$ is equal to a given constant. By means of this family of isoclines the value of the derivative $C\frac{de_c}{dt}$** for any combination of values e_c and i_L is read directly from the diagram.

By assigning several constant values to $L\frac{di_L}{dt}$ in equation (4), and by plotting them on the same set of coordinates, a second set of isoclines is obtained. Each of these isoclines joins all the points in e_c–i_L plane for which the derivative $L\frac{di_L}{dt}$ is equal to a given constant. By means of the second family of isoclines the value of derivative $L\frac{di_L}{dt}$,* for any combination of values e_c and i_L is read directly from the diagram.

These two families of isoclines can be superimposed. The resultant construction represents a graphical solution of the equations (3) and (4), as for any combination of e_c and i_L it gives directly the values of $C\frac{de_c}{dt}$ and $L\frac{di_L}{dt}$, which satisfy the original equations (3) and (4).

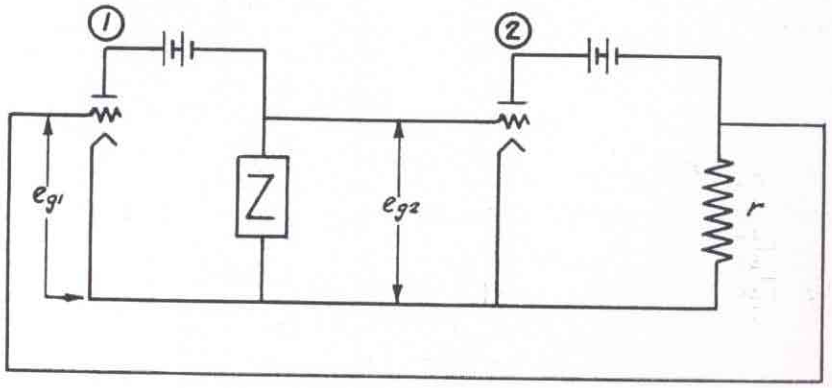


FIGURE 5

* Even if it were expressed analytically, the graphical solution may be the only way out, as, for it, the complexity of $f(e_c)$ is not an obstacle.

* Multiplied by a constant L.

** It is really the value of derivative multiplied by a constant C.

Figure 10 shows a complete problem of a relaxation oscillator worked out by the isocline method. Referring to this plot, take the point $e_c = -14$ v, $i_L = +4$ ma; the two isoclines $C\frac{de_c}{dt} = +1 \times 10^{-3}$ and $L\frac{di_L}{dt} = +10$ pass through this point.

Putting these values into equations (3) and (4), following identities are obtained:

$$4 \times 10^{-3} = 3 \times 10^{-3} + 10^{-3}$$

$$-14 = -4 \times 10^{-3} \times 10^{-3} - 10$$

It shows that equations (3) and (4) are satisfied at this point as well as at any other point of the plane. The reason for this is that the families of isoclines were drawn from equations (3) and (4).

To get a curve which is a particular solution of equations (3) and (4), it is necessary to assign a boundary condition such as $e_c = 0$, $i_L = 1.6$ at time $t = 0$. Next, choose an arbitrary interval of time Δt, small enough to assume that derivatives are constant for its duration. To get an accurate solution Δt must be small in comparison with the period of oscillation. In this example Δt is chosen as 100 microseconds and 50 microseconds.

By drawing the isoclines as outlined above, every point of the plane e_c–i_L becomes a solution of equations (3) and (4), and so there is no further use for these equations. From now on the computation proceeds from the two approximate relations:

$$\Delta i_L = \frac{1}{L}\left(L\frac{di_L}{dt}\right)\Delta t \qquad (5)$$

$$\Delta e_c = \frac{1}{C}\left(C\frac{de_c}{dt}\right)\Delta t \qquad (6)$$

Starting then at the point $i_L = 1.6$, $e_c = 0$, it is seen that the two isoclines $L\frac{di_L}{dt} = -1.6$ and $C\frac{de_c}{dt} = 0$ pass through this point.

As a first approximation it is assumed that $L\frac{di_L}{dt}$ stays -1.6 and $C\frac{de_c}{dt}$ stays zero during the interval Δt. Inserting these values in (5) and (6) the change in i_L and e_c is obtained as

$$\Delta i_L = -1.6 \times 10^{-4}$$

$$\Delta e_c = 10^8 \times (0) \times 10^{-4} = 0$$

So, if $L\frac{di_L}{dt}$ remained -1.6 and $C\frac{de_c}{dt}$ remained zero for 10^{-4} sec., i_L and e_c at the end of this interval would be 1.44 ma and 0 volts respectively. Drawing a straight line between the point $e_c = 0$; $i_L = 1.6$ ma; and $i_L = 1.44$; $e_c = 0$, the segment representing the first approximation to the exact solution is obtained. This segment $0-1'$ shown in Figure 10 has been so drawn.

As a second approximation find the isoclines $C\frac{de_c}{dt} = C_1$ and $L\frac{di_L}{dt} = C_2$ which pass through the midpoint of the segment drawn as a first approximation and assume that these values of $L\frac{di_L}{dt}$ and $C\frac{de_c}{dt}$ remain constant during the interval Δt. To find the isocline passing through the midpoint of the segment, interpolate along the e_c – axis for $L\frac{di_L}{dt}$ and along the i_L – axis for $C\frac{de_c}{dt}$. Thus, at the midpoint ($i_L = 1.52$ ma; $e_c = 0$) $C\frac{de_c}{dt} = -.08 \times 10^{-3}$ and $L\frac{di_L}{dt} = -1.5$, and assuming that $L\frac{di_L}{dt}$ remains -1.5 volts for the interval 10^{-4} sec. and $C\frac{de_c}{dt}$ remains $-.08 \times 10^{-3}$ for the interval 10^{-4}

e_{g2} VOLTS	e_{p2} VOLTS	i_{p2} ma	e_{g1} VOLTS	e_{p1} VOLTS	i_{p1} ma	i_{g2} ma	i_c ma
-50	50	0	0	0	0	0	0
-40	50	0	0	10	1.0	0	1
-30	50	0	0	20	1.6	0	1.6
-20	50	0	0	30	2.5	0	2.5
-10	50	0	0	40	3.3	0	3.3
-6	50	0	0	44	3.5	0	3.5
-5	49.5	.5	-.5	45	3.3	0	3.3
-4	49	1.0	-1.0	46	3.0	0	3
0	46.5	3.5	-3.5	50	1.5	0	1.5
2	45.5	4.5	-4.5	52	1.1	0	1.1
3	44.5	5.5	-5.5	53	.4	.5	.9
4	44	6	-6	54	.1	1.0	1.1
10	39	11	-11	60	0	3.5	3.5
20	30	20	-20	80	0	10.5	10.5

$E_{p1} = 50v$

$E_{p2} = 50v$

$R = 1000v$

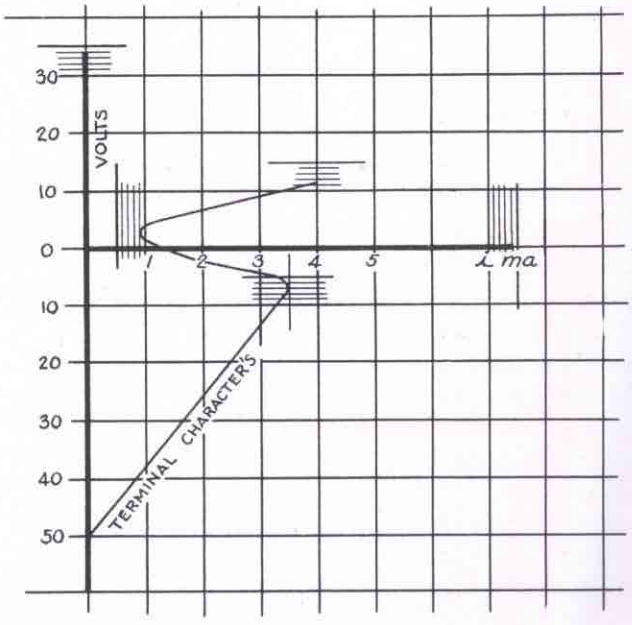


FIGURE 6

sec., there results from equations (5) and (6):

$\Delta i_L = 1 \times (-1.5) \times 10^{-4} = -.15$ ma.

$\Delta e_c = 10^8 (-.08 \times 10^{-3}) \times 10^{-4} = -.8$ volts.

So at the end of 10^{-4} sec., i_L and e_c have the values 1.45×10^{-3} amp. and $-.8$ volts respectively. Drawing a straight line between the points $e_c = 0$; $i_L = 1.6$ ma, and $i_L = 1.45 \times 10^{-3}$ amp. and $e_c = -.8$ volts, the segment representing the second approximation to the exact solution is obtained. This segment, $0-1$, shown in Figure 10 has been so drawn.

To obtain a second segment, repeat the process; that is, find the values of $L \frac{di_L}{dt}$ and $C \frac{de_c}{dt}$ as given by the isoclines at the beginning of the second segment (end of first segment), and use these values in (5) and (6). This gives the first approximation to the second segment. To obtain the second approximation find the values of $C \frac{de_c}{dt}$ and $L \frac{di_L}{dt}$ as given by the isoclines at the midpoint of the first approximation of the second segment and use these values of $L \frac{di_L}{dt}$ and $C \frac{de_c}{dt}$ in (5) and (6).

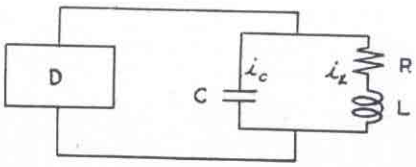


FIGURE 7

By the repeated application of (5) and (6) in the manner described above, the heavy spiraling curve shown on Figure 10 was obtained. From this spiraling curve the curves of e_c and i_L are readily constructed as functions of time because each chosen time interval corresponds to a particular pair of Δe_c and Δi_L. Figure 11 shows e_c and i_L plotted as functions of time.

In general, given a circuit as that shown in Figure 4, it follows from Kirchoff's first and second laws that:

$$i_L = f(e_c) + C \frac{de_c}{dt} \qquad (7)$$

$$e_c = -i_L R - L \frac{di_L}{dt} \qquad (8)$$

where $i = f(e_c)$ is the "terminal" characteristic of the device.

To solve these two simultaneous non-linear differential equations by the isocline method, proceed as follows: First, determine in the $e_c - i_L$ plane the two families of isoclines $C \frac{de_c}{dt} = \text{const.}$ and $L \frac{di_L}{dt} = \text{const.}$, namely, the curves

$$i_L = f(e_c) + \text{const.}$$

$$e_c = -i_L R - \text{const.}$$

which are obtainable by parallel displacements of the curves $i_L = f(e_c)$ along the i_L – axis and $e_c = -i_L R$ along the e_c – axis.

Second, assign a boundary condition; that is, decide upon a point in the plane at which to begin the integration.

Third, choose an interval of time Δt. This Δt does not have to be

(Continued on Page 50)

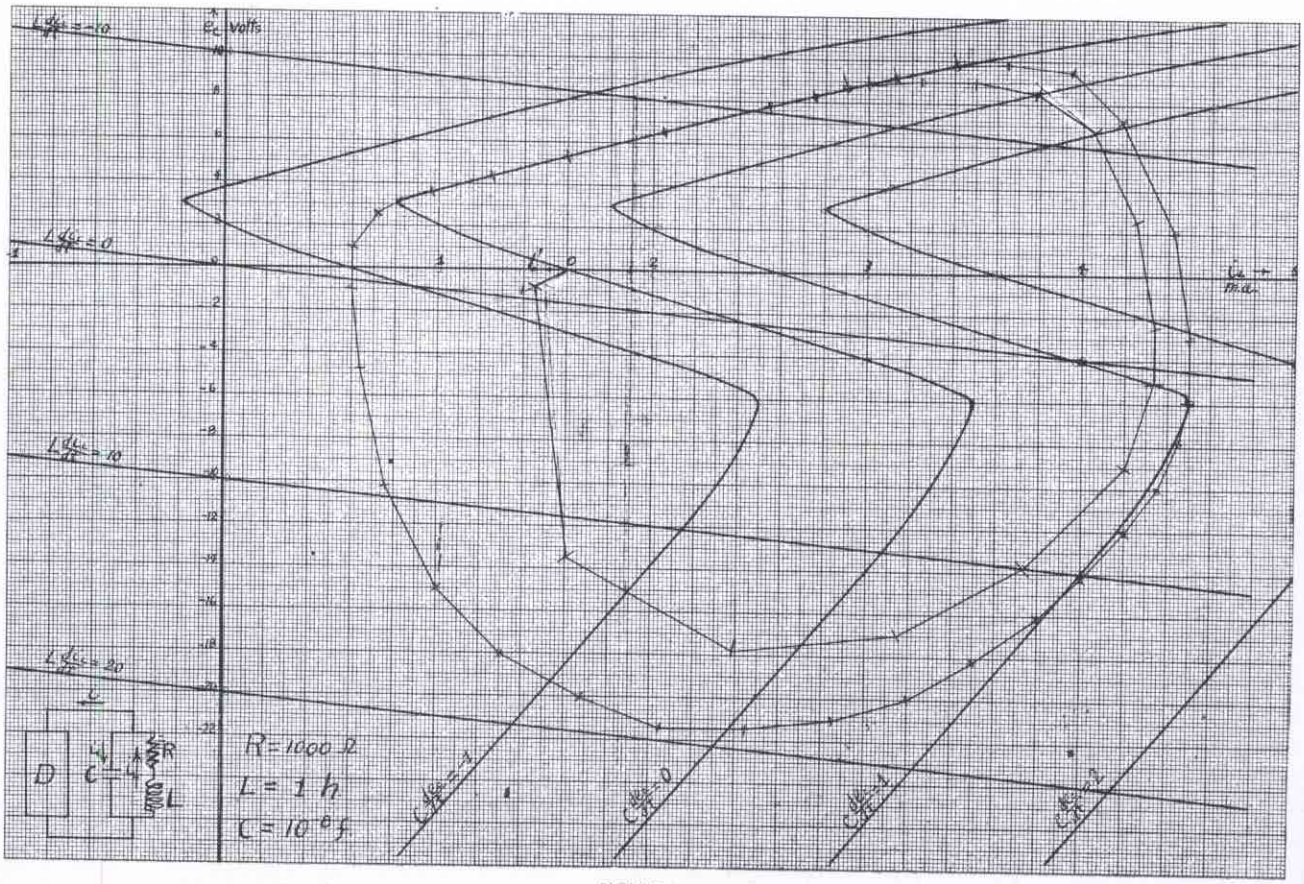


FIGURE 10

Making America Easier to Look At

(1) **JOHN VASSOS,** THE LATEST GENIUS TO BECOME AFFILIATED WITH "RADIO HEADQUARTERS"
(2) A WELL-KNOWN ORANGE DRINK GOES **VASSOS**
(3) DESIGN FOR AMERICAN LEGION MEMORIAL BUILDING, BY **VASSOS**
(4) OFFICE AND STUDIO OF **MARGARET BOURKE WHITE,** THE FAMOUS INDUSTRIAL PHOTOGRAPHER, DESIGNED BY **VASSOS**
(5) A NEW VERSION OF THE LOWLY KITCHEN STOVE, À LA **VASSOS**
(6) **"AICHMOPHOBIA,"** ONE OF **VASSOS'** ILLUSTRATIONS FROM HIS BOOK ENTITLED **"PHOBIA"**
(7) ATLANTA'S FAMOUS BEVERAGE IN A NEW AND ATTRACTIVE PRESENTATION
(8) **"SALOME,"** FROM **OSCAR WILDE'S** PRESENTATION, ILLUSTRATED BY **VASSOS**
(9) NOT A ROLLS-ROYCE, BUT A **"BODY BY VASSOS"**

New Art in Radio

Celebrated Designer Joins Staff of RCA Victor Company

IN THIS day of stream-line automobile bodies, bullet-shaped express trains and modern home furnishings completely shorn of their mid-Victorian but useless gingerbread adornments, we are becoming more and more conscious of the fact that in sheer utilitarian simplicity lies the most enduring beauty.

As we roll by the quaint suburban home in our 1934 vehicle, at the modest speed of 60 or 70 miles per hour, we catch a fleeting glimpse of the jigsaw lace work around the porch balustrade and the eaves of the roof, and many of us unconsciously make note of the fact that it was probably built in the Gay Nineties, before folks had come to realize such decorations were not only expensive and useless, but that they actually did more to detract from the appearance of the place than to improve upon the fundamental and useful part of the structure itself. Many of us also subconsciously estimate the approximate cost of removing these superfluous adornments and modernizing the structure so as to present a more pleasing and up-to-date appearance, —but that is as far as we ever get with the idea. We never actually do anything about it.

Not so with John Vassos. He has for several years been making America easier to look at. He takes a keen delight in re-shaping the commonplace object, with which we come in daily contact and which we are inclined to tolerate as a necessary evil of ugly appearance, and by his very unique process of simplifying its outward appearance to that which is fundamentally characteristic of the object itself, he produces as if by magic a pleasing and individually artistic structure. And what is most astonishing about the results which he accomplishes is that the change is so obviously proper that we wonder why we didn't think of it ourselves, and we agree that it should have been done in the beginning.

A brief conversation with Vassos out on location in the midst of his work is most revealing. He pauses in the midst of his work of creating pleasant surroundings in an up-to-date eating place. We ask him how he arrived at the decision to run that chromium plated metal band around the wall, about 36 inches above the floor,—an attractive border line between the gray below and the red above. With his characteristic smile, he explains that that is the portion of the wall into which the patrons and employes alike will bump the backs of the chairs, and if the plaster at that point were not protected, it would become chipped and would require frequent repair and redecoration in order to keep the place looking presentable. With the introduction of the metal band, the plaster is not only protected but also the necessity for frequent retouching of the decorations is precluded and the metal band itself being chromium plated does not require any attention,—whereupon we mentally admit that we should have thought of that ourselves.

THE **VASSOS** INFLUENCE IN AN UP-TO-DATE RESTAURANT. HERE BEAUTY IS COMBINED WITH EFFICIENCY, CONVENIENCE AND SANITATION. EVEN THE MENUS BEAR THE MASTER TOUCH

Hardly any detail in the old order of things is safe from the radical changes originating in the mind of John Vassos. The humble turnstile, which we have always regarded as just an ugly and commonplace necessity in the commercial world of today, suddenly takes on a new individuality, pleasing in appearance and miraculously harmonizing with its surroundings. We imagine it confiding to us: "Vassos passed this way."

We come upon a new type of orange drink dispensary, rife with graceful curves and other astonishing innovations in design. We find that Vassos has paused here for more than a drink of orange juice. The curved counters we learn have increased the serving capacity of the stand and that recess beneath the counter for our toes permits us to stand closer to the counter and avoid spilling the orange juice on our clothing, as we used to do when we had to stoop forward. The indirect illumination, we learn, attracts the thirsty from clear across the street,

spreading the identity of the place over a broader area than ever before.

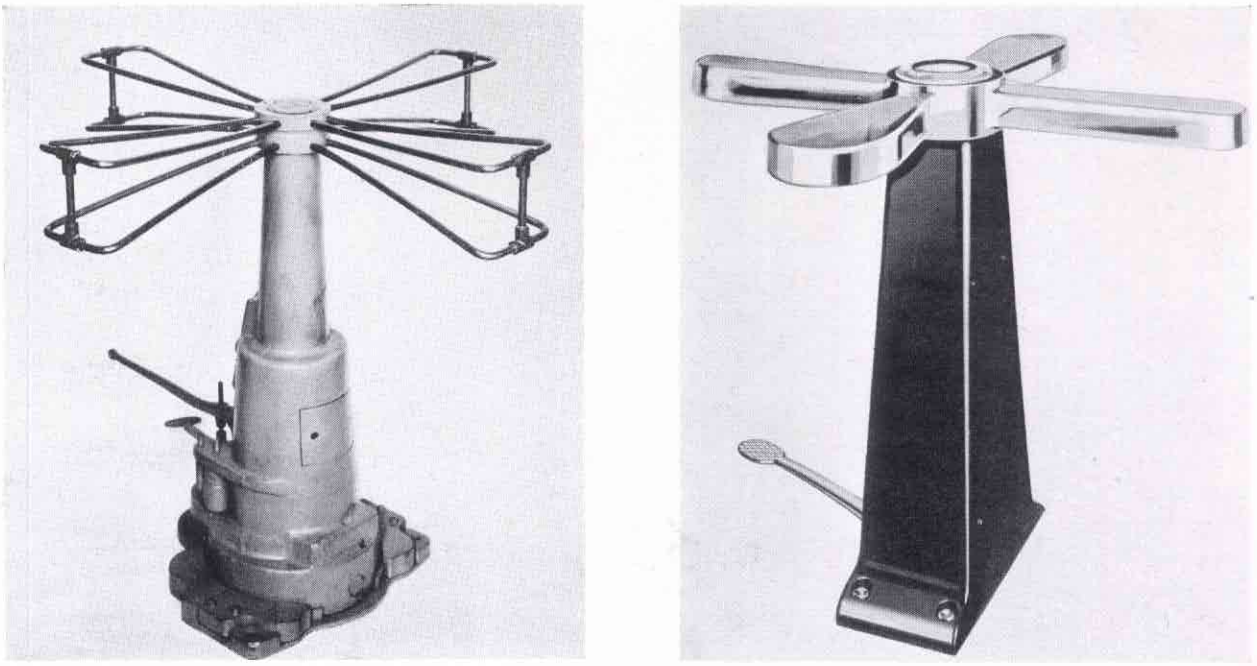
A car of uncommonly attractive and luxurious appearance passes down the Great White Way. We pause on the sidewalk and turn to follow it with our eyes, and we are quite astonished to learn that it really is not a Rolls-Royce with a custom-built body, but a well-known product of Detroit, in which Vassos has recently taken an artistic interest.

We are invited to visit the studios of a modern broadcasting station and as we pause to marvel at the simple but effective interior decorative schemes embodying motives representative of this great industry, we learn that here again Vassos has created the appropriate settings, and upon inspection, we find that each and every mural depicts the activities in some branch of the organization. Truly artistic and yet ever practical, Vassos is as quick to catch the spirit of an electron within a vacuum tube for a radio mural as he is to depict the peculiar mental bent which prompted Salome to demand the head of John the Baptist, for the illustration of Oscar Wilde's presentation of Salome.

Realizing that up-to-date America craves modern beauty in its modern appliances, the RCA Victor Company was quick to grasp the opportunity to add John Vassos to its staff of creative geniuses, and the result has already been highly gratifying. The new line of broadcast receivers for the home in their modern enclosures has already been accepted so enthusiastically by the purchasing public that it is planned to extend this modern art into other models of receivers and even beyond that,—into transmitting equipment for the broadcast studios where the programs originate. Surely the vast thousands of curious visitors who daily visit the broadcast studios to witness programs in the making, are not alone listeners,—they are watching the artists and they are also taking mental notes of the surroundings. No longer is the broadcast studio of the progressive radio organization a makeshift arrangement, sufficient alone to accomplish the necessary acoustic and electrical results. The up-to-date studio today makes ample provision for courteously receiving and comfortably entertaining the hosts of visitors who would peek behind the scenes. Here lies a priceless opportunity for favorable publicity. Visitors having been once properly entertained amid the right surroundings at the studios will subconsciously be attracted to the programs emanating from that station and, moreover, will take a greater interest in the features on their programs. Those who have visited "back stage" in the Great Theatre of the Air are inclined to describe the scenes to their friends who are as yet uninitiated, and with the proper handling of these visitors, a great amount of prestige is built up by the broadcasting organizations who fully appreciate the importance of this form of publicity.

It is safe to say that everyone who has visited the new studios of WCAU in Philadelphia has received a pleasant and a lasting impression from the modern interior decorative scheme, and the intriguing murals created and executed by John Vassos.

Not confining his efforts to commercial art, Vassos has produced much work which only his personal friends have had the privilege of viewing. He has produced a book entitled "Phobia," in which he



THE HUMBLE TURNSTILE, BEFORE AND AFTER THE **VASSOS** TOUCH—EMPIRE STATE BUILDING, NEW YORK CITY —NOT ONLY IS THE NEW DESIGN 15 PER CENT CHEAPER TO MANUFACTURE, BUT ITS SALES HAVE INCREASED 25 PER CENT OVER THE OLD DESIGN

has not only created the illustrations, but also has written the text. It is an astounding exposé of the various complexes which have harassed civilized man down through the ages. This work has attracted much attention among psychiatric specialists and students of mental disorders. Only a limited edition of this book, autographed by its creator, has been distributed among his friends. Mr. Vassos has already illustrated eight well-known books, and in the February issue of *Fortune* magazine, an article appears on the subject of "Design in Industry" in which ten outstanding designers are taken as exemplary, in today's art. One of these is John Vassos. As an indication of his versatility we might add that he has designed the ballet costumes and scenic sets for two recent theatrical productions,—one being the "Sixth Sense," presented at the Theatre Guild, and the other "Phobia," at the Barbazon Plaza.

VASSOS (CENTER) AND HIS STAFF AT WORK IN THE NEW STUDIOS OF STATION **WCAU**, PHILADELPHIA

Such magazines as *House and Garden* are already beginning to use the new RCA Victor radio sets, bearing the Vassos influence in external appearance, as examples befitting the up-to-date, artistic home, and it can be safely said that the Vassos influence in the radio industry is only at its beginning.

GRAND RAPIDS POLICE RADIO INSTALLATION

(Continued from Page 11)

assignment; other calls are distributed to the precinct stations for booking and then to radio. The telephone operator is equipped with a power switch and microphone to enable him to put the address on the air before a car assignment is possible, used especially for holdups. The Superintendent and Chief of Detectives each have a microphone for intercommunication purposes and may also direct squad cars or lecture to them at will. One of the RCA 40-RB line amplifiers is used which also drives nine magnetic speakers throughout the Headquarters building, enabling all important offices to listen to all broadcasts made, and also completes the communication system for interoffice communication. A constant watch is maintained on the State Police frequency of 1574 kilocycles, the transmissions of which may be connected to the speaker lines at will through a unique switching arrangement. All precinct stations and sheriffs are equipped with receivers.

All transmitting and studio equipment is of the RCA manufacture; the cars are equipped with Bosch, Spartan and Gypsy receivers.

The antenna system is a brass vertical pole 82 feet high, the base mounted on the attic floor and projecting through the roof with two sets of guys. The base is 3½ inches in diameter and the top 1½ inches in diameter, telescoped 2 feet at each joint.

The system was installed by the chief engineer, and is operated by A. A. Kirchner, Chief Engineer, P. Van Bendegon, maintenance supervisor and relief operator, R. S. Sellon, first assistant, A. E. Warner, second assistant.

The above arrests shown in the report were made by the assigned car to each dispatch. There are a great many more arrests made by the investigation squad which are not considered radio arrests. For example we have an auto squad, homicide squad, etc., which follow up on dispatches and take the investigations from the cruisers so that a cruiser has to be out of service only a few mintues on each call. This method is found very effective, which works as follows: The cruiser is dispatched and makes the initial run; if there is anyone still at the scene he is arrested by the cruiser; if criminals are gone on arrival the investigation is taken up by the roundup squad (detectives). Arrests made after the departure of the cruiser are not credited to radio in the report. The next step to be taken by this station will be two-way communication for the cars. It will not be soon, but we hope to equip them in the near future.

Did You Know?

By W. S. FITZPATRICK, RCA Institutes

THAT more than four million persons visited RCA Hall at the Chicago Century of Progress Exposition last year?

That the RCA Victor-recorded motion picture, "Three Little Pigs," was rated in the New York *Evening Post* as one of seventeen outstanding events of 1933? It was placed between the Lindberghs' flight and the recognition of Russia.

That the world's tiniest radio tube, one-half inch in height and with maximum overall dimension of less than three-fourths of an inch, is a development of B. J. Thompson and G. M. Rose, Jr., of the Cunningham-RCA Radiotron research laboratory?

That the staff of NBC, at Radio City, New York, numbers 800?

That one of the wooden poles being erected at an R.C.A. Communications station on Long Island is 130 feet long and weighs four and one-half tons? The shipment of 50 of these poles from Everett, Wash., presented an unusual transportation problem, especially on the railroad, where the poles had to be arranged so that the train could round curves.

That the Radiomarine Corporation of America is planning to move its general offices from 66 Broad Street to 75 Varick Street, New York.

That at the New York school of R.C.A. Institutes is an acoustically-treated model theatre with a projection room and complete professional sound motion picture equipment?

Tall Problem Solved

That installed in the 31-story RKO Building in Radio City, New York, is an Antenaplex System, a development of the RCA Victor Camden laboratories, which provides antenna and ground connections for 1,200 individual radio receivers operating from a single, scientifically constructed antenna? Many of the tenants of the RKO Building are associated with entertainment and talent-booking enterprises. (*Radio World.*)

W. S. FITZPATRICK

That between the 10-meter and 5-meter wavelength there are 1,000 channels three times as wide as existing broadcast channels and an additional 8,000 channels between 5 meters and 1 meter, each 30 k.c. wide, free from static, fading and interference by distant stations? (*Electronics.*)

A Record for Records

That a record for record manufacture was made when 100,000 Victor records were turned out in a single day?

That *Scientific American* says: "Animals do recognize the voices of their own and other species when played on a phonograph record, so 'His Master's Voice' is not just a bit of clever advertising"?

That it used to be said the capitol in Albany could be seen through a telescope on a perfectly clear day from the Woolworth tower, but nobody has as yet "discovered" the capitol from the RCA Building, half again as high as the Woolworth and three miles, or so, nearer?

That there are 409 radio cars in the New York City Police Department covering the city's area of 312 square miles, providing an average of one car to every three-quarters of a square mile?

That the old 10 k. w. spark transmitter used by Mr. Arthur A. Isbell to flash the first direct radio telegraph signals from Hawaii to the mainland in 1908, now forms the nucleus of a museum at Wahiawa?

That the successful two-way police radio system of Bayonne, N. J., is operated with headquarters and between cars on 8.6 meters?

That the latest from the G. E. laboratories is an announcement of the development of an instrument that smells, called the "electric nose"?

That the first words recorded by Edison on his original cylinder-type phonograph, with tinfoil covering, were: "Mary had a little lamb," and that the first tune to be recorded on a Victor record was: "I guess I'll have to telegraph my baby"? (George Clark.)

That NBC's telephone switchboard in Radio City has 100 outside trunk lines as well as hundreds of lines to studios and offices?

That a control for flashing signs which saves 35 to 45% power costs and which has no contacts or moving parts has been developed at Schenectady? (*G. E. Review.*)

That in the NBC Radio City plant alone there are 1,250 miles of wire connecting studios and control board, in addition to the thousands of miles connecting the network stations?

Flying High

That no other house flag in the world flies as high as the RCA emblem atop the RCA Building in New York?

That a recent issue of *Electronics* listed 249 applications of the photo-electric cell?

That among the latest uses to which the photo-electric tube is put is to test the hardness of water?

That no less than 25 new types of tubes made their appearance during the year 1933?

That O. H. Caldwell in *Radio Retailing* uses a unique and appropriate phrase in saying "it is like viewing Niagara through a pinhole" to use inadequate radio receiving equipment, cheap, low quality sets or flimsy antenna, in an endeavor to obtain appreciation of Radio City's "magnificence with technical perfection" and the "new attractions and new thrills before the microphone with money seemingly no object"?

Moving Up

That when the National Broadcasting Company moved into Radio City it required 365 van loads to transport 20,000 articles in 42 hours?

That it was harder to devise a smooth - running, constant - speed spring motor for the first talking machines than to make the talking apparatus itself? Every effort of the Berliner Gramophone Co., the first in America exploiting the disc form of record, to create such a motor failed, and it was only after Eldridge Reeves Johnson, of Victor fame, showed the way that a practical talking machine was available. (Tnx to George Clark.)

That among new institutions at Radio City, New York, are regular scheduled tours, occupying two hours, which conduct visitors to all points of interest? Parties are guided through the NBC studios, RKO Building, the international buildings, Music Hall, and the 70-story RCA Building, with a trip up the world's fastest elevators to the observation roof.

Adios Sparks

That a new sacrifice was added to the already long list credited to radio operators when an operator named Bree was recently slaughtered and eaten by a tribe of cannibals near the Cacheo River in the forests of Portuguese Guinea?

That newspapers are ranking Radio City as 38th in population, placing that center ahead of such cities as Syracuse, Omaha and Hartford?

That those tuneful hits from "Footlight Parade," "College Humor," "Gold Diggers," "Forty-Second Street" and "Three Little Pigs" are available on Victor records?

THIS ONE *DIDN'T* KNOW

That 22 broadcasting stations are now entitled to use 50 k. w. power?

That Robert F. (Bob) Miller, of the Radiomarine Corporation, has a championship cup which he won at a national telegraph speed contest about twenty years ago?

That several internationally-known executives in the radio industry received their fundamental training in radio at RCA Institutes?

That one of the country's earliest police radio stations passed out of existence when, on December 8th last, the New York Police Department discontinued the radio telegraph station which had been in continuous operation seventeen years, because of its no longer being needed with the three police broadcasting stations?

That among the many women who have taken RCA Institutes courses one was 45 years old when enrolled?

That each RCA Radiotron and Cunningham radio tube is seasoned by about 25 hours of use under operating conditions before it is shipped to the trade?

That an NBC program of unusual interest was in having nine children of foreign diplomats in Washington extend Yuletide greetings to American children, then, in their native tongues, to children of their respective countries?

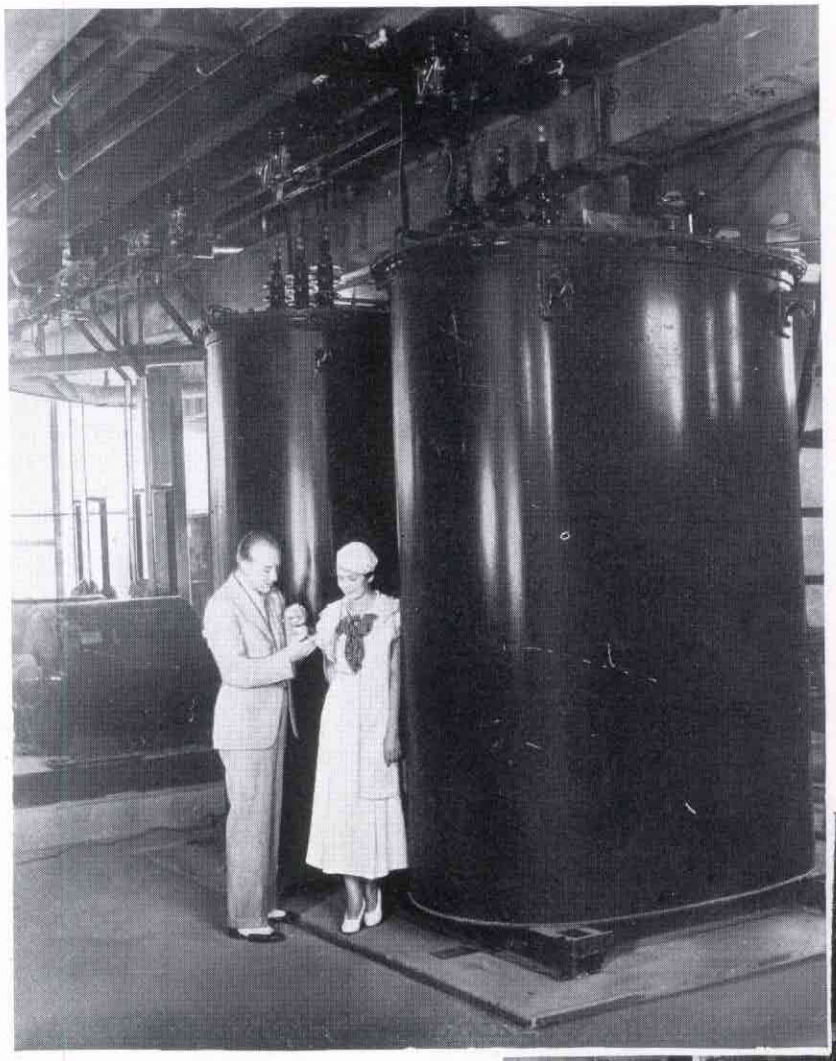
That curious radio listeners asking why the Eastchester, N. Y., police cars and headquarters station sign off with "Kay" brought the response that it means "O. K., good bye"?

Hot Job for Ops.

That installation of radio equipment on city fire trucks is now being advocated in several quarters, in some cases the plans including pack transmitters to be carried into burning buildings?

That there are 49,000 patents on file at Washington awaiting action, according to *Modern Mechanic?*

That if a belated passenger steps across the threshold of an elevator in the RCA Building, two safety-ray beams are intercepted and reopen the doors? (*Electronics.*)



HOW THE LITTLE AUDIO TRANSFORMER HAS GROWN UP! HERE WE HAVE TWO THAT ARE OVER 12 FEET HIGH AND WEIGH 50 TONS APIECE. ALL OF THE RADIO ENGINEERS' PROBLEMS ARE NOT ELECTRICAL ONES, AND THE ENGINEERS HEAVED A COLLECTIVE SIGH OF RELIEF WHEN THESE TWO UNITS FINALLY CAME TO REST IN THEIR PERMANENT LOCATION

A VISIT TO WLW

(Continued from Page 3)

panel are six large mercury tubes, glowing brightly.

As we approach the control desk, we hear an operator explaining the layout to visiting engineers. The description has been given many times.

"Three separate amplifiers are used, each having four 100-kilowatt tubes operating class 'C.' These are modulated class 'B' by eight 100-kilowatt tubes." The visitor interrupts:

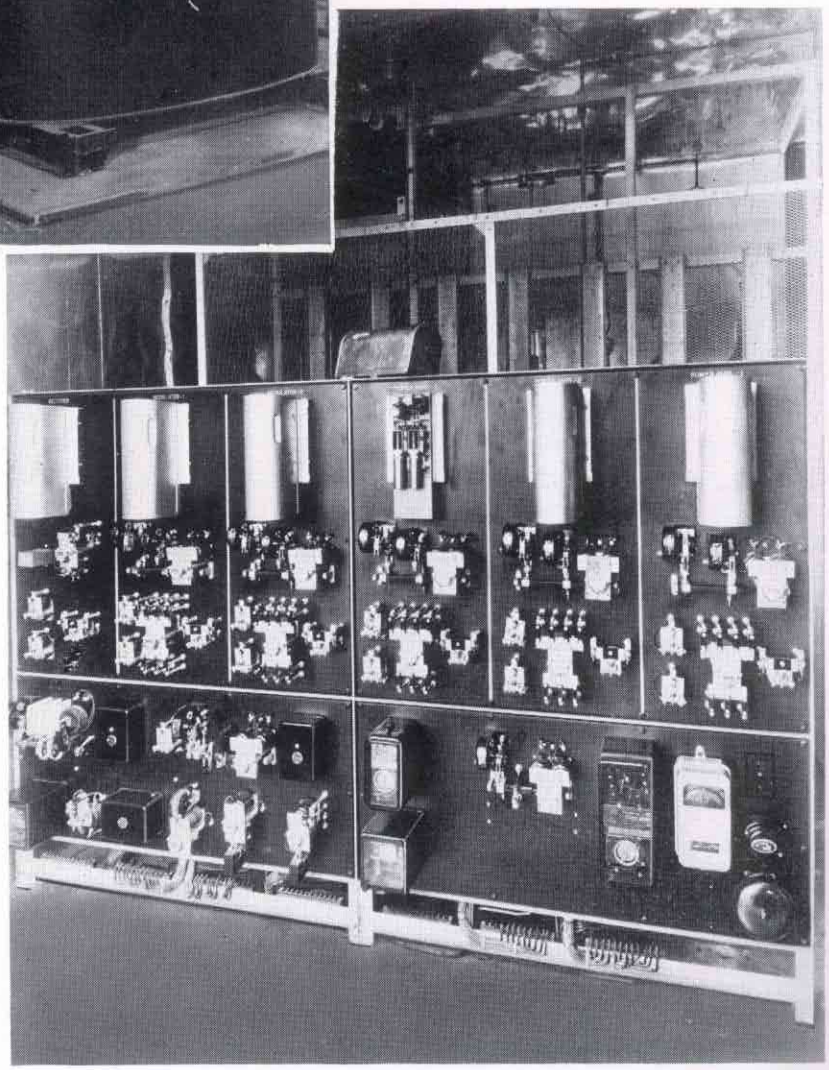
"I can't conceive of a modulation transformer of those proportions."

When told that each transformer weighs approximately 50 tons, he gasps in amazement, and wants to see them immediately. He is taken downstairs to see for himself.

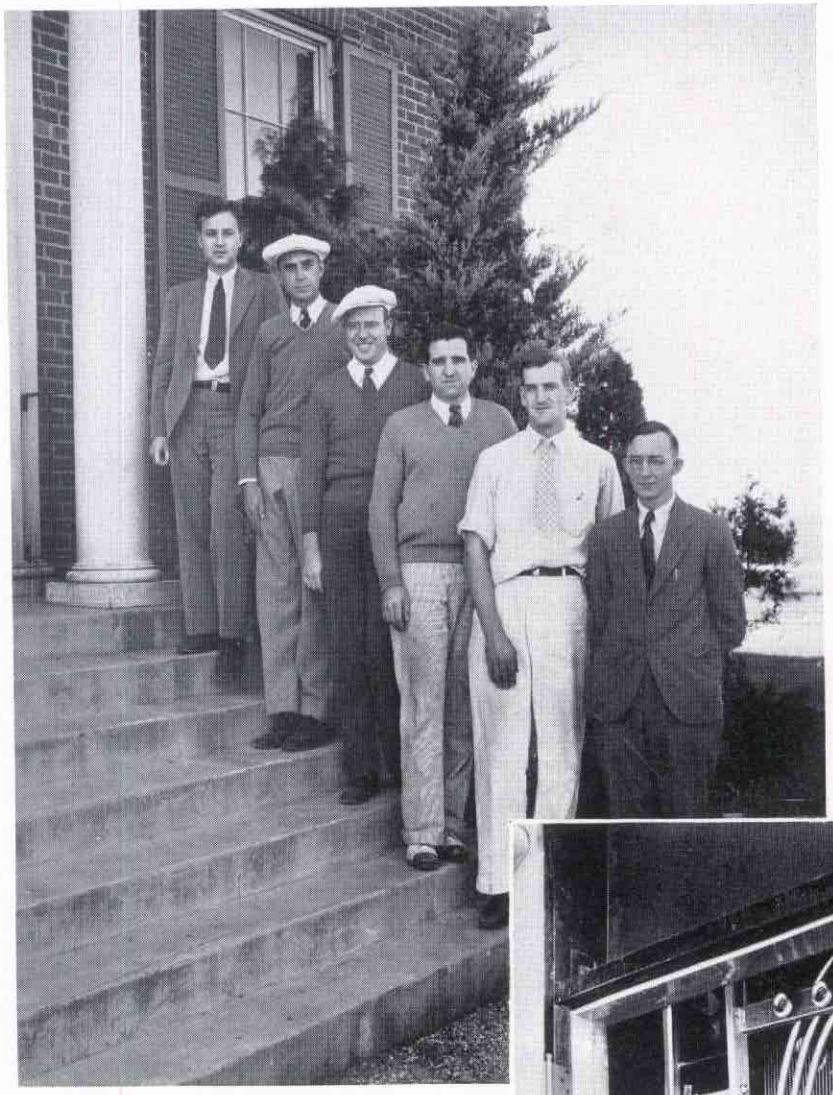
A small water leak is detected, and the transmitter is shut down. We go downstairs with one of the engineers to check the operation of the automatic circuit breaker. As we enter the basement, all is quiet. In a few minutes the water pumps start up. . . . The water leak is fixed.

We are standing near the three 1500-ampere filament machines. Suddenly all three start up with a terrific whine. Someone's sense of humor, we conclude.

We pause to watch the high speed circuit breaker as it is thrown on and off several times. The visiting engineer marvels at the explanation of its operation—no wonder—it's hard to conceive of a circuit breaker that will clear a 20,000-KVA circuit in 1/15th of a second.



RELAYS, SEQUENCE SWITCHES, METERS, RECORDERS, ALARMS—THE VERITABLE NERVE CENTER OF THE 500 KW. **WLW** PLANT



UPWARDS OF 35 PEOPLE HAVE BEEN EMPLOYED IN CONNECTION WITH THE INSTALLATION OF THE NEW **WLW** 500,000 WATT TRANSMITTER. ABOVE ARE SIX OF THE ENGINEERS IN CHARGE OF THE WORK. LEFT TO RIGHT: **RAY H. WILLIAMSON, E. A. LEACH, J. A. HUTCHISON, GEORGE W. FYLER, G. V. BATE,** AND **J. J. FARRELL**

We go back upstairs to watch the further operation. Plate power is applied again and all seems well.

"Low voltage at first," an engineer remarks. "Cleaning up a gassy tube."

The engineers are now checking the power output in the tuning house to calibrate the antenna meter on the control desk.

"Let's try higher voltage?"

A quick trip outside the building and an "O.K.—Let 'er go!"

When plate power is applied, a gas flash in tube No. 10 kicks the set off. It comes back on the air automatically in a fraction of a second, operates smoothly for several minutes, and suddenly kicks the set off twice in rapid succession. Before we can comment, No. 3 power amplifier is isolated. The remainder of the set is operating in a normal manner. An engineer remarks:

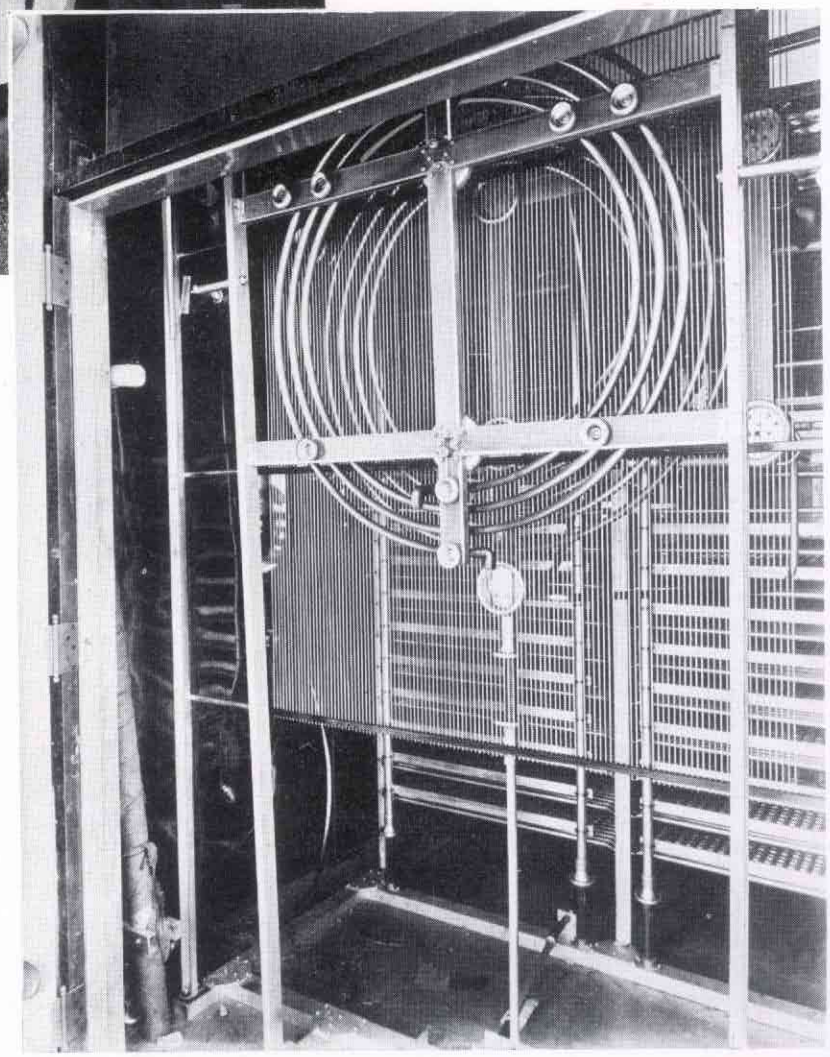
"In any event, that's a demonstration of how the 42-foot automatic isolation switch works."

The water supply for No. 3 amplifier is shut off and with the remainder of the set in operation, the tube is hurriedly replaced. A rapid engineering diagnosis of the defective tube.

"A minute crack in the glass near the seal—probably happened in shipment."

No. 3 amplifier is thrown back into service and the tests proceed again at low voltage, but with heavy loading.

(Continued on Page 29)



ONE OF THE TANK CIRCUIT INDUCTANCES WITH ELECTROSTATIC SHIELDS IN THE BACKGROUND

The Admiral Byrd Broadcast Pick-Up

By DONALD B. TEMPLETON, R.C.A. Communications, Inc.

ADMIRAL RICHARD E. BYRD is now engaged upon a second Antarctic Expedition, the outgrowth of plans which he formulated during his first Antarctic Expedition. As a part of the activities of this second expedition, radio has been called upon to bring the voices of members of the expedition staff to America, where the Columbia Broadcasting System, and R. C. A. Communications, are co-operating to carry these broadcasts from the Antarctic Ice Cap into any American home equipped with radio.

The plans for the radio side of this expedition have been in a formative stage for some time, but the actual work began with the installation of the radio equipment on board the S. S. Jacob Ruppert early in October, 1933, when she was docked at the Boston Navy Yard. Both the Columbia Broadcasting System and R. C. A. Communications sent representatives aboard, at Boston, to assist in the final testing and adjustment. The vessel left Boston for New York about October 10th, and during this short trip the radio gear met its first tests successfully, contacting Riverhead, Long Island (the receiving center for R. C. A. Communications in this area), upon several occasions. The Ruppert docked at Bayonne, N. J., in New York harbor, to take on fuel oil, and other supplies. At this point the R. C. A. engineer left the ship, which departed for Norfolk, Va., where the "official" farewell ceremonies were held. The Panama Canal was the next port of call, and more radiophone tests were conducted with Riverhead, the first taking place while the ship was off Jacksonville, Fla., and the last while she was moored to a dock at Panama.

During one of the tests which was carried out while the ship was near Panama, an interesting incident occurred: John Dyer, the chief radio man aboard, was in the radio control room, and wanted Charlie Murphy, the announcer—who was in the hastily extemporized "bunk room studio," adjoining the radio room—to move a little farther away from the microphone. At that time no intercommunicating system had been installed between the "studio" and the control room, and the two men were prevented from talking to each other by a glass partition . . . and John could not make Charlie understand his "sign language." John knew, however, that Charlie could hear New York, so he asked New York to tell Charlie to move . . . and Charlie did. Thus, it was that the message which passed from one man to the other, actually but a few feet apart, had to travel over nearly 4000 miles of radio circuit!

The next test occurred the day that the ship left Panama, and headed out into the broad reaches of the Pacific Ocean, and was successful. The vessel was steering southward along the west coast of South America, with Valparaiso as its first port of call,—and, incidentally, Valparaiso was the place from which the first official broadcast from the ship was to have taken place. Off the coast of Ecuador, however, Admiral Byrd received information which caused him to alter the ship's course, and to steer for New Zealand. This may seem to have been an ordinary feat of navigation to the layman, but what it meant to the radio engineers interested in the broadcasts, and how it altered their plans, will now be explained.

Figure 1, accompanying this article, is what is known as an "Azimuth map of the world, around New York as a center." Figure 2 is a similar azimuth map, around San Francisco as a center. Now, it is well known

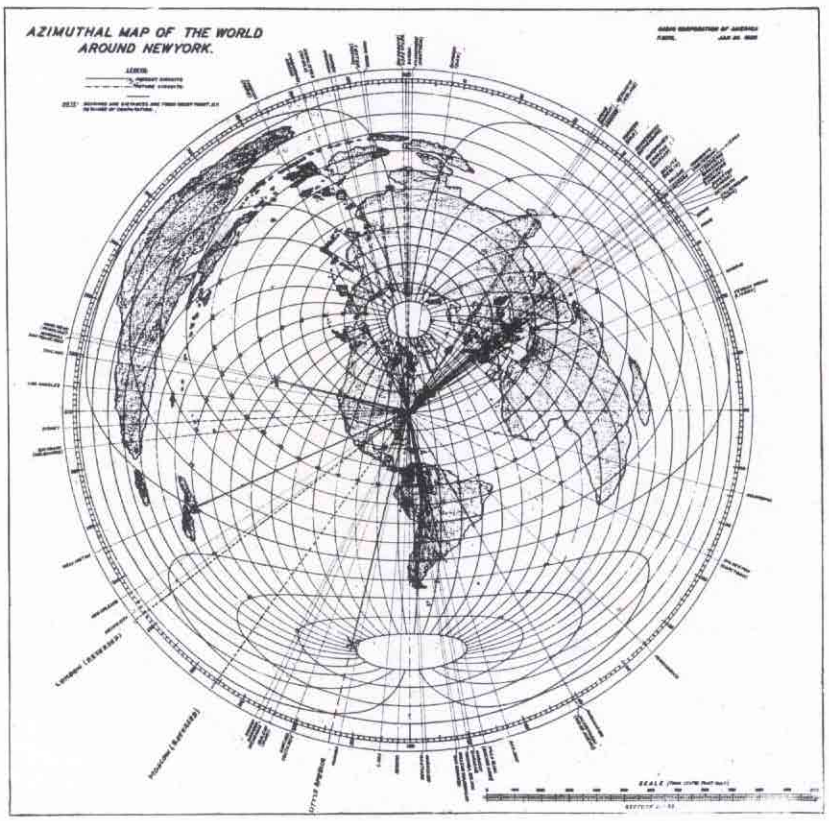


FIGURE 1—AZIMUTH MAP OF THE WORLD AROUND NEW YORK

that the ordinary flat maps . . . such as we are familiar with from our school days . . . do not present a true picture of the earth's surface, except along the equator. As the next best thing—for certain purposes—these "Azimuth Maps" have been prepared, giving an effect something like turning the world "inside out" . . . did Australia, for instance, ever look to you as it does in Figure 1? Imagine that you stand at New York: This map will now give you the true compass direction (bearing) and distance in miles (according to the accompanying scale), to any point indicated on the map. As a navigator would put it, this map will give him the "great circle route," and distance, to any given destination, if New York is the starting point. Figure 2 does the same thing with San Francisco as a starting point, or center . . . and it is quite interesting to note the differences between these two maps.

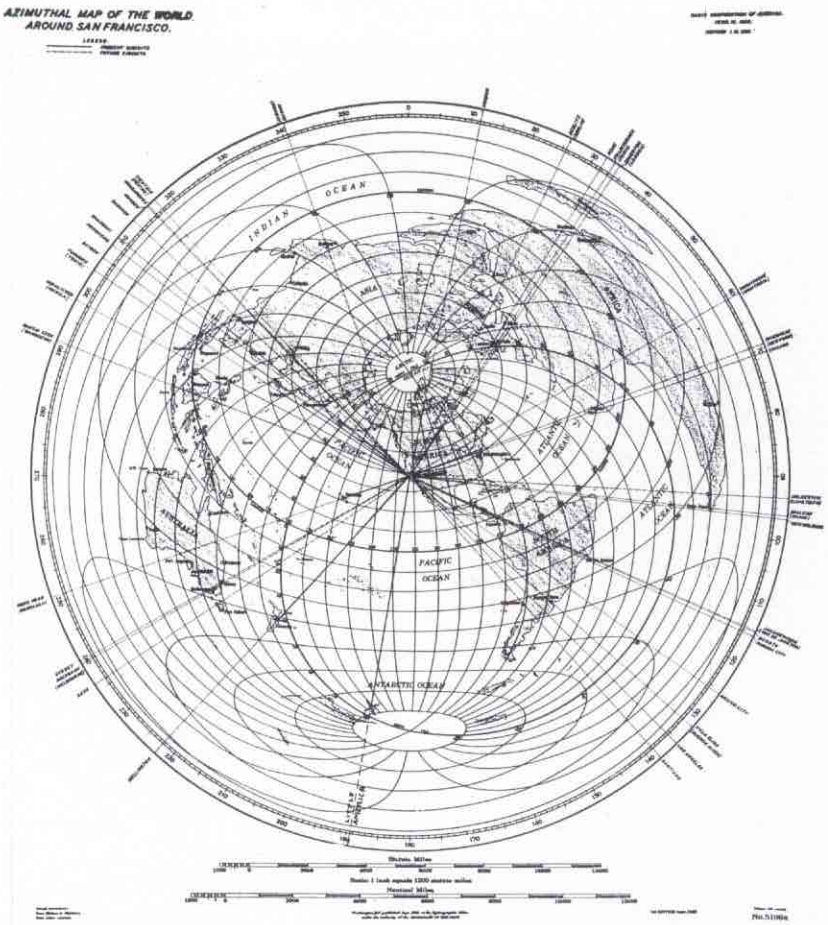


FIGURE 2—AZIMUTH MAP OF THE WORLD AROUND SAN FRANCISCO

Another point, which should be explained here, is the matter of directional radio. A broadcasting station, of course, dissipates its energy more or less equally in all directions, and, as a consequence, the radius of its effectiveness is comparatively limited. For commercial "point-to-point" working, however, it is highly desirable that as much of the radiated signal as possible travel toward the desired receiving point only, since a spreading-out of the signal to other points would be just so much wasted energy. Another consideration is that by so concentrating the signal, much less power is needed to maintain a given circuit than would be otherwise necessary. Engineers have developed several types of directive transmitting antennas, some of which are so effective that they will concentrate such a high percentage of the energy radiated within a "beam" about ten degrees wide, that the receiving point toward which it is directed will receive a signal approximately seventy times as strong as would be received from an ordinary, non-directive antenna . . . and this with no increase of power in the radio transmitter! Such antenna transmitter units may be used as either telegraphic or telephonic directional transmitting units. Similarly, for reception, special antenna types have been developed which are very sensitive to signals approaching from a given direction, and practically "dead" to signals from any other direction. Receiving sets for use with these directional receiving antennas are also special types, being unusually sensitive and efficient superheterodyne units, especially developed for short-wave telephone work. It might be of interest to add, here, that for normal use on a given circuit, three of these directive antennas, widely spaced apart, but all directed at the same distant transmitting point, feed the incoming signals into three receivers (one receiver for each antenna), and the combined output of the three receivers is ingeniously combined in a "mixing" unit, to give a better and steadier signal than any one of the receivers, used alone, could supply. This system greatly minimizes the fading, which is so troublesome on short waves.

If it will be kept in mind that the transmitter on board the S. S. Jacob Ruppert is rated as a one kilowatt (1 kw.) unit . . . or, as an engineer of the Columbia Broadcasting System so picturesquely defined it, "a transmitter using about the same power as two ordinary household electric flat-irons, or a couple of toasters" . . . and if the great distances over which it is necessary for this comparatively low-powered transmitter to work are also considered, the need for the specially designed and highly efficient equipment outlined above becomes apparent, for it is quite a trick to pick up the signals from a one kilowatt transmitter which is at times more than 9000 miles away. The fact that this transmitter is using an ordinary, non-directive ship's antenna increases the difficulty, and

when it is definitely attempted to make these pick-ups on a regular schedule, at the same hour each Saturday night, the engineers concerned have something to shoot at!

The above descriptions have been given in some detail, because R.C.A. Communications depends upon these directive types, not only for commercial work but also for contact with, and reception from, the Byrd flagship. A certain set of transmitting and receiving antennas had been selected for maintaining the circuit between the ship and New York as she traveled down the west coast of South America. The change of course, by the ship, when she headed for New Zealand, however, carried the vessel out of the "beams" of the chosen antennas, and other selections became necessary. The ship was near Easter Island, South Pacific, on November 18th, when the first broadcast was scheduled, and the engineers found that by reversing a transmitting antenna which originally was directed on Moscow, they could get signals through to the ship all right. Reception presented another problem, and a more difficult one. Hours before the program began, receiving engineers at Riverhead, L. I.; Buenos Aires, Argentina; Point Reyes, Cal. (near San Francisco), and at Koko Head, Hawaiian Islands (near Honolulu), were keenly searching the air waves for signals from the ship. When they did "pick up" the vessel's signals, they were relayed to New York, where the central control engineers listened to them. It was soon apparent that Buenos Aires was passing through the best signal, so just before the broadcast started the signal from the ship, via Buenos Aires, to New York, was connected to the New York control room of the Columbia Broadcasting System, and the Byrd program, starting with three deep-throated blasts from the Ruppert's whistle, was heard throughout the nation . . . but little did the listeners realize of what had gone on "behind the scenes" to bring the program to them.

The second program, on November 25, 1933, was covered in the same manner. This time, however, it was Point Reyes, California, that had the best signal, and it was fed into the CBS network at San Francisco. December 2, 1933,—time for the third program,—found the boat docked at Wellington, New Zealand. Through the courtesy of the local broadcasting company at Wellington, a regular broadcasting studio was placed at the disposal of the expedition, and the "show" was put on in the studio, which was connected to the ship's radio transmitter by special wire lines. Again Point Reyes had the best signal, which was fed to CBS at San Francisco.

The Ruppert was far to the southeast of New Zealand when the time arrived for the fourth program, on December 9th. Again came the keen hunt for signals, and Koko Head, in distant Hawaiia, took the first place, with the best signal. Koko Head relayed the signal to San Francisco over an RCA short-wave program circuit, thence to the CBS control room in New York, a signal path, from the ship to New York, of nearly 12,000 miles! It was after this broadcast that a tired but happy R.C.A. Communications engineer finished his day's report with the words: "So ends this day . . . with R.C.A. pulling another miracle!" The fifth program, on December 16th, reached New York via the same channels as the fourth program, but a shift took place when the sixth program came through, on December 23rd. Then Buenos Aires handled the first part of the program, but half-way through Koko Head got a

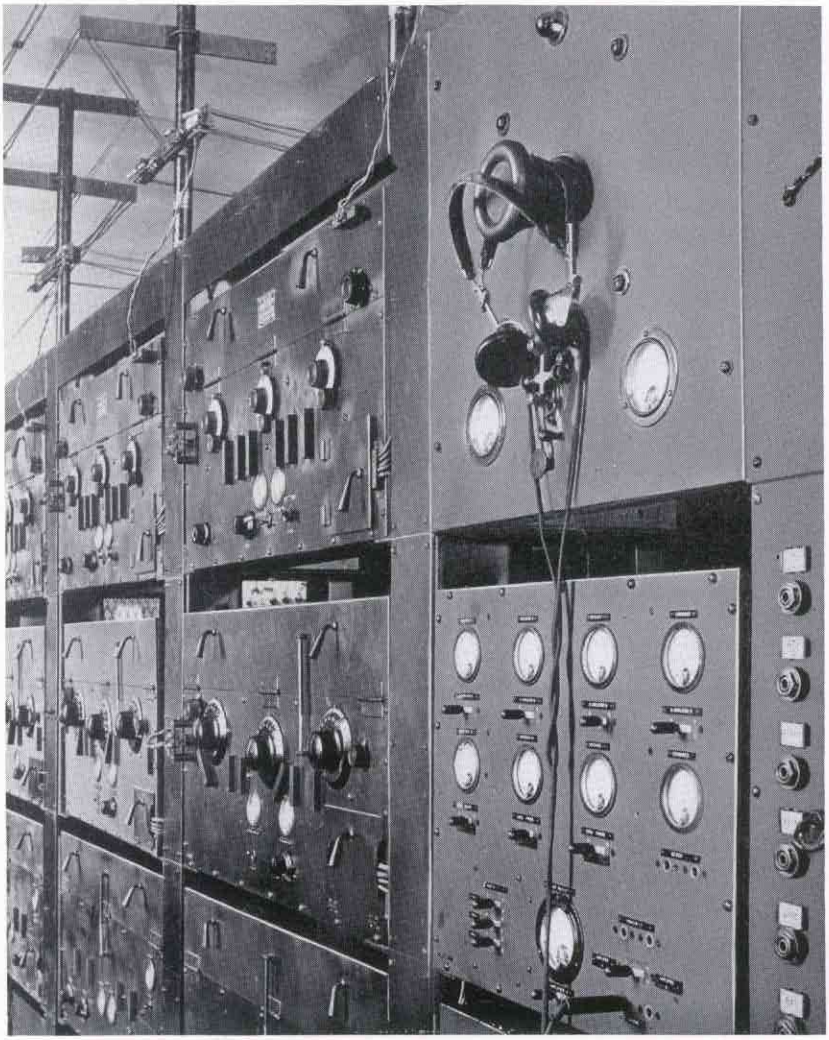


FIGURE 3—VIEW OF COMPLETE DIVERSITY RECEIVING ASSEMBLY, CONSISTING OF THREE COMPLETE SUPERHETERODYNE RECEIVERS, AND MIXING PANEL. NOTE THE SEVERAL ANTENNA CONNECTIONS AVAILABLE FOR EACH RECEIVER AT TOP. (RCA RIVERHEAD, LONG ISLAND)

better signal than Buenos Aires had, and, relaying it to New York via San Francisco, the switch-over was made so smoothly that it was perceptible to the listeners only as reception of improved quality! The last program of the year, on December 30th, came via Buenos Aires in its entirety, that proving the superior channel for that particular night.

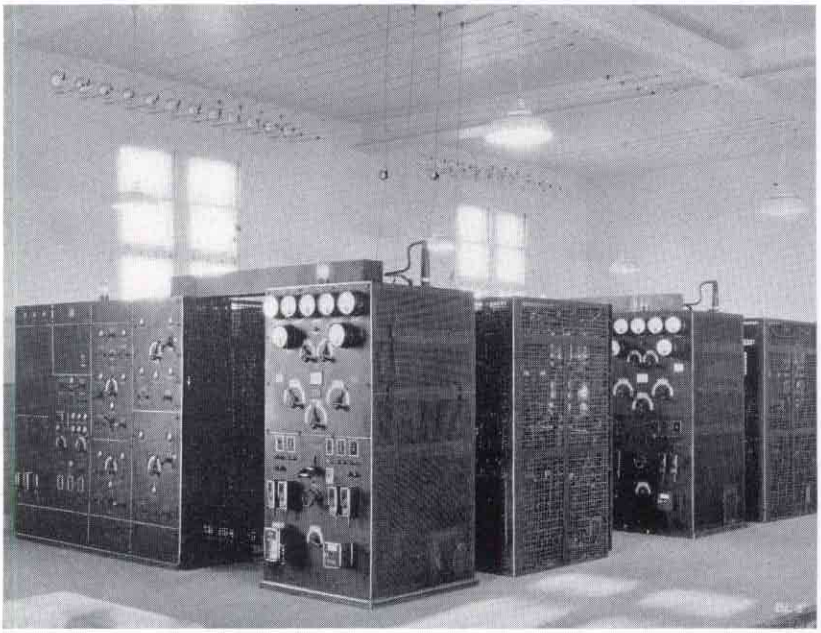


FIGURE 4—HIGH-POWER SHORT-WAVE RCA TELEPHONE-TELEGRAPH TRANSMITTERS, AS USED AT ROCKY POINT, LONG ISLAND, N. Y., AND BOLINAS, CALIFORNIA, FOR CONTACT WITH THE BYRD EXPEDITION, AND OTHER POINTS

When the expedition reaches its base in Little America, directive transmitting antennas will be erected, which will result in greatly improving the quality of these broadcasts, and will eliminate the necessity for constant testing which the movements of the ship have made necessary to date. As long as the vessel was making jumps of about 1,500 miles between broadcasts, each program presented a separate and special problem for the engineers to solve. It will be difficult for the public to realize the enormous amount of testing that has, so far, preceded these programs. Nearly sixty hours of testing occurred before the first broadcast went "on the air," and for the subsequent schedules, each minute "on the air" meant about an hour of testing, sometime during the preceding week.

Many interesting happenings have occurred during these tests. For instance, at one time the ship could hear only Buenos Aires, whilst only Koko Head could hear the ship well . . . so the engineers calmly proceeded to set up a great "round robin" circuit, over which New York talked *to* the ship via Buenos Aires, and return speech *from* the vessel reached New York via Hawaii, San Francisco, and thence to New York. Conversation was then carried on as easily as though a direct connection existed between New York and the boat!

Other interesting details will no doubt come to light as this two-year period of schedules is carried on . . . such as the light fingers of some Easter Islanders, who removed a number of articles of value from Charlie Murphy's pockets, and escaped undetected! Charlie swears that New York pickpockets are amateurs, and says that Easter Island grows the real thing! . . . but this is primarily an article on radio. It purports to give some of the highlights of what has already happened on the first long-distance, *regularly-scheduled* short-wave program hook-up. As for the future . . . well, the men who are doing it are beginning to believe in miracles . . . so it is time, as Charlie Murphy, aboard ship, says, to "return you to civilization."

A VISIT TO WLW

(Continued from Page 25)

We get curious as to the power output and look at the antenna ammeter. It is now reading 64 amperes. A slip of paper above the meter indicates the antenna resistance to be 100 ohms. A hurried mental calculation—

"415 kilowatts," I exclaim.

The voltage is brought back up to normal. Adjustments are made. We glance again at the antenna ammeter—it's slightly above 92 amps—almost unbelievable.

"That's over 800 kilowatts—the highest power ever put on the air," an engineer comments.

Smiles appear on the faces of the engineers who have labored for months to accomplish this end

I. R. BAKER, RCA VICTOR

"But wait," they say. "There is much more work to be done—many more details to be cleaned up, and then we promised you modulation."

The set is unloaded. Output is still over 700 kilowatts. Again the tense moment while the engineers adjust the beat frequency oscillator. We are watching the cathode ray oscillograph. 10—20—50—70—and finally — 100 per cent modulation. Everyone breathes a sigh of relief as nothing breaks down.

Over 700 kilowatts with 100 per cent sinusoidal modulation. Another momentous occasion. An engineer breaks the silence with:

"She sure can take it!"

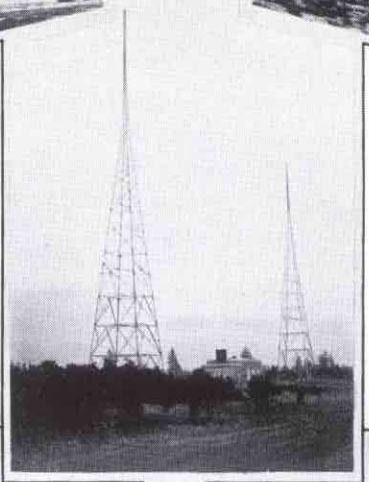
It's nearly six o'clock. A button is pressed—another milestone in radio is passed.

THE WORK OF A RADIO ENGINEER MAKING FIELD STRENGTH SURVEYS TAKES HIM FAR AFIELD INTO MANY WEIRD AND INTERESTING LOCALITIES

(BELOW) SUMMIT OF MOUNT SPOKANE

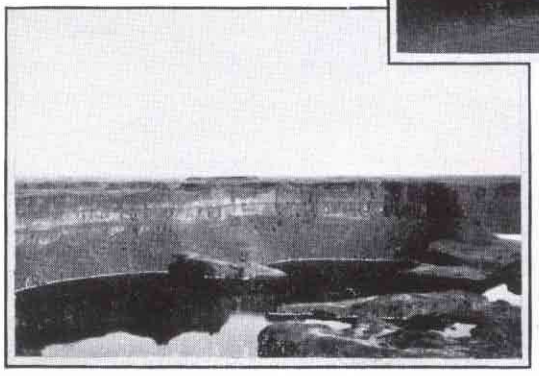
(ABOVE) LAKE COEUR D ALENE, IDAHO, ON THE 500 MICROVOLT LINE OF STATION **KHQ**

(BELOW) STATION **KGA**, SPOKANE WASHINGTON



(BELOW) ABOVE THE CLOUDS IN CHAPEL MOUNTAINS

(BELOW) DRY FALLS, GRAND COULEE, WASHINGTON. THESE FALLS IN PREHISTORIC TIMES WERE HIGHER THAN NIAGARA, AND THE LAKES AT THE BASE ARE ALKALINE. THE ATTENUATION IN THIS DISTRICT IS "NOTHING FLAT" ACCORDING TO THE SURVEY.



(BELOW) LOG CABIN ON MOUNT SPOKANE, WASHINGTON, WHERE THE SURVEY PARTY PUT UP FOR THE NIGHT ALTHOUGH STRANGE SOUNDS WERE HEARD AT THE WINDOWS AND DOORS DURING THE NIGHT, NATIVES OFFERED THE COMFORTING ASSURANCE THAT IT WAS "ONLY BEARS."

The Importance of the Field Strength Survey

If We Were to Trace the Radiated Energy from Our Transmitters Like so Much Soot from a Factory Smokestack, Most of Us Would Be Surprised. Why Not Do Just That? Let's See Just What Spots We Are Missing—Just Where There Are Holes in Our Signal Blanket—and Then We Can Intelligently Go About the Business of Covering These Spots

By WILLIAM L. FOSS, Radio Engineer, Foss-Southmayd, Inc.

IF we were able to capture a lone, free electron and place upon his hypothetical tail one large drop of indigo, then introduce said electron into a stream of his brothers and sisters flowing into the microphone of one of our big broadcasting stations of today; and IF, by virtue of his smearing everything that he touched, we were able to trace his path visually through the maze of wire circuits to the antenna and his explosive take-off into space—we might be able to produce an exact picture of what our worthy brethren, the advertising men of this country, are demanding of the broadcast engineer today. IF, by this same method, we could so mark the path of the broadcast waves that an indelible record would show the number of receivers being sensitized at any and all times, the results would be, for some broadcast station owners, gladness; for some, sadness, and for others madness.

The engineers today, however, are able to answer some of the problems which the advertising agents and advertisers behind them are propounding with insatiable glee. In the last analysis, it is not unfair for every broadcast station executive to listen with very attentive ear to the demands of these men. The whole broadcast structure in the United States today not only depends upon them but they have also been responsible for placing our system in the position of being the greatest in the world.

The business men of this country are in the habit of paying good money in great quantities for advertising. They are also in the habit, through the study of factual data (supplied them by the mediums in which they advertise), of learning exactly what they receive for the money expended.

In radio, however, until recently their expenditures have largely been experimental, in some cases showing excellent results. In a great many cases they have been very disappointing. Today it is only reasonable that these advertisers should demand from the broadcaster factual data showing at least the ability of his station to reach a given number of receiving sets in the homes of his potential audience. They have the right to demand that their programs and advertising matter are available to a given number of people in the territory which they wish to cover, and if we are to continue to enjoy their patronage, it behooves us as broadcasters to do a little investigating and find out how many receiving sets and consequent listeners our stations are able to serve.

Gathering this data through actual field surveys has been possible since broadcasting began, and yet at this late date, with the industry being in existence for more than twelve years, less than thirty per cent of all the station managers and owners in this country have any engineering data to indicate their station's actual ability to serve the territory which the Federal Radio Commission intended should be covered at the time the license was issued.

W. L. FOSS, TAKING OBSERVATION ON STATION WBZ WITH RCA VICTOR FIELD INTENSITY METER—MT. TOM IN THE DISTANCE

A survey of a station's coverage by a competent engineer not only brings out facts which are invaluable to the commercial department of that station, but also very clearly indicates inefficiency of the radiating system quickly and accurately where it exists. In a great many cases the antenna system is today eating up many dollars of the station owner's money, due to its inefficiency and to directional effect which were not intentionally or scientifically built into it.

In a recent trip across the United States, the writer had the opportunity to observe this last mentioned con-

dition in several instances. In one case, a station rated one kilowatt was carefully living up to all operating conditions to the letter. The survey proved it to be radiating only 600 watts. This station, a regional by classification, was serving the city in which it was located with an acceptable signal and was serving a vast, sparsely settled territory to the north and west with a strong signal, but due to unintended directional effect of the antenna system, it failed to serve a city equally as large only ten miles to the south and a large, thickly settled agricultural country to

DONALD ANDERSON, OPERATOR, STATION **KGA** OF SPOKANE, WASHINGTON, AND **A. G. SPARLING,** CHIEF ENGINEER, STATION **KHQ,** SPOKANE, PHOTOGRAPHED IN A WHEAT FIELD NEAR PASCO, WASHINGTON

the east. A few simple changes in the antenna system, which were very easily made by the station engineer, served to increase the number of radio receivers in this station's service area by more than forty per cent.

In another series of observations made by the writer, a transmitter rated at 5 kilowatts was radiating less than 1,000 watts. In this case, also, the resident engineer was able to make the necessary changes, greatly increasing the service area and consequently the revenue of the station.

Another great benefit gained through the use of field apparatus is the actual knowledge, which comes from night-time readings, showing the extent of interference from other stations on the same and adjacent channels. Very frequently a radio station is found that enjoys exceptionally fine coverage which is pushed back in intolerable interference after sunset. In some cases this interference comes from the vertically polarized waves of the station itself. This condition can usually be corrected to a great extent by a change in the antenna system.

The greatest problem of the Federal Radio Commission since it came into existence has been the one of interference, and while it is true that a great many stations have supplied invaluable information to this governing body, it is also true that a great number of hearings and controversies have been based on unreasonable demands by station owners. In many of these cases the lack of engineering data has been responsible for the denying of the seemingly reasonable requests of station owners.

Actual readings taken nightly over long periods of time on the channels in question would have undoubtedly convinced the station manager of the futility of making the application. They would perhaps have shown the possibility of using another channel, enabling this station to obtain relief through the action of the Radio Commission. At the same time, this information as used by the Federal Radio Commission gives that body additional accumulative information which it has been piling up and utilizing since its engineering department began to function. It has in Washington at present a great deal of data which has been accumulated from data supplied by many intelligent and reliable engineers. Each case brings it more, and no matter how small the amount, the data helps to mould the ideas of the commission's engineers, resulting in benefits to the whole industry as well as to the stations individually.

One of the effects of this accumulative information has been shown clearly in the changing separation tables issued periodically. Another is the willingness of the commission to permit the use of directional antennae where an intelligent analysis will show that interference will be reduced and consequently increase the coverage of all stations concerned. Other indications are the actual granting of new stations and the increase in power granted to old ones. These changes are all based on decisions made after sufficient engineering information was amassed to assure the Federal Radio Commission that they were desirable.

A. G. SPARLING OF **KHQ,** AND **DONALD THOMPSON** OF **KGA,** DOWN ON A SURVEY IN THE SNAKE RIVER VALLEY, NEAR PULLMAN, WASHINGTON

In this article the writer has endeavored to show some of the advantages of the field survey to broadcast stations, both large and small. Although the present allocation of stations seems to indicate that too great a number are assigned to the present available channels, this is not strictly true. In some locations there is a heavy over-concentration of stations, but in a great many sections in this country there is considerable leeway and many possibilities may present themselves to stations suffering from bad interference when field surveys are made.

At this time it is fitting to mention a subject that has been on the mind of the writer for some time. A cartoon, posted in the reception room of one of our big western broadcasting stations, illustrates the subject naïvely, humorously and clearly, yet seriously shows the underlying thought which is ever present in the

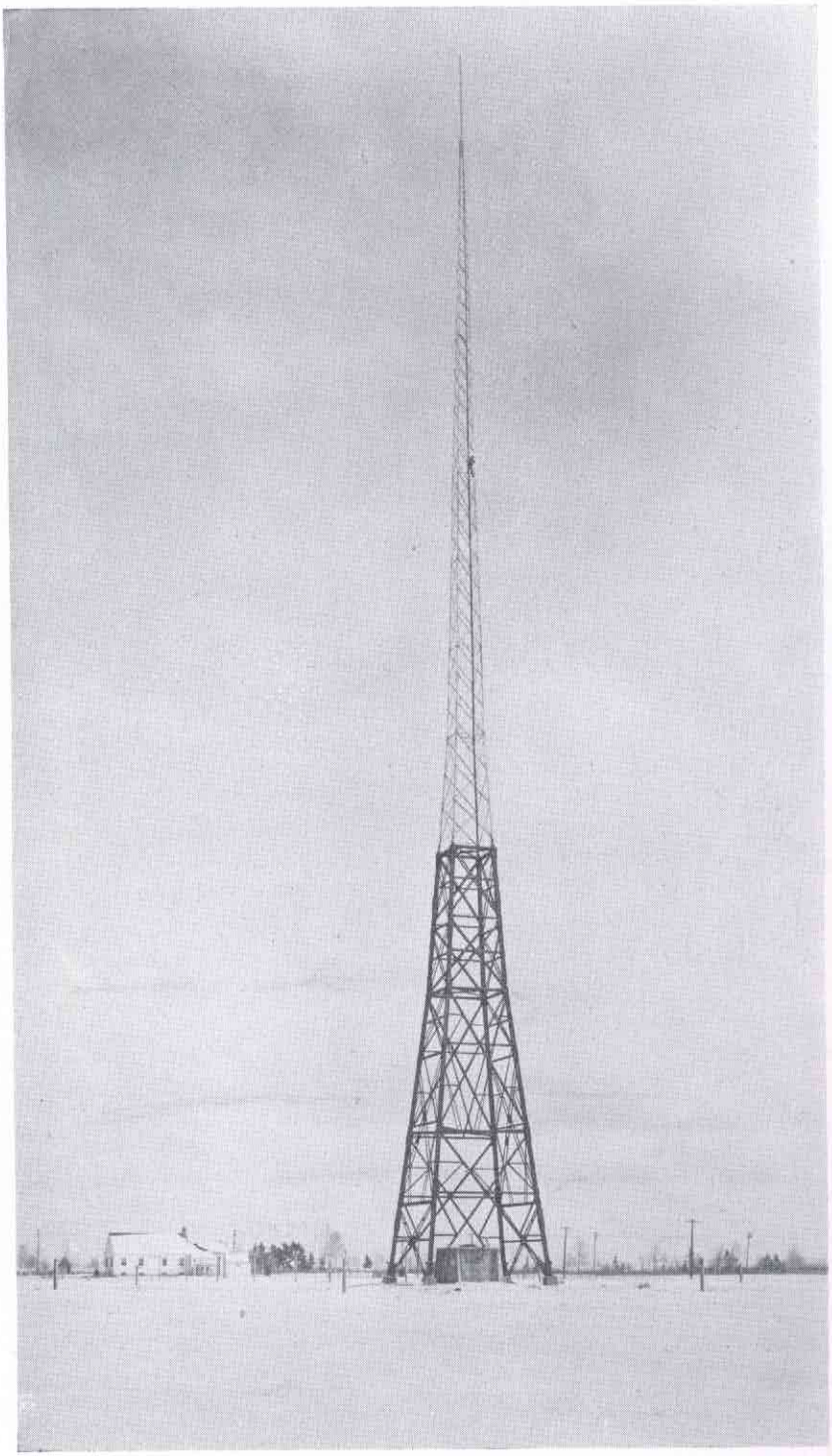
minds of many station owners and managers. This drawing shows a party of ambitious youngsters who have built themselves a back-yard radio station with odds and ends. The building consists of an imposing pile made from dry-goods boxes. The windows reveal an orchestra in the act of broadcasting. The instruments are home-made and one can clearly appreciate the resulting harmonies being broadcast to the neighbors via actual sound waves. The microphone, which is clearly seen, consists of a length of iron pipe capped by a perforated tin can. The station manager, program director and orchestra leader are portrayed in important rôles strutting their stuff in fine shape.

Built onto the back of the imposing edifice, as an afterthought, is the operating room in the shape of a dog kennel, from the door of which protrudes the head of a forlorn mongrel pup. The label on this little fellow says, "Al." It just happens that this is the name of the station engineer.

In this particular station it is a fortunate fact that the transmitter and operating room were not an "afterthought." It is also a fact that "Al" is a very brilliant engineer and receives due consideration.

The cartoon reflects the lack of consideration given to the engineer and the technical staff of a great many stations in this country. For that reason, it is mentioned here to bring home to the station managers the fact that more good dollars can be poured into the antenna system and the transmitter and be lost like water under the falls, because due consideration is not given to the pleas of the technical staff, than can be saved by excellent management throughout the rest of the organization.

A large number of station owners have tried every known method of treatment to alleviate the ills of a badly harassed station without attempting to find the true cause and extent of their troubles before appealing for help. If these stations will apply the "radio stethoscope" to their own cases, they will find the results most gratifying, to themselves and to the radio industry.



Something New in Vertical Radiators

STATION WEBC, at Duluth-Superior, has recently erected a tower as illustrated above. The lower portion which appears dark in the picture is constructed of wood, and is 125 feet in height. The upper part of the tower, up to a height of 357 feet, is constructed of steel, and a one-inch copper tube connects the tuning house equipment with the steel portion of the tower.

The improvement in performance has considerably exceeded the anticipation of the engineers and it is recorded that the 1 kw. transmitter has broken its former records.

Who's Who at "Radio Headquarters"

W. R. G. BAKER, VICE-PRESIDENT AND GENERAL MANAGER, **RCA VICTOR COMPANY, INC.**

NO DOUBT the background of the men who are taking an active part in the affairs of the RCA Victor Company, Inc., will be interesting reading for most people associated with the Radio Industry.

Receiving his Master's Degree at Union College, Schenectady, in 1918, W. R. G. Baker immediately went to work in the laboratory of the General Electric Company. The country was at war. The United States government was sorely in need of efficient radio equipment for both the Army and Navy. All types of craft had to be equipped, for in war—even more so than in peace—rapid communication was of vital importance. Mr. Baker's work in developing and testing new vacuum tube transmitters and receivers to meet the unusual requirements of the Army and Navy took him aloft in planes, balloons and dirigibles, down to the sea in ships, and down below the sea in submarines. Data had to be obtained on the radiation characteristics of various antennas on each type of craft in the service. Equipment had to be developed and tested for trenches, tanks and blimps. As the work expanded, a separate Radio Department in the General Electric Company was formed, and he was placed in charge of the transmitter work, and the results accomplished take an important place in the history of America's part in the World War.

Mr. Baker's experience in government radio work and his record for constructive co-operation with the fighting forces of the United States have been so outstanding that today he carries the rank of Lieutenant-Commander in the Engineering Division of the U. S. Naval Reserve.

With peace came the advent of broadcasting. Whereas in the past it had been customary to manufacture one receiver for every transmitter, the entire complexion of the radio industry began to undergo a radical change. The public was demanding radio receivers by hundreds, and by thousands. Vacuum tubes were selling at a premium—far above list prices. All kinds of organizations were clamoring for broadcast (radio telephone) transmitters and work was rushed forward on the development of 250-watt and 1-kilowatt vacuum tube transmitters for the Radio Corporation of America. Much pioneering was necessary in the design and manufacture of power tubes. The "giant" 20-kilowatt vacuum tube transmitter for the United Fruit Company was at that time more of a problem than the 500-kilowatt transmitter of today. The United Fruit Company wanted a powerful radio network for their Caribbean and Central American activities, and W. R. G. Baker supervised the construction of the equipment for their elaborate stations at Swan Island, Nicaragua, New Orleans, and various other locations.

So successful was W. R. G. Baker's work in these fields that in 1924 he was made Design Engineer on all radio products of the General Electric Company, including both the transmitting and receiving equipment,

and he established the transmitter development station at South Schenectady. While WGY was originally built in 1922, it had been subsequently remodeled and expanded in power from time to time, until the powerful South Schenectady plant was installed.

Then came interest in short-wave high-power transmitters, opening up another new field. In 1926 Mr. Baker was made Managing Engineer of the entire Radio Department of the General Electric Company in Schenectady, having charge of research, development, design and production.

On January 1, 1930, with the concentration of RCA's manufacturing activities at Camden, Mr. Baker was appointed Vice-President of the new RCA Victor Company, in charge of Engineering. Within the year, he was also placed in charge of Production.

Effective January 24, 1934, Mr. Baker became Vice-President and General Manager of the RCA Victor Company, Inc.

BORN in Russia in 1889, Dr. Vladimir K. Zworykin was trained in electrical engineering at the St. Petersburg Institute of Technology, and subsequently continued his studies in Paris, under Professor P. Langevin, in the College de France.

At the beginning of the World War, he returned to Russia and entered the Signal Corps of the Russian Army, where he engaged in the development of radio equipment for aircraft.

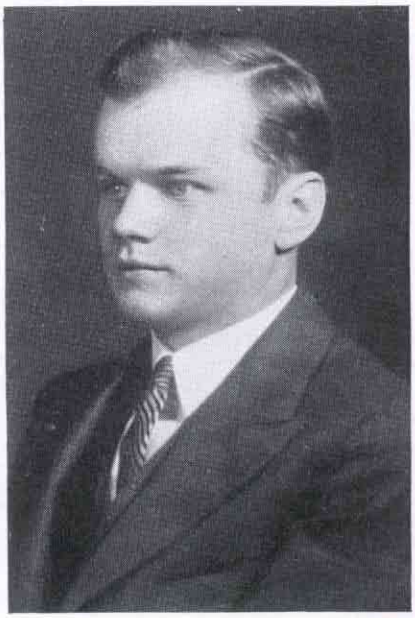
At the conclusion of the war, Dr. Zworykin moved to the United States and was engaged by Westinghouse Electric and Manufacturing Company at East Pittsburgh, in their research laboratory, specializing in vacuum tube work. Dr. Zworykin played an important part in the development of the first dry battery operated vacuum tube for broadcast receivers, — the pioneer Radiotron WD-11, — which became very famous in the early days of broadcasting, as there were then no A. C. operated sets, and a storage battery was an inconvenience in the household. He also took part in the design of the first A. C. vacuum tube. Later he turned his attention to mercury vapor rectifiers and photoelectric cells and also devised a useful type of Kerr cell. Many fundamental principles and important features of the modern sound movie equipment were the outcome of his work.

Facsimile equipment for the transmission and reception of photographs, drawings, maps and various other types of pictures—even including the written or printed page—was perfected under the direction of Dr. Zworykin.

DR. VLADIMIR K. ZWORYKIN,
RESEARCH ENGINEER, **RCA VICTOR CO., INC.**

In 1930 Dr. Zworykin was transferred to RCA Victor Company in Camden, N. J. Here his research was in the field of television, particularly that involving the cathode-ray tube. One of the results of this research was the development of the iconoscope. It is anticipated that many other important developments will shortly emanate from behind the door in the Engineering Department at "Radio Headquarters" which bears the inscription, "Dr. Zworykin —Walk In."

IN 1923 the University of Minnesota graduated E. W. Engstrom, who immediately went to work for the General Electric Company at Schenectady, New York. Here he was associated with research work on radio transmitters until early in 1926, when he began research work on radio receivers. He later was placed in charge of a newly formed section organized for the purpose of performing research work on sound motion picture equipment, and he was very active in the early days of the sound-on-film system which was destined to become world famous as the RCA Photophone System.



E. W. ENGSTROM,
IN CHARGE OF RESEARCH ACTIVITIES OF **RCA VICTOR** AT CAMDEN, N. J.

In 1930, when all research, development and manufacturing work of the RCA Victor Company was concentrated at "Radio Headquarters" in Camden, N. J., Mr. Engstrom was transferred to the Engineering Department of this plant, and placed in charge of the work corresponding to that in which he had previously engaged at Schenectady.

In 1931 he became responsible for radio receiver and phonograph research work and he subsequently has been placed in charge of the research activities of the RCA Victor Company at "Radio Headquarters."

...LET'S GET ACQUAINTED...

EDMUND FROST, SALES ENGINEER FOR **RCA VICTOR** BROADCAST AND POLICE TRANSMITTER EQUIPMENT, RECENTLY APPOINTED ASSISTANT TO **W. H. BELTZ,** WITH HEADQUARTERS IN THE WESTERN DISTRICT OFFICE AT SAN FRANCISCO

CLYDE D. MARTIN, RCA VICTOR SALES ENGINEER FOR POLICE RADIO TRANSMITTERS AT THE HOME OFFICE IN CAMDEN.

◆ ◆ ◆ ◆ ◆

BORN in 1907 at Athens, Pa., Edmund "Jack" Frost was later to become, in speech and education at least, a "Downeast Yankee." He went through public and high schools in Maine and graduated from Bates College in 1927.

Mr. Frost pursued an active interest in amateur radio-telephony while at school. After graduation he entered the Radio Test and later the Radio Engineering Departments of the General Electric Company. His training there was augmented by valuable experience with test apparatus and short-wave transmitter development as well as by courses in radio theory, general engineering and business administration. With the advent of higher power for broadcasting stations he specialized in engineering design and installation work on this type of equipment.

His experience in this field includes initial installation and adjustment of a number of prominent RCA Victor equipped stations as far afield as Maine, Louisiana, California and South America. He has also visited many other stations in the United States and Mexico to furnish engineering services in connection with the operation of these broadcast transmitters.

Mr. Frost will leave for San Francisco in the near future to assist W. H. Beltz in broadcast and police transmitter sales, after having spent several months in the General Sales Offices of the RCA Victor Company at Camden.

◆

CLYDE D. MARTIN was born in 1906 at Algona, Iowa, where he learned his "Three R's." During his high school days, he became interested in radio and did much experimenting with home made sets, to the discomfort of his neighbors, whose reception was impaired by his exploits. He further increased his knowledge of radio by pursuing an Electrical Engineering course at Iowa State College, where he obtained a BS degree.

Realizing that experience is the best teacher, he joined the Test Course of the General Electric Company at Schenectady, New York, where he began to receive remuneration for what originally was only a hobby. After a year at the General Electric plant, he entered the Engineering Department of the RCA Victor Company, Inc., at Camden, New Jersey, and feeling the need of more advanced theoretical training in radio, he continued his studies at the Graduate School of the University of Pennsylvania.

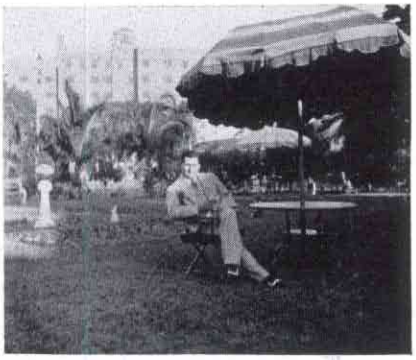
After three years in the Engineering Department of the RCA Victor Company, he was transferred to the Engineering Products Division, to assist in the sale of Police Radio Equipment, of both standard and ultra high frequency types. His work in this field has brought him in contact with the personnel of many police departments, and as a result, he has become so completely convinced of the necessity for adequate protection to society that he is today

Broadcasting Personalities

one of the most energetic boosters of Police Radio Communication Systems.

EMIL VELASCO, popular radio organist, recently arrived from Hagerstown, Md., with (believe it or not) a portable pipe organ, which he brought up to the NBC studios in three sections, each mounted on casters. The lot of the itinerant harpist isn't so bad, after all!

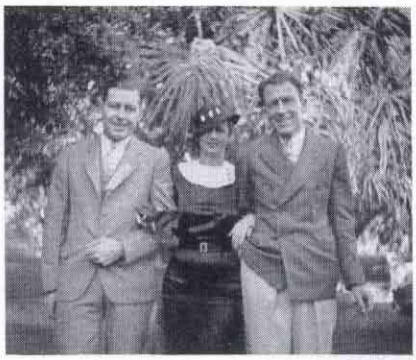
IN a recent (January) issue of the New York *Daily News*, Ed Sullivan's column entitled "Broadway" contained some very interesting references to the RCA Victor Recording Studios on East 24th Street in New York. Sullivan referred to the studios as "not a theatre and not in the theatre band," but he guaranteed that more celeb-



. **R. BAKER,** MANAGER OF THE TRANSMITTER SALES SECTION, **RCA VICTOR,** ENJOYING THE FAMOUS FLORIDA SUNSHINE AT ST. PETERSBURG DURING THE CONVENTION

rities visit the place in the course of a month than any theatre on New York's "Great White Way." He also mentioned having made a transcription in these studios for one of the large automobile companies with Clarence Chamberlain, Rube Goldberg, Lowell Thomas and Ted Husing, and continued to relate that between rehearsals he learned from Frank Walker that Walter Hampton, about to go touring with his show in the Provinces, had made records of all the music cues in his repertoire, thus making him independent of the small-town musicians.

Another interesting reference in his column concerned William Woodin, who, while he was Secretary of the Treasury, was a regular visitor at the RCA Victor studios, where he recorded all of his own compositions, sometimes keeping a large symphony orchestra on hand all day long.



H. W. SLAVICK, LEFT, MANAGER OF **WMC, IRENE FARR, WIOD,** AND **E. C. CARGILL,** MANAGER OF **WMAZ.** THIS PICTURE WAS TAKEN AT ST. PETERSBURG, FLORIDA, DURING THE FOURTH INTERNATIONAL RADIO CONVENTION

IT IS also interesting to note that Babe Ruth, he of the notorious swat, has recently been working on some transcriptions at this studio which will no doubt become very

BABE IN THE WOODS

popular in the near future. The Babe says he would rather face the highest velocity twirler in the League than the silent, motionless but awe-inspiring Velocity Microphone.

CELLSWORTH WYLIE, general manager of KHJ, Columbia Don Lee Broadcasting System in Los Angeles, has announced the appointment of David Heenan as publicity director for the station. Heenan came to KHJ from Bowman-Deute-Cummings advertising agency in San Francisco. He was assistant advertising manager of the Los Angeles Steamship Company in Los Angeles for several years, until the consolidation of that line with the Matson Navigation Company interests two years ago. Prior to his associations on the West Coast, Heenan spent seven years in Honolulu, Hawaii, where he was engaged in newspaper and theatrical work. He was city editor of the Honolulu *Star-Bulletin* from 1925 to 1927.

N. A. THOMAS, LEFT, AND **E. C. WINGER,** RIGHT, OF STATION **WDOD,** CHATTANOOGA, TENN., TAKEN AT THE CONVENTION

MR. GEORGE HEID, well known in broadcasting circles on the West Coast, has for several months been Manager of KVOA in Tucson, Arizona. In addition to his executive duties, Mr. Heid finds time to appear personally before the microphone on special programs.

Mr. O. B. Hansen, Manager of Plant Operations and Engineering for NBC, visited the Pacific Coast recently on a tour of inspection.

RECENT visitors to "Radio Headquarters" at Camden included W. M. Witty, Manager of the Southwestern District, who furnished us with much important news concerning Police Radio activities in his territory (quoted elsewhere in this issue), and Ben Adler, Manager of the Southeastern District, who has been active lately in Police Radio sales—

(Continued on Page 41)

A 1934 Monitoring Equipment

By W. L. GARNETT, Transmitter Engineer, RCA Victor Company

TWO hundred monitoring equipments purchased by one customer for a single project! Sounds incredible, but it is true. A short time ago, the National Broadcasting Company purchased two hundred of these new 1934 monitoring equipments for their spacious studios at Rockefeller Center, in New York City. This means that these equipments have successfully met the exacting standards of quality that NBC engineers require of their equipment.

It is always the aim of any up-to-date leader in industry to anticipate the future needs and requirements of its customers. In the Radio Broadcasting Field, this aim is especially true of the RCA Victor Company.

Radio receivers are advancing toward higher fidelity so quickly that those people connected with transmitters and speech input equipment are kept very active. It is their responsibility, as well as that of those people who operate transmitting equipment, to continually improve and use apparatus that is ahead of the radio listener's demands. This new monitoring equipment is offered to the broadcasting trade as a link in the transmission chain that will meet the requirements of 1934.

When development work on the monitoring system was started over a year ago, the first objective was to obtain a truly high-fidelity system. A fidelity that extended to both higher and lower frequencies. A fidelity that because of its unusual "naturalness" would make itself instantly noticeable. To such a degree has the fidelity of this system been developed.

The overall combination has a response (loudspeaker sound pressure) that is practically flat over the 60 to 8,000 cycle range and has a useful response from 30 to 14,000 cycles. With this "lifelike" reproduction, program directors and production engineers will be able to actually hear the "balance" of their programs. They will be able to tell distinctly whether the violins are coming through properly, if they are getting enough of the bass viol, whether the studio is sufficiently "alive," or if any other desired or undesired condition exists. With the use of velocity microphones, and the widening of the frequency band throughout the entire speech input system, this 1934 monitoring equipment will give the operating personnel and station owners a new "thrill" when they hear high-fidelity from their own studios.

W. L. GARNETT, RCA VICTOR

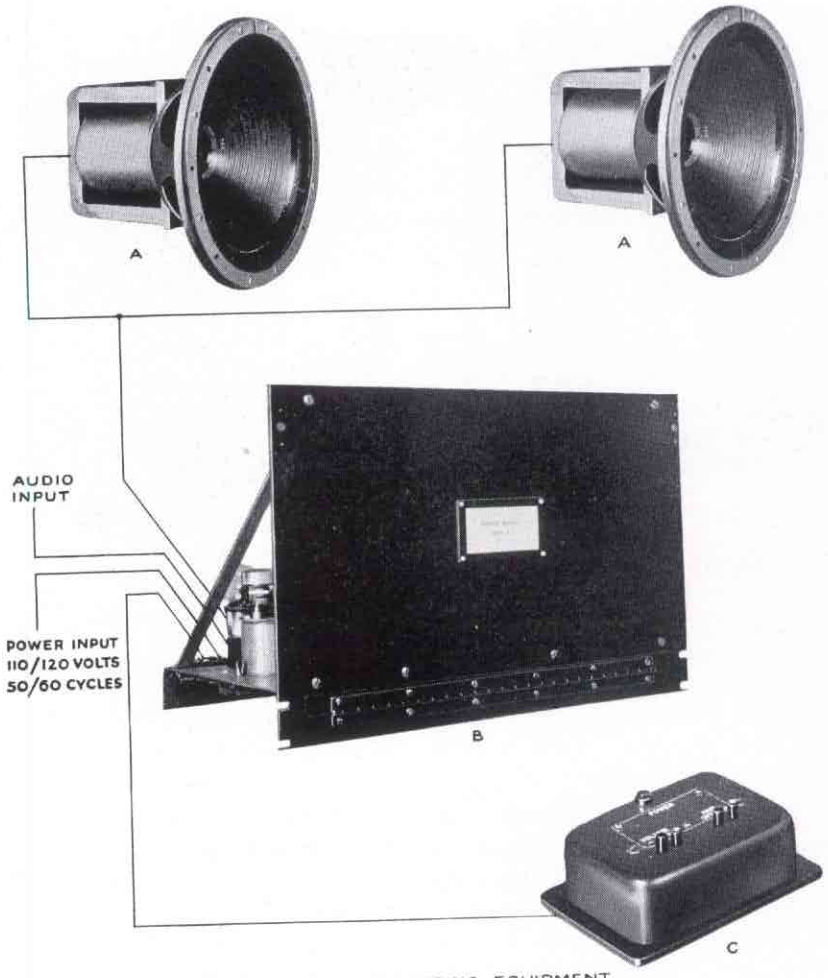
Another feature of the equipment is its simplicity of control. Only four push-buttons, mounted in a remote control box, are required to operate the equipment. The four buttons control a power relay and motor-operated volume control located in the amplifier unit, Type 4194-B. This permits the amplifier to be turned on or off and the volume adjusted higher or lower by the push of a button. More than one remote control box can also be used with the equipment if desired. This means that when the equipment is used as a monitor in an audition or customers' room, in a studio observation gallery, or in an executive's office, the volume can be controlled from a position at a desk, in a chair, or in a lounge.

A unique mounting arrangement has been incorporated in the amplifier design. Provisions have been made to permit its being swung into three different positions when desired. Figures 1 and 2 show this clearly. Figure 1 (a) shows how the amplifier may be mounted in a loudspeaker cabinet; 1 (b) demonstrates the position the amplifier may take to facilitate tube inspection and servicing; 1 (c) shows a third position which permits the quick checking of circuit continuities and voltages. The simple idea of mounting the amplifier so that it can be readily swung through 180° (while it is still connected and in operation) is very helpful to the station maintenance engineers. Figure 2 shows the amplifier mounted in the RCA Victor Type 9-AJX cabinet rack.

Obviously, all of the desirable features incorporated in older designs were also wanted in the 1934 equipment. These features included: 1, all AC operation; 2, generous voltage amplification; and 3, adequate power with plenty of reserve. These features have been retained, studied and improved.

The amplifier operates entirely from AC, either 50 or 60 cycles, 110–120 volts, single phase. In the past, AC amplifiers have been detrimentally associated with "hum," but such an association will not be made with this equipment. Because of the required low frequency response, considerable effort has been used successfully in reducing the AC "hum" factor to a negligible quantity.

The voltage amplification is 40 decibels, an abundance for monitoring purposes when operated from a zero level line, as is customarily done. The volume control, logarithmically tapered, is connected across the secondary of the input transformer. It operates over the entire range of



SHOWING 1934 MONITORING EQUIPMENT.

A. LOUDSPEAKERS TYPE UZ-4209.
B. AMPLIFIER TYPE 4194-B.
C. REMOTE CONTROL BOX

FIGURE 1

40 decibels and gives approximately the same attenuation in decibels per degree of rotation.

The amplifier uses three stages of amplification. The Radiotrons, one RCA-57, one RCA-59, four RCA-45's, and one RCA-83, are connected and operated so that their efficient and outstanding performance is the result. The loudspeaker fields are utilized as a part of the rectifier's filtering system. Either one or two loudspeaker fields may be used.

The four RCA-45's, comprising the output stage, are connected in parallel push-pull and are operated as class "A prime" amplifiers. This enables the amplifier to deliver approximately 25 watts on "modulation peaks" without noticeable distortion instead of the usual 10 watts. The increase in "peak power" output gives a reproduction that is a distinguishing improvement and in direct keeping with high fidelity. It is evident that a monitor can have high-fidelity frequency response and yet have objectionable distortion when sudden loud passages occurring in the program overload the amplifier. This 1934 monitoring equipment has raised the noticeable overload point to 25 watts.

Although power consumption may not be so important an item to studio equipment owners, nevertheless it may be pointed out that the total AC power required to operate this equipment is but 150 watts, approximately. This is an unusually small amount for an equipment which has so high an amplification and power output rating.

Serviceability, that ready access to parts and circuits, has always been an important factor in amplifier design for speech input equipment. Ask the design man and the maintenance engineer—they know. This amplifier, in addition to the hinged mounting arrangement which permits it to assume an accessible position, has been constructed and simplified to provide even greater access to parts and circuits than in previous designs. A study of Figures 3 and 4 will show how this has been accomplished.

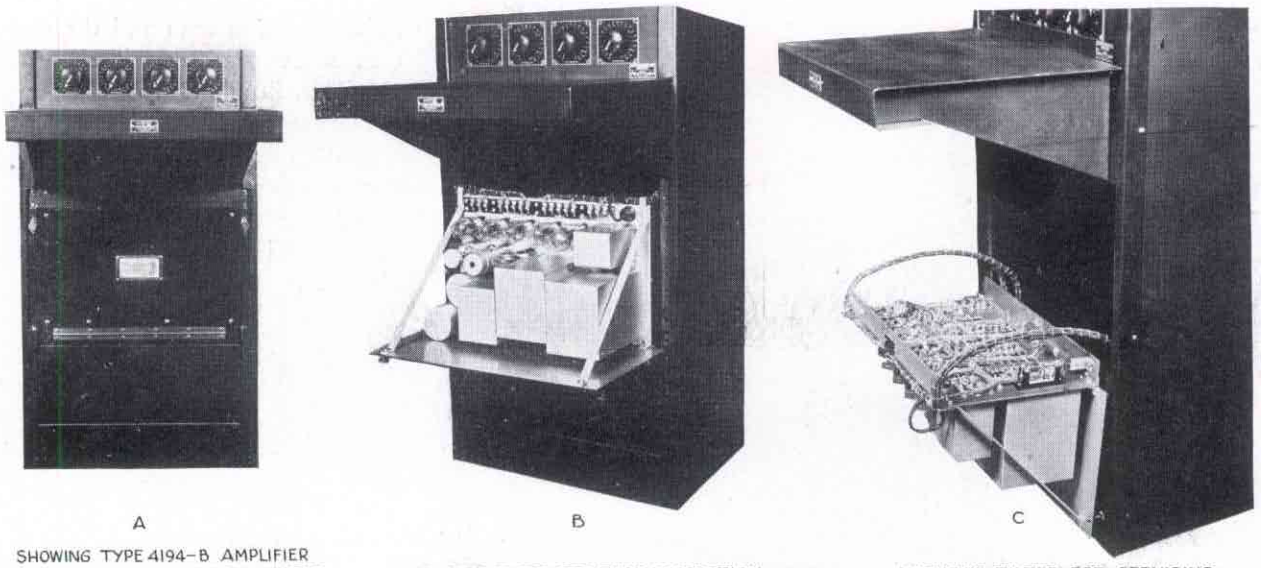
Figure 3 shows that the amplifier base is formed of one piece of sheet steel, with edges bent over to form front and rear aprons. All of the main units are mounted above the base and secured in place by machine screws and nuts. The terminal boards of the main units (capacitor, transformer and filter packs) project through openings in the base so that connections are easy to get at. All of the wiring is contained under the base.

As shown in Figure 4, the base is mounted to a large steel panel which, in turn, is hinged to a narrower steel panel. The total front panel height is $13\frac{31}{32}$". The panel is 19" wide and $\frac{3}{16}$" thick (standard dimensions for speech input panels). With the amplifier mounted on the panel, the depth is approximately 11". The front panel is blank except for the identification card and card holder. The card is furnished in blank form so that the customer may place any information on it that he desires.

The front panel is finished in a dull black lacquer, which harmonizes with standard speech input panels. The back of the panel, the base, and all units mounted on it are finished with silver gray lacquer. This gives the amplifier an appearance of richness and "freshness" that is both pleasing and durable.

Photographs 1 (a) and 3 show that customary practice has been followed by stenciling a schematic diagram and necessary data on the cases of the main units. Each small unit also carries its stenciled designation number so that it can be identified in the connection diagram.

There are no covers furnished or required for the amplifier. The units are well shielded from circuits within



A

SHOWING TYPE 4194-B AMPLIFIER MOUNTED IN STANDARD RCA-VICTOR CABINET RACK TYPE 9AJX.

B

AMPLIFIER TILTED FOR TUBE INSPECTION.

C

AMPLIFIER TILTED FOR SERVICING.

FIGURE 2

the amplifier itself and from outside disturbances. The amplifier is unusually stable (free from oscillation, motor boating, etc.) and can be operated without any grounding connection.

The amplifier is quite adaptable in its usefulness. The input and output circuits are transformer coupled. Its input may be bridged (connected) across any line having an impedance ranging from 0 to 20,000 ohms. Its output is provided with taps so that it may be connected to a load having either 15, 30 or 500 ohms impedance or any combination of loads having an equivalent impedance.

Although the amplifier was designed to operate as a monitoring amplifier in conjunction with the Type UZ-4209 loudspeaker, it may be used as a studio amplifier, a line amplifier, or wherever an amplifier of its rating is desired. In order to operate it in this special manner, with a flat frequency response, certain minor changes must be made. They consist of the removal (electrically speaking) of the compensation stages that are present in the amplifier for the benefit of its associated loudspeakers. These changes can be quickly incorporated by the customer and require only two inexpensive resistors as additional parts. When there is no UZ-4209 loudspeaker field available for connection to the amplifier, an equivalent reactor, Type XT-1304, is necessary. The changeover is described clearly in the amplifier instruction book.

The loudspeakers used in this equipment are known as the Type UZ-4209. Fundamentally, they are of the customary electrodynamic type, consisting of a moving coil suspended in an electromagnetic field. Actually, however, there are many unique ideas used in this loudspeaker that enable it to reproduce over a range wider than has been obtained previously. The moving coil construction is ingenious. It consists essentially of two sections: a high frequency coil and a low frequency coil. This contrasts with the usual single coil construction. The high frequency coil, in order to be most efficient, must be light in weight, so it is wound with aluminum wire and physically mounted nearer the cone. The low frequency coil is heavier, is wound with copper wire, and is physically mounted further away from the cone. The two coils are wound on a slitted phosphor-bronze ring, which has two groups of ridges or beads formed circularly around it. One group is located between the cone and high frequency coil, and the other group between the two coils. These beads act as a coupling or compliance and produce, with the mass of the coil structures, a desired mechanical filter.

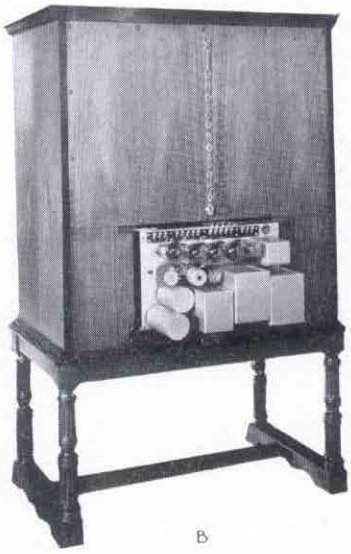
With this arrangement, when high frequency signals excite the high frequency coil, the coil (because of its extreme lightness) can actuate the cone without having to move the heavier and more massive low frequency coil. To further aid this action, a capacitor is connected across the low frequency coil to by-pass high frequency signals. Obviously, low frequency signals will excite both coils and they, in turn, will actuate the cone. In the middle range of frequencies there is an overlapping, or dovetailing, of the responses from the two coils which adds smoothness to the loudspeaker response. The net result is that two coils permit more efficient design and do actually reproduce more effectively over a wider frequency range than former designs.

The cone is approximately 8 inches in outside diameter and has an increased power output rating of 15 watts. The voice coil impedance is 15 ohms.

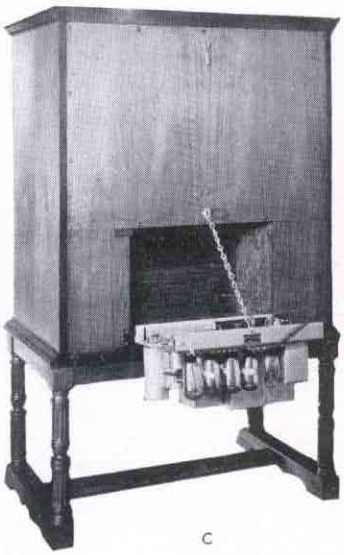
The loudspeakers for this equipment are supplied unmounted, but recommended methods for mounting them are furnished. This policy permits the customer to choose a method that he feels is most desirable for his individual application.

The announcement of this new 1934 high-fidelity monitoring equipment comes then as a welcome message to studio owners and opera-

A
SHOWING TYPE 4194-B AMPLIFIER MOUNTED IN A LOUDSPEAKER CABINET



B
AMPLIFIER TILTED FOR TUBE INSPECTION



C
AMPLIFIER TILTED FOR SERVICING

FIGURE 3

tors, large and small alike. It brings to them the opportunity of obtaining something that will aid them in doing better work. Even though you may be a small station owner, you can have your programs sound as well as the big NBC programs from their huge, luxurious studios at Rockefeller Center, in New York City. This 1934 monitoring equipment, in a quantity of two hundred, was installed and is being used exclusively by NBC in their new, modern home at Radio City. NBC selected this equipment to help them obtain the higher quality studio programs of the future. They entrusted to this equipment the responsibility of presenting their service to clients in their customers' audition rooms. They chose this equipment to reproduce their programs for executives in their offices and for the public in the galleries and lounges. AC "hum," tube hiss, extraneous noises, insufficient volume, distortion—any of these undesirables so characteristic of other monitors would be extremely disagreeable and out of place in any of their uses. Therefore, quality and reliability were certainly paramount in their selection of this equipment.

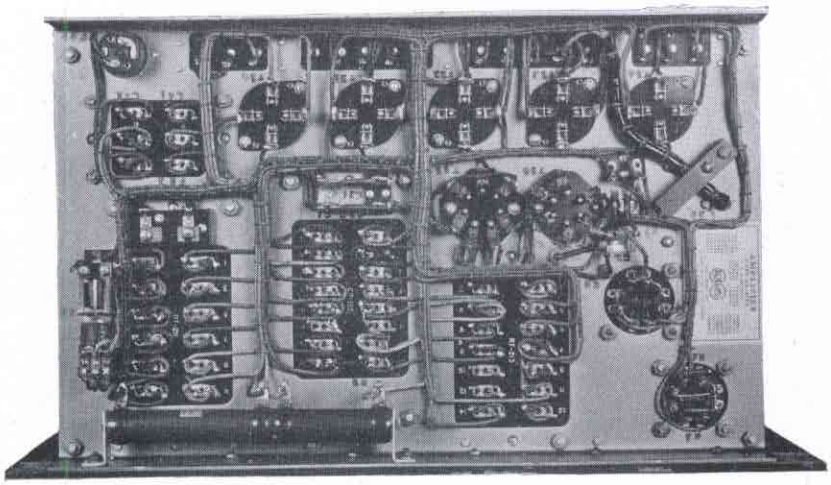


FIGURE 4—SHOWING BOTTOM VIEW OF TYPE 4194-B AMPLIFIER ILLUSTRATING ACCESSIBILITY OF UNITS AND CONNECTIONS

To take advantage of the features of this new monitor, the Columbia Broadcasting System, ever on the alert for improved equipment, has also purchased a number of these units for their WABC studios in New York City. A page can be taken from the notebooks of these broadcasting leaders (NBC and CBS) when you wonder how you can improve your service.

BROADCASTING PERSONALITIES

(Continued from Page 37)

more concerning which appears in the Police Radio Department of this issue.

Ted Smith, Manager of the Eastern District, called upon us shortly before Christmas, and R. P. May, of the same District, paused in Camden over night on his way to Western Pennsylvania.

D. A. Reesor, of the Central District, also paid us a visit and furnished us with some very interesting photographs which he had taken with his own camera. This camera, like several others preceding it, has since mysteriously disappeared. Reesor confided to us that he expects shortly to break himself of the habit of losing cameras and says he has found a sure way to cure it—he is not going to buy any more. This would be a great loss to *Broadcast News*, and we are seriously considering the purchase of some cheap cameras in dozen lots at wholesale, which we will issue to Mr. Reesor from time to time as required.

RCA Victor Develops New Field Intensity Meter

By WILLIAM F. DIEHL, Test Methods and Equipment Engineer, RCA Victor Company, Inc.

DEVELOPMENT and field tests have been completed on a new instrument for measuring the field intensity of all type transmitters. This instrument will be designated as RCA Victor Type TMV-75-B Field Intensity Meter and will replace the well-known TMV-21-A instrument which has been in such demand for the past several years and which has proven exceedingly popular due to its portability, wide frequency range and wide range of field intensity.

The increasing interest in field strength measurements and the widespread acceptance of this type of measurement as a figure of merit of the transmitter have indicated to us that certain new features, such as greater stability, higher accuracy, still wider range of field intensity and carrier frequency, are highly desirable if an instrument of this type is to adequately meet the future requirements.

Figure 1 is an over-all view of the complete TMV-75-B equipment, which consists of the Field Intensity Meter proper and a separate carrying case to house the loops, plug-in coils and batteries.

The equipment is self contained in two metal cabinets whose weights, less batteries, are each about 30 pounds. While its weight with batteries is somewhat high it is considered that the stability and extreme range of the instrument justify this weight.

As shown in Figure 3, the controls have been so arranged and grouped as to make the instrument easy and simple to operate. Because of the method of calibration, loop constants do not have to be measured, so several measuring operations have been eliminated from previous equipments of this type.

WILLIAM F. DIEHL, RCA VICTOR

All tuned circuits are controlled by means of vernier dials whose vernier ratio may be varied between 6-1 and 20-1. This makes possible easy tuning of the various circuits at high frequencies without too great a vernier action at the lower frequencies.

The equipment requires a power supply of 25 M. A. at 135 volts for "B" supply and 1.6 amperes at 6 volts for "A" supply. A choice of batteries may be made, depending upon the battery life desired. The approximate life of the various batteries which may be used are illustrated in the following table:

"A" SUPPLY

Type	*Hours*
Four No 6 cells	4
Eight No 6 cells (*series parallel*)	15
Six volt storage cell (*motorcycle type*)	20 (*per charge*)

"B" SUPPLY

Type	*Hours*
No 4156	7
No 5308	15
No 2305	60

The instrument will measure intensities between 20 microvolts per meter and 6 volts per meter at carrier frequencies between 500 kc. and 20,000 kc. It consists, essentially, of a loop receiver using the superheterodyne principle in which the intermediate frequency operates at 300 kilocycles. A resistor attenuator operating at 300 kc. is provided in the intermediate frequency amplifier to control the gain of the receiver and, thereby, permit measurements of field strength over a wide range. In order to measure extremely high field intensities, an additional attenuator is provided as indicated by C-2, R-1 and C-3 in the diagram. The switch S-2 is provided for switching the additional attenuator in and out of the circuit. A separate calibrating oscillator and mutual inductor attenuator is provided for the purpose of maintaining the calibration. Four loops are provided to cover the frequency range and four sets of plug-in coils are required, one set for the beating oscillator (shown on the print as detector oscillator), the other set for the calibrating oscillator.

The switch S-1 when open disconnects stator plates from the variable condenser C-1 to permit proper tuning in the high frequency range. The variable condenser C-4 is provided for compensation so that the capacity to ground across each side of the loop will be constant.

The field picked up by the loop at the carrier frequency (500–20,000 kc.) is applied to the grid or input circuit of the RCA-78 detector and the frequency changed to 300 kc. by introducing the voltage from the beating oscillator which uses a tuned grid circuit and an RCA-30 tube. The plate circuit of the RCA-78 is tuned to 300 kc. and the secondary of the I. F. transformer (L-9) is

connected to a resistance attenuator, the output of which feeds the input of the first I. F. amplifier consisting of an RCA-36. The signal is then amplified by a second I. F. amplifier (RCA-36) and a third I. F. amplifier (RCA-78), after which it is applied to the diodes of an RCA-85 connected in parallel to supply half-wave rectification and also amplify at audio frequencies by the same tube. For the purpose of listening to the signals a jack (J-1) is provided, connected in the secondary of an audio transformer (T-1). For purposes of measuring the output meter (M-3) it is connected in the diode or detector circuit and remains connected and operates regardless of whether the telephone receivers are plugged in or out of the circuit. The switch (S-4) is an "On–Off" switch and the meter (M-2) is a double range voltmeter. Resistors R-4 and R-5 are provided for the purpose of changing the gain in the I. F. amplifier and thereby performing the functions of a volume control.

The Calibrating

The calibrating oscillator utilizes an RCA-30 tube in the tuned plate circuit indicated by L-4 and C-7. The output of the calibrating oscillator is applied to the primary L-2 of a mutual inductor attenuator and a thermo-couple meter (M-1) reads the voltage across L-2. The coupling between L-2 and L-1 is fixed and a definite voltage appears across L-1 which is connected in series with the loop, and this voltage acts in the same manner as the signal and is used for the purpose of calibration. Since the secondary (L-1) of the mutual inductor always remains connected in the circuit, no error results, due to changing impedance conditions with calibration.

When a loop antenna is placed in a magnetic field a voltage is induced in its circuit. The magnitude of this voltage is dependent upon the strength of the field, the effective height of the loop and the angle between the field and the loop. When the loop is so directed as to give maximum induced voltage this induced voltage may be expressed by the formula:

$$e = Fh \quad (1)$$

where e = induced voltage in microvolts

F = field intensity in microvolts per meter

h = effective height of the loop antenna in meters

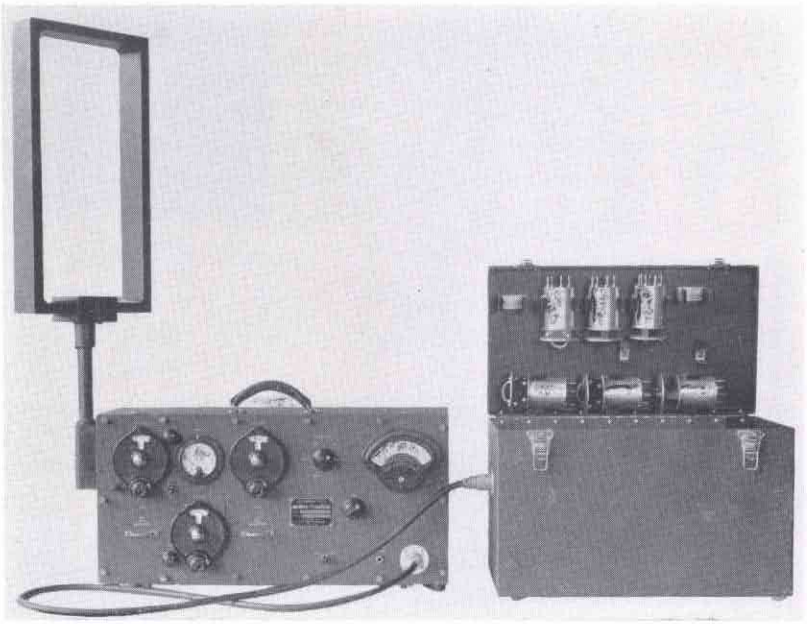


FIGURE 1—**RCA VICTOR** TMV-75-B FIELD INTENSITY METER, OPEN FOR ACTION

If a variable capacitor is placed across the loop antenna and the circuit tuned to resonance with the frequency of the field, a voltage will appear across the loop antenna and condenser larger than the induced voltage by an amount called here, the step-up of the loop, and expressed by the symbol Q. We now have for the voltage across the loop antenna in the magnetic field a voltage E expressed by the formula

$$E = Qe = QF\,h \quad (2)$$

Due to the necessity of balancing the loop to ground to prevent antenna effects, only one-half of this voltage, or $\frac{E}{2}$, is impressed on the grid of the first detector and heterodyned with the heterodyne oscillator. Across the plate load of the first detector will now appear a 300 kc. voltage whose amplitude is dependent on the voltage $\frac{E}{2}$ and a constant, the conversion conductance of the first detector tube designed as M_d. The circuits associated with the first detector are so designed as to make this quantity M_d constant for any input voltage $\frac{E}{2}$ over the range of the instrument at any given frequency and as nearly constant as possible, for all frequencies, without overloading any of the associated tubes.

We now have a voltage E_d at a frequency of 300 kc., the intermediate amplifier frequency

$$\text{and } Ed = \frac{E}{2} Md$$

$$\text{or } Ed = \frac{Q\,F\,h\,Md}{2} \quad (3)$$

This voltage is impressed across a resistance attenuator network where it may be attenuated by any amount up to 50,000 in steps of 4 and 5 each, that the attenuation factors are 1, 5, 20, 100, 500, 2000, 10,000 and 50,000. The attenuated voltage is impressed on the grid circuit of the first tube of the intermediate frequency amplifier. The gain of the amplifier may be varied by means of a gain control between rather wide

limits. The gain at any constant setting will be designated by M_a and the attenuation of the attenuator will be designated by A_1, A_2, etc. The output voltage of the I. F. amplifier is measured by means of a d.c. microammeter and a diode rectifier. Because of the fact that the diode rectifier is not a true linear device, a marked scale is placed on the meter so that the meter readings are directly proportional to the I. F. output voltage. The output of the I. F. amplifier will be designated as R_1, R_2, etc. Thus

$$R = \frac{E_d \times M_a}{A}$$

$$\text{from (3) } R = \frac{Fh\ Q\ Md\ Ma}{2\ A} \qquad (4)$$

$$\text{or } F = \frac{2\ RA}{h\ Q\ Md\ Ma}$$

In order to be able to calculate the field intensity giving the reading R, it is now necessary to know h, Q, M_d, and M_a. To find these values it is necessary to calibrate the instruments. If a known voltage V is induced in the loop circuit it will be possible to calculate a value which will include all of these constants with the exception of h, which is known from the physical dimensions of the loop. This voltage is introduced in the loop circuit by means of a mutual inductance attenuator.

The mutual inductance attenuator consists of two self-inductances inductively coupled to each other and so shielded as to prevent any capacity coupling. The primary or larger inductance is fed with current from the calibrating oscillator and the voltage across the coil is measured by means of a thermocouple voltmeter. The secondary or smaller coil is connected in series with the loop antenna, opening the loops at their electrical center so that one side of the secondary of the mutual inductance may be at ground potential as well as one side of the primary. The secondary voltage V is proportional to the primary current and the mutual inductance between the two coils,

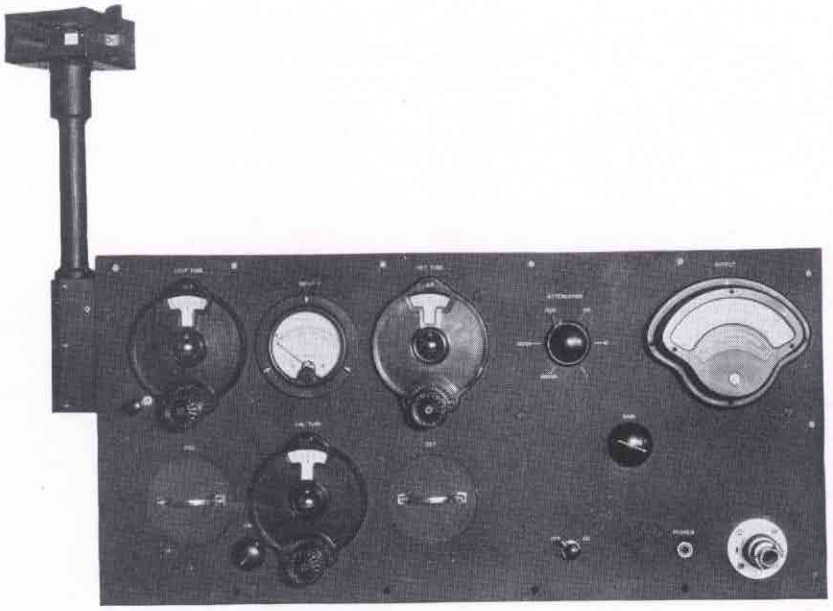


FIGURE 3—A CLOSEUP OF THE CONTROL PANEL ON THE NEW TMV-75-B FIELD INTENSITY METER

$$V = 2\ \pi\ f\ I_p \quad L_m \qquad (5)$$

$$Ep = I_p\ 2\ \pi\ f\ Lp \text{ or } Ip = \frac{Ep}{2\ \pi\ f\ L_p} \qquad (6)$$

$$\text{Thus } V = \frac{E_p}{L_p}\ Lm \qquad (7)$$

as L_m and L_p are constants, it follows, if E_p is held constant, the secondary voltage V will be constant regardless of the frequency. We thus have a known constant voltage source as long as the primary voltage is held constant by means of the thermocouple voltmeter across the primary coil.

If we now introduce the voltage V in the loop circuit as stated we have impressed on the grid of the first detector a voltage equal to $\frac{VQ}{2}$, which will produce an output reading proportional to Md, M_a, and A.

$$R = \frac{VQ\ Md\ Ma}{2\ A} \qquad (8)$$

To calibrate the instrument we will set certain values as calibrating values. These values will be

$$R = R_1$$

$$V = V_1$$

$$A = A_1$$

and will adjust Ma so that these conditions may be met at this frequency. We then have from (8)

$$R_1 = \frac{V_1\ Q\ Md\ Ma_1}{2A_1}$$

$$\text{or } \frac{2A_1\ R_1}{V_1} = Q\ Md\ Ma_1 \qquad (9)$$

If now we place the loop of the instrument in an unknown field of field strength F and allow the gain of the I. F. amplifier to remain Ma_1, but vary the attenuator setting to A_2, the output reading will be some value R_2 and from (4) we have

$$F = \frac{2\ R_2\ A_2}{h\ Q\ M_d\ Ma_1} \qquad (10)$$

substituting (9) in (10) we have

$$F = \frac{2\ R_2\ A_2\ V_1}{2\ h\ A_1\ R_1}$$

from which the field strength may be calculated, as all quantities are known.

By collecting the terms of the calibrating conditions this formula is simplified to the form

$$F = \frac{R_2\ A_2\ K}{h} \text{ (11) where } K = \frac{V_1}{A_1\ R_1}$$

This formula is still further simplified by substituting in it the formula for the effective height of a loop antenna

$$h = 2\pi S N A F$$

where S = a constant

N = number of turns

A = area enclosed by the loop

For any given loop this becomes

$$h = s^1 f \qquad (12)$$

Substituting (12) in (11)

$$F = \frac{R_2 A_2 C}{f} \quad (13) \text{ where } C = \frac{K}{S^1}$$

The value C is calculated for each loop so that calculation of field intensities from R_2 and A_2 are very simple, f being a known and constant quantity for many measurements such as making a station survey or when recording fading. It must be remembered that the quantities Q and Md are not constants with respect to frequency, so the instrument must be recalibrated for each different frequency if the frequency difference is greater than a few per cent. Up to 5 per cent change in frequency these quantities do not vary appreciably.

In order that the higher field intensities may be measured it is necessary to attenuate the voltage across the loop to prevent overloading of the first detector. This is accomplished by placing a capacity attenuator in the grid circuit of the first detector. This attenuator may be placed in or out of the circuit, as desired. No attempt has been made to keep the attenuation ratio of this unit constant with respect to frequency, and so when making measurements with this unit in the circuit it will also be necessary to calibrate with like conditions.

When calibrating with the input attenuator in the circuit (position L) it will be found necessary to calibrate with the I. F. attenuator on a different position than when the input attenuator is disconnected (position H). The field strength calculated by (13) must therefore be multiplied by the ratio of the previous I. F. attenuator setting for calibration to the new I. F. attenuator calibrating setting.

The writer wishes to acknowledge the assistance given by Mr. H. E. Ghiring, whose experience in field survey work was invaluable in preparing the original specifications, and credit Mr. H. J. Schrader for his conscientious assistance in carrying through the development and design. The writer wishes also to thank Mr. Raymond Guy, of the National Broadcasting Company, for his excellent co-operation and valuable suggestions during the development, and for his data taken in the field using the first development model.

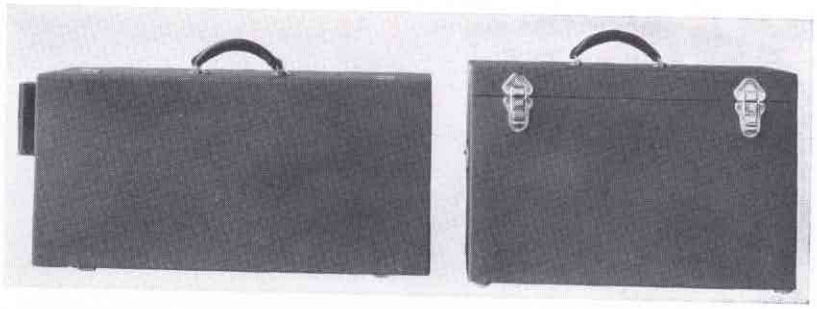
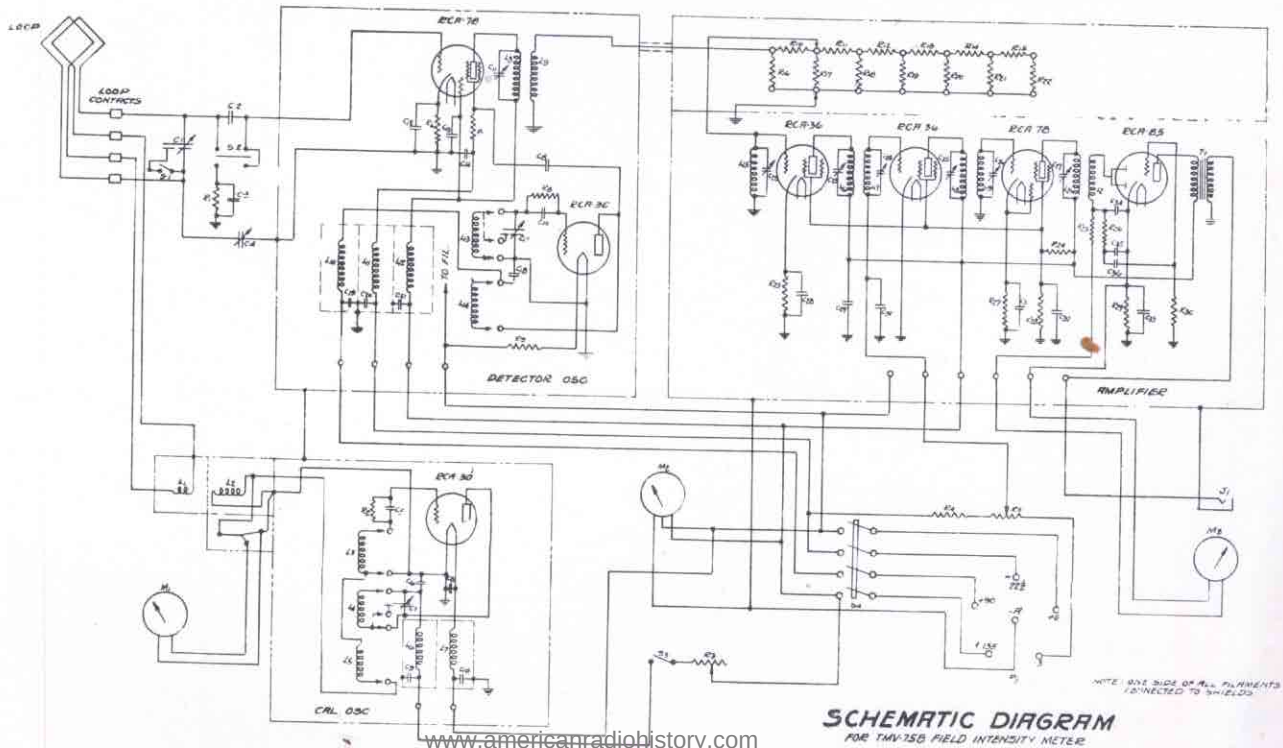


FIGURE 2—THE TMV-75-B FIELD INTENSITY METER EQUIPMENT, CLOSED UP IN ITS CARRYING CASES, READY FOR TRANSPORTATION



SCHEMATIC DIAGRAM
FOR TMV-75B FIELD INTENSITY METER

Air Conditioning at the Radio City Studios of NBC

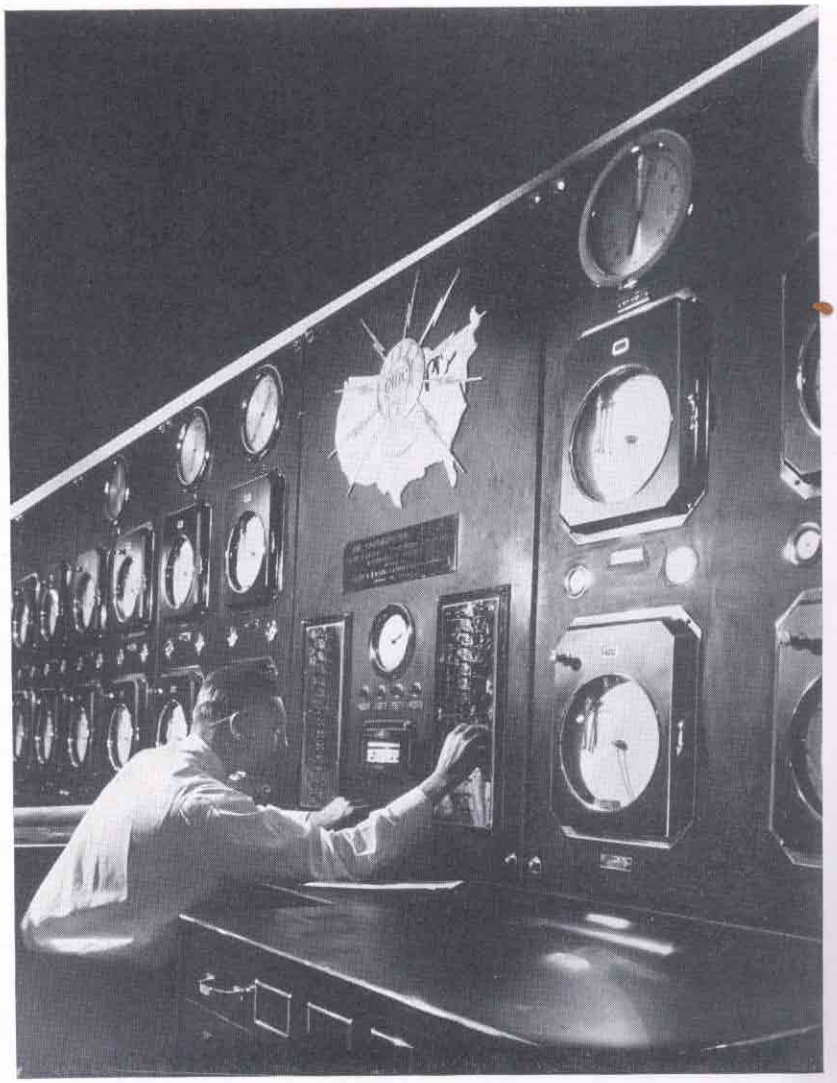
Manufactured Weather Solves Problem Created by Perfect Sound Installation

By OSCAR McCLELLAN

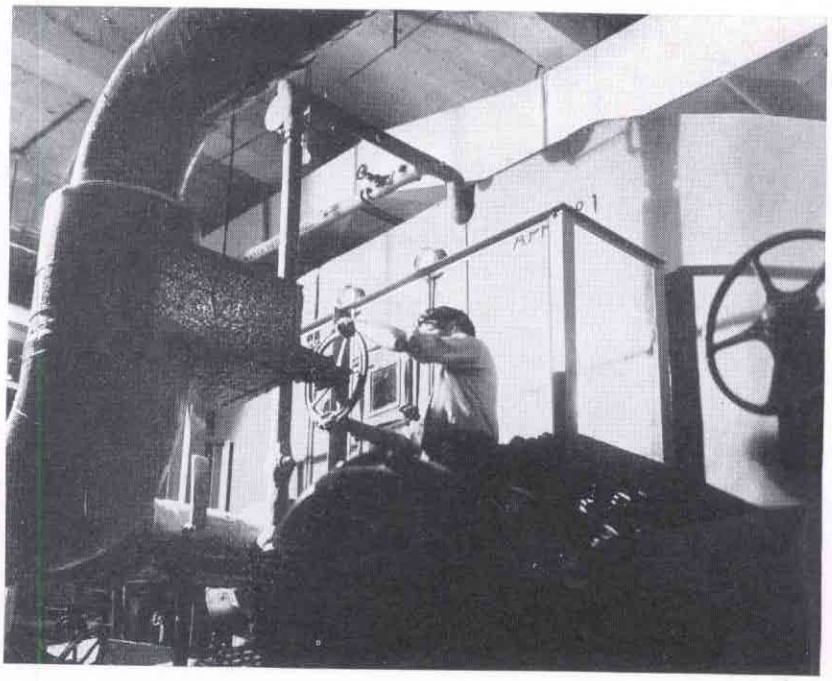
SO effectively are the studios of the modern broadcasting stations insulated against sounds from the outside world that ordinary means of ventilation are completely cut off and provisions for artificial ventilation and temperature control become of vital importance. Moreover, the heating, cooling, and ventilating apparatus must all be designed to operate in absolute silence, so as to have no effect whatever upon the sensitive microphones employed to pick up the program material which is to be broadcast.

A visit to the new NBC studios at Radio City is most revealing to the casual visitor, who gradually becomes aware of the fact that there are no windows or other openings affording access to the outside light and air and the ever persistent background of noises generated by the great metropolis without. However, the visitor becomes conscious of the fact that the interior of these studios is always as comfortable from the standpoint of temperature as it is from the standpoint of clean and refreshing atmosphere. Just how this is accomplished remains a mystery to the uninitiated guest, until he is invited by a guide to inspect the elaborate air conditioning plant which is part of the NBC studio installation.

While in the studios, control rooms, observation galleries and various other spaces associated with the production of broadcast programs, there are no visible evidences of the elaborate air condition system, a trip through the air condition plant itself is most impressive. Inside the master control room of the "weather manufacturing" plant, the visitor is amazed at the huge expanse of switchboard on which scores of recording meters keep a continuous record of the temperature and humidity of each and every space connected to the system. A close inspection of one of these recorders discloses a printed paper dial with divisions representing the 24 hours of the day, and a pair of little pens which trace in ink a continuous record of the temperature and humidity throughout the 24 hours in the space to which this particular instrument is connected. Various control devices and electrical indicators and meters are arranged in an orderly manner throughout the 64 major divisions on this switchboard, and in the center, seated at the master console, may be seen the engineer on watch, under whose careful guidance the entire system performs its endless task.



THE ENDLESS TASK OF CONTROLLING THE TEMPERATURE AND HUMIDITY OF THE SCIENTIFICALLY CLEANED AIR WHICH IS FED TO THE VARIOUS QUARTERS OF **NBC** AT RADIO CITY. NBC PHOTO



WASHING AIR FOR ARTISTS

CIRCULATING PUMP AND TANK FOR WASHING THE AIR WHICH IS SUPPLIED TO THE **NBC** STUDIOS IN RADIO CITY. IN THE TANK, THE AIR IS DE-HUMIDIFIED OR HUMIDIFIED, ACCORDING TO THE STATE OF THE WEATHER. AS THE STUDIOS ARE ENTIRELY ENCLOSED, CONSTANT CIRCULATION AND CLEANING ARE NECESSARY. NBC PHOTO

Leaving this control room, the visitor is guided through a maze of humming motors, whirling blowers, hydraulic air washers, and various other appliances and auxiliaries which occupy an entire floor of the great tower. The guide pauses before two long horizontal tunnels, and invites the visitor to listen in the mouth of one tunnel while the guide proceeds around to the opposite end to demonstrate how his voice will carry through this ordinary untreated metallic tube, and the visitor finds that he can clearly understand every word that the guide is saying to him from the opposite end of the tube. Now the guide invites the visitor to step over to the other tube, the interior surfaces of which have been treated with the same sound insulating material as employed in the distribution ducts connecting the air conditioning plant with the various studios and other spaces. The visitor is amazed to find that while he can clearly see the guide's lips moving at the opposite end of this tunnel, he is unable to hear any of the sounds being produced as the guide speaks.

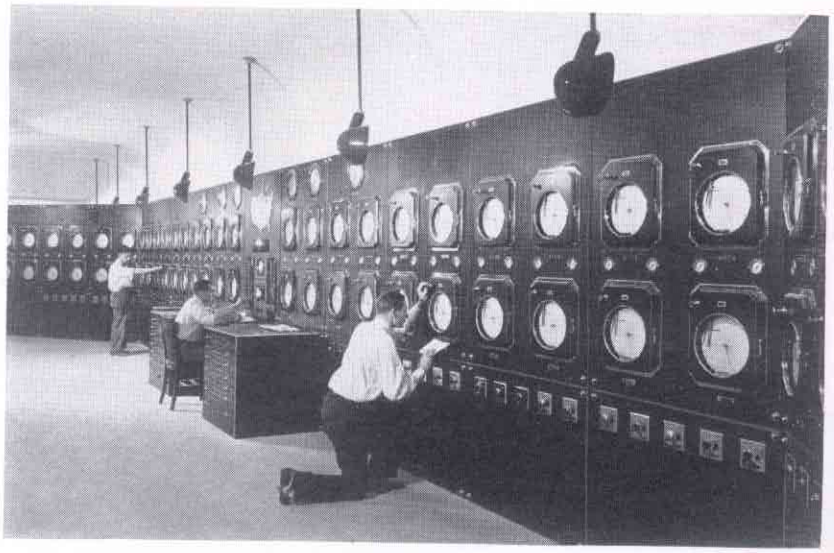
Thus the visitor learns how fresh, humidified and temperature controlled air is distributed throughout the NBC quarters in complete silence. Not only are the sounds originating in the air conditioning plant prevented from reaching the studios, but the sounds originating in any particular studio are prevented from being transmitted to any other studio.

No less than a million dollars is invested in this huge air conditioning plant, which is the largest installation in the world.

BABE GOES ON "THE AIR"

Babe Ruth is now broadcasting a splendid series of programs through WSM, the broadcasting service of the National Life and Accident Insurance Company, each Monday, Wednesday and Friday from 6 to 6:15 p. m. He is at a stage of his career where he feels that he can give more of his time to developing American youth and using his influence with them to foster a more widespread interest on their part of the athletic life, in clean living and in sports in general. His programs are being broadcast to a territory in which there are more than seven million radio sets.

"These Boys' Clubs are a real thing," Ruth explained. "I'll head them up and through my three broadcasts every week I'll be in touch with a million or more kids all over the country. I think this is just what kids need today. Let them get out and play ball, swim, row, play handball, fish, hunt or go camping. They need somebody to tell them about these things and to let them know the real fun there is in sports, and if we get a million kids taking this stuff up and going through with it, we'll have a country full of real, regular fellows that can give and take and that know how to play the game." These programs are presented by Standard Oil.



AIR TO ORDER

THE LARGEST AIR CONDITIONING SYSTEM IN THE WORLD HAS BEEN INSTALLED IN THE **NBC** SECTION OF RADIO CITY. SHOWN ABOVE IS THE CONTROL PANEL, FOR REGULATION OF TEMPERATURES IN ALL PARTS OF THE STUDIO BUILDING. THE LARGE DIALS KEEP A CONSTANT GRAPHIC RECORD OF AIR CONDITION IN EACH SECTION. NBC PHOTO

What is an "RA" Tag?

An Interview with the Service Division of the RCA Victor Company

TO MANY of the customers who purchase Transmitter Equipment, the "RCA Victor Company" means the *Field Representative* with whom they are most familiar. The chief interest of the customer probably lies in Radio Broadcasting. When he thinks of Camden it is in relation to this interest. A regrettably small number of these valued friends are able to spare the time to come to Radio Headquarters and become acquainted with the remainder of the RCA Victor Family.

Broadcast Transmitters are an important portion of the activities that are taking place on the many acres of floor space in the six, eight and ten story buildings which occupy eight city squares in the city of Camden. Naturally, when the customer thinks of microphones, he regards them in the light of the programs he is producing. If he pauses for a moment he will realize that these microphones are also made for paging systems in hotels and railroad stations, for stage managers' call systems, for battleships, for sound re-enforcing systems, public address systems and many other diversified types of installations. The same applies to vacuum tubes, amplifiers, transcription equipments and similar equipment used by broadcasting stations. When any of this material arrives at Camden for inspection, replacement or repair, it should be identified in some manner so that it may be determined:

1. What type of equipment is it?
2. Why was it returned?
3. What is to be done with it?
4. Who is to do it?

Step with us into the Receiving Department where material is arriving by motor freight, express, parcel post, railroad freight and air express. Some of the incoming packages contain no information, but are

merely addressed to the RCA Victor Company, Inc. Others have a number marked on the outside of the package, or contain the original copy of our Return Authorization. The packages with no information are placed aside for further investigation. The packages which are identified with the proper authorization tags or numbers move quickly. Copies of instructions which bear this number are taken from a file located right where the men are working. *The material was expected.* Trucks back up to the doors and the equipment is started on its way in accordance with the directions that were awaiting its arrival.

We turn then to the material which was not marked. Each package is examined carefully. Perhaps there is a letter somewhere "inside,"—or maybe there is nothing but the address of the concern sending the material. Then we get busy on the telephone! Each person who might possibly know anything about the arriving material is called. Hours are lost while we are trying to find out why it is in Camden.

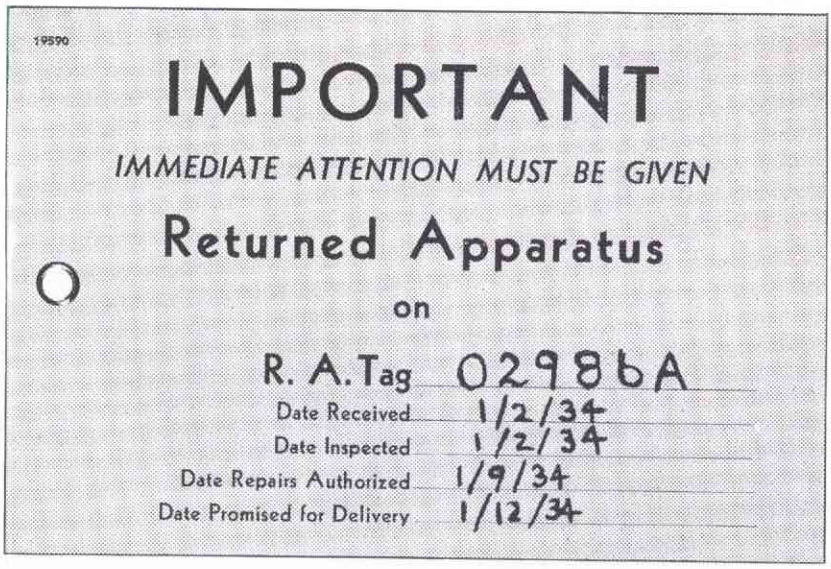
An "RA" tag is designed to avoid this confusion. When you write and ask the district office serving you for one of these "RA" tags before returning material to us, you immediately start us working on the problem for you, so that what you want done may be accomplished in the shortest possible time. The

to make copies of your letters, or for us to dictate one, telling the staff at Camden what to do when your equipment reaches us. Two copies are sent to you. One is returned by you in the package with your shipment. The other is retained by you as your record. From it you know the name of your personal representative at Camden who is handling your transactions for you. It also tells you what we intend to do with the material after we receive it.

At the same time we send your copies to you, four copies go to the Receiving Department, two to the Accounting Division and one to the Sales Department. It is our way of notifying everyone that you have a shipment on the way to us. If we do not receive the shipment within a reasonable time, it gives us an opportunity to let you know so that a tracer may be started in case it has become delayed or diverted during transit.

The copy you enclose with the shipment you make identifies it immediarely upon its arrival. The Receiving Room's copies are taken from their file. One of these copies comes back to the Service Division as notice that your equipment is in Camden. One stays in the Receiving Room, one goes by office mail to the department which is going to work for you and the other goes with the material itself. The copy is mailed so that if the material does not arrive at the designated point, the department is given an opportunity to ask what has happened to it. More important to you, the tag illustrated herewith is attached to your equipment at this time.

From then on, action starts. A report of the work to be done to meet your wishes is soon forthcoming. We then pass the information on to you. If the material doesn't appear, Service, Sales and Accounting are in a position to ask



number, no doubt exists in anyone's mind as to which particular transaction is being referred to. When we receive your acceptance of any quotation and we authorize the shop to proceed, there is no doubt which equipment is to be worked upon. When work is authorized, promises of completion are obtained and a strict follow-up is maintained until your equipment is on its way back to you.

The "Why?" of "Service Reports" on transmitting tubes and mica-capacitors which are returned on "RA" tags may not be clear to you. They enable us to find out what is happening in your station and to be of greater assistance to you. Facts are brought out which often would not appear in a letter. We realize that there is plenty to do at any broadcast station and that you are interested only in getting things done with as little red tape as possible. If we knew of a cheaper, easier or simpler way of doing the job for you that was foolproof and offered less opportunity for errors, we would use it.

We are constantly trying to serve you more quickly and with less expense to you. You can help us to do this if you will:

1. Ask the nearest district office serving you for an "RA" tag number before making shipments.
2. Tell us definitely the items concerned.
3. Tell us your wishes in regard to them.
4. Make shipment promptly when you receive your "RA" tag.

We can promise that if you will help us in this way, your equipment will be with us as short a time as is consistent with the nature of the work you wish to have performed. To that end, we have co-ordinated our internal activities to a greater degree than ever before to eliminate delays.

Radio From Stratosphere

The Settle-Fordney Ascension Sponsored Jointly by the NBC and the Chicago *Daily News*

Checking of data obtained during the Settle-Fordney stratosphere ascent reveals definite proof that long-distance communication can be maintained with aircraft above the atmospheric levels, according to Charles W. Horn, general engineer of the National Broadcasting Company.

"If stratosphere planes ever are developed," Horn said, "it will be possible to keep in constant communication with them. We were able to maintain a two-way voice circuit with Commander Settle and Major Fordney from the time they took off until they dropped their batteries to lighten their load."

Seven times during the record-breaking ascent the NBC broadcast conversations with the balloonists over its networks, so that listeners could hear the voices from the stratosphere.

The specially built transmitter carried in the ascension had an energy radiation of only one watt, Horn said, yet it was picked up strongly by the widely separated stations of RCA Communications at Riverhead, Long Island, and Point Reyes, California.

Stations in Akron, Pittsburgh and Washington were in constant touch with Settle and Fordney, and many other points reported hearing a clear signal. The eight-pound receiver and twelve-pound transmitter were built by C. P. Sweeney and C. K. Atwater, respectively, under the direction of Robert Morris, NBC experimental engineer. The transmitter operated on a frequency of 15,760 kilocycles.

Horn explained that it was possible to send so far on such low power from the stratosphere because of the absence of ground reflections. This changes the angle of reflection from the Heaviside layer, greatly increasing the range of coverage.

Regarding the possibility of airplane travel through the stratosphere, Horn said that it would be possible to use much more powerful transmitters in planes. In the balloon it was necessary to carry batteries, whereas in a plane the set could be operated on the regular generator.

"We are greatly pleased with the results of our experiment," the NBC engineer said, "and look forward to an opportunity to go further, when the next stratosphere flight is made."

THE ISOCLINE METHOD

(Continued from Page 17)

the same interval throughout the problem.

Fourth, calculate segments by the repeated application of equations:

$$\Delta i_L = \frac{1}{L}\left(L\frac{di_L}{dt}\right)\Delta t \quad (5)$$

$$\Delta e_c = \frac{1}{C}\left(C\frac{de_c}{dt}\right)\Delta t \quad (6)$$

For a first approximation, the values of $L\frac{di_L}{dt}$ and $C\frac{de_c}{dt}$ are evaluated at the beginning of the segment; for a second approximation, $L\frac{di_L}{dt}$ and $C\frac{de_c}{dt}$ are evaluated at the midpoint of the segment determined as a first approximation.

In this manner a curve in the $e_c - i_L$ plane is determined which represents the process of oscillation. The closed portion of the curve depicts the steady state, while the remaining portion shows the transient state.

The isocline method may be applied to all two terminal devices such as arcs, glow tubes, multivibrators, relaxation circuits, etc. For a three terminal device, however, it cannot be applied without modifications. For a regular three electrode tube oscillator with a grid blocking condenser it cannot be applied at all. But this does not mean that here all the brute force methods fail. On the contrary, the only method we know, by means of which a complete answer to such a problem is obtainable, is the brute force method of successive approximations.

Method of Successive Approximations

Essentially this method consists in writing down the differential equations for such circuit. There usually results for a circuit of three reactive elements a set of six differential equations of which two are of the non-linear type. Since they are of this non-linear type there is no use in trying to get a general solution. Instead, one can just substitute all the known numerical values in them and have the plots of the non-linear ones handy. The non-linear ones are usually the grid current as a function of the plate and grid voltages and a similar relation for the plate current.

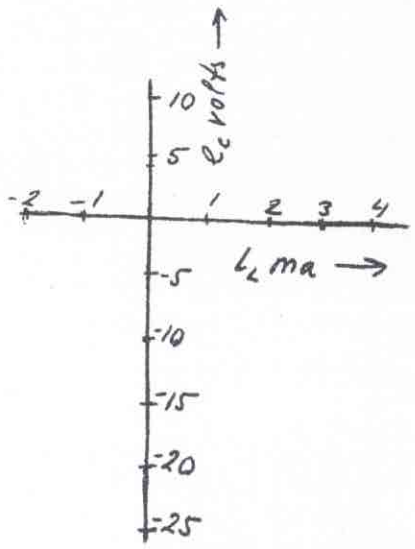


FIGURE 8

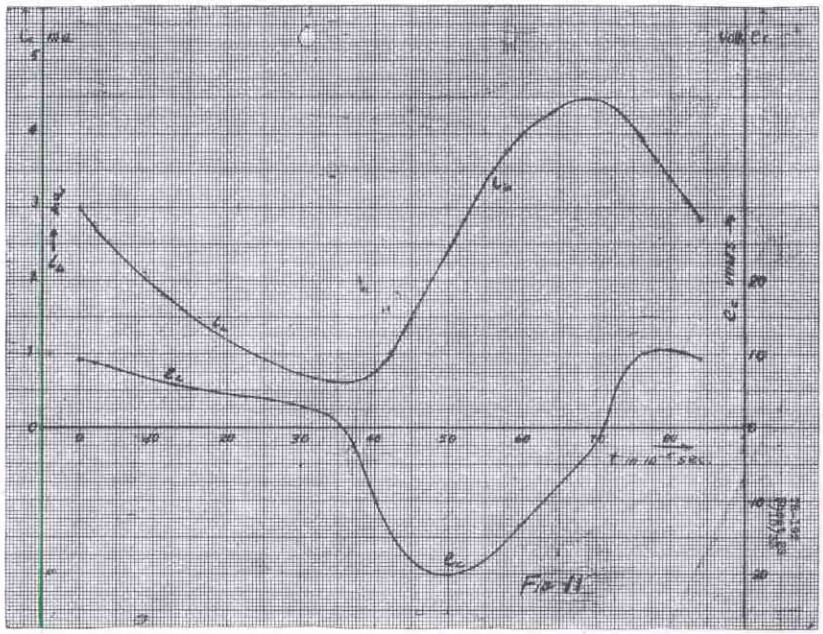


FIGURE 10

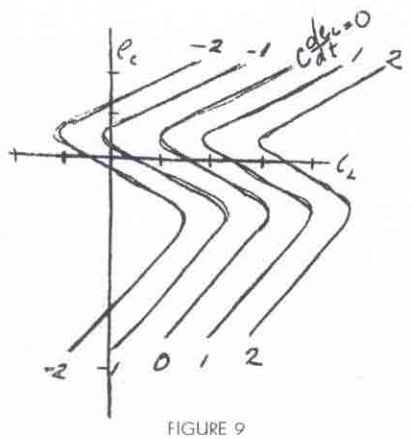
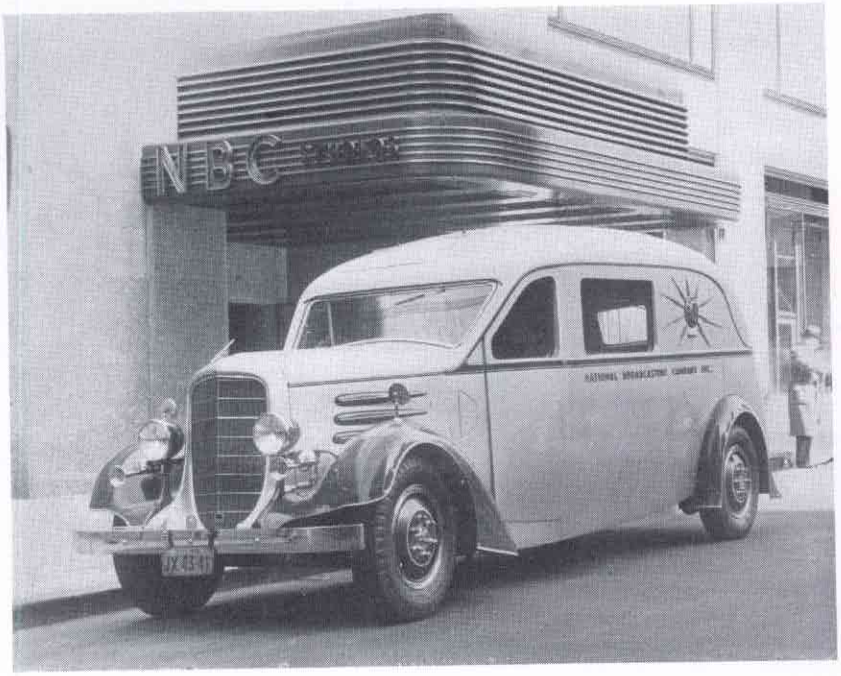


FIGURE 9

Conclusion

The next step is to decide on certain starting conditions, of which the best is the case of turning on the plate voltage. Then for the plate voltage equal to the value of the applied plate supply and the plate current corresponding to the zero grid voltage, compute the changes in all variables for a chosen small interval of time delta t. The best way is to assume a certain change in one variable and see what happens to all the others. If the resultant values are not consistent with the functions as given by the curves of plate and grid currents, the first chosen assumed change will have to be modified and tried again. With some experience not more than two approximations are needed to compute a point, and a complete performance of an oscillator can be completed in approximately one working day, with accuracy limited only by the time one wants to spend on a particular calculation. It is meant by this that the accuracy is entirely within the control of the user of the method.

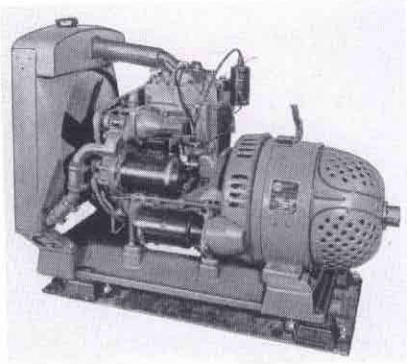
New Mobile Transmitter for Radio City Service



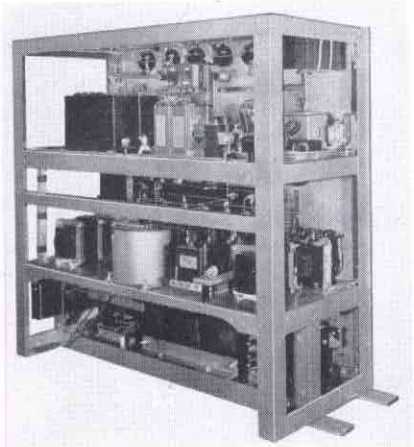
NBC's NEW MOBILE TRANSMITTER CAR AT THE ENTRANCE TO THE NEW **NBC** STUDIOS IN "RADIO CITY." THE TRANSMITTER IN THIS VEHICLE HAS A POWER OF 150 WATTS, WITH A RANGE OF 100 MILES WHILE STATIONARY AND MORE THAN 50 MILES WHILE IN TRANSIT

THE NBC's new mobile transmitter, mounted in a specially built automobile, represents a new departure in the radio industry.

The car, twenty-two feet long, was built by General Motors to specifications drawn up by NBC engineers. It is capable of a speed of sixty-five miles an hour and is sturdy enough to stand all existing road conditions. It is streamlined and aluminum painted.



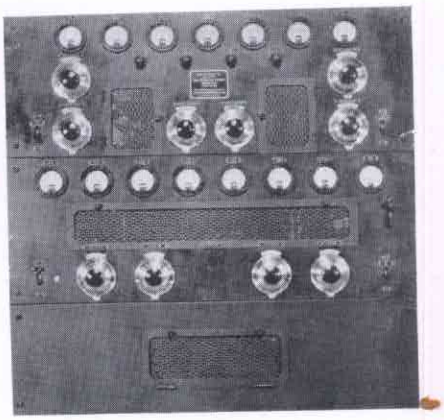
THE INDEPENDENT GASOLINE ELECTRIC PLANT USED TO PROVIDE POWER IN **NBC's** NEW MOBILE TRANSMITTER



The short-wave transmitter which is housed in the car was designed and installed under the direction of George Milno, NBC eastern division engineer. It has a power of 150 watts, three times the strength of the NBC's old mobile transmitter, and a range of up to 100 miles. This makes it possible for the NBC to originate special broadcasts at practically any point in the United States, since there are few places not within 100 miles of a wire line where a pickup could be made for

The car has a trap-door over the announcer's seat, next to the driver, so that when desirable the announcer may stand, with his head outside, above the top level of the car, to witness and describe what is going on. On the dashboard, in front of the announcer, is a desk which may be used for a microphone or a portable typewriter.

The new mobile transmitter greatly increases the field of events which may be covered directly by NBC.



THE "RADIO" UNIT FOR THE **NBC** MOBILE TRANSMITTER

PROGRAM AMPLIFIER

(Continued from Page 6)

control rack—an amplifier obviating the necessity of all batteries and plate rectifiers—and a unit providing the additional built-in features of volume indicator and local microphone power supply and control. And you may be sure that the 40-C Amplifier may be added to your present facilities without complications or difficulties. In new installations, you will find that this recently advanced "high quality" speech input equipment—all of it, including velocity microphones, 41-B preamplifiers, 40-C program amplifiers, 4194-B monitoring amplifiers and associated high quality speakers—may be used to advantage in upholding and strengthening broadcasting prestige in meeting the

Hollywood on the Air

By GEORGE GREAVES, NBC, San Francisco

"HOLLYWOOD on the Air." This familiar introduction heard on a weekly transcontinental broadcast from the new NBC-RKO studio brings before the microphone many screen luminaries and Hollywood's most interesting people. Many special broadcasts have featured such well-known screen stars as Will Rogers (Gulf Oil), Rudy Vallée (Fleischmann), Durante and Rubinoff (Chase & Sanborn) and many others.

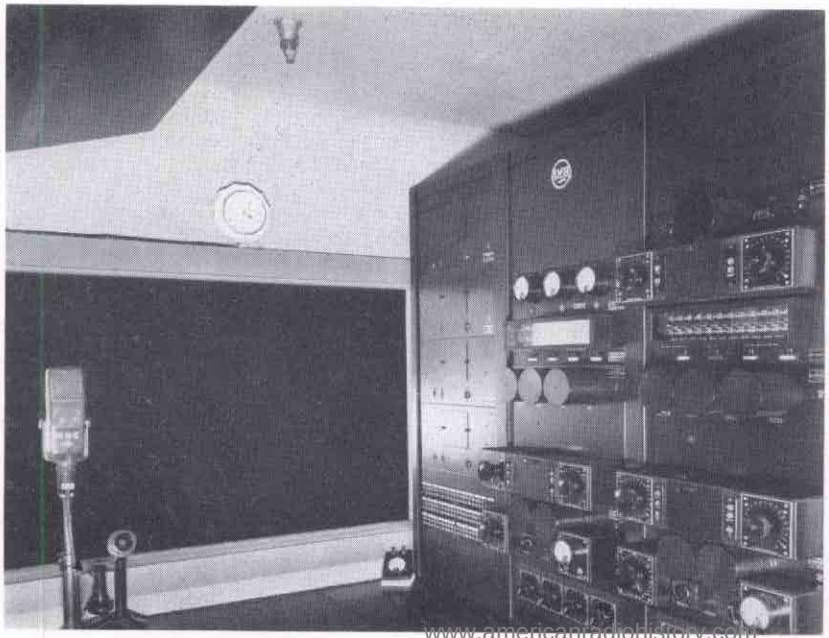
The studio marks the first actual link between radio and the films, and is the first concerted effort on a week-to-week-program basis.

The studio, furnished by RKO, is actually a large sound stage slightly remodeled for radio requirements. The studio proper measures 78 feet x 100 feet with a high roof, broken up with rafters and cross beams. The "picture lot" atmosphere has been retained throughout; this effect is especially desired for the many audience-shows which are featured weekly. With such a large studio an audience of three or four hundred can be accommodated in addition to the orchestra and artists.

ESTELLE TAYLOR BEFORE THE VELOCITY MICROPHONE IN THE **NBC-RADIO PICTURES** STUDIO

The control room is a combination control room and audition booth.

The equipment was built and assembled at the RCA Victor Company's plant at Camden, New Jersey. The main control panel consists of four pre-amplifiers for the velocity microphones. The studio amplifiers, volume indicators and mixer panels are in duplicate and terminated in a jack panel. The monitoring equipment consists of a new RCA Victor, Type UZ-4220, high quality loudspeaker working out of an RCA 14-B audio amplifier.



The power rack consists of a B supply rectifier panel with adjacent filters for B and A supplies. The filament supply is furnished by Tungar chargers highly filtered. All panel equipment is mounted in the new RCA dust-proof racks. During the installation of the equipment particular care was taken in the placement of the apparatus for convenient one-man operation.

A public address system was installed for the use of the producers during rehearsals. Velocity microphones are used exclusively.

On completion of the installation an overall frequency run proved sub-

NRA Parade at "Radio Headquarters"

THE **RCA VICTOR EMPLOYEES' BAND,** IN THEIR STRIKING UNIFORMS OF RED COATS, WHITE TROUSERS AND PLUMED HELMETS, FOLLOWED BY A TURNOUT OF PRACTICALLY ALL EMPLOYEES OF THE COMPANY, MADE A BRILLIANT SHOWING IN THE PARADE IN WHICH MOST OF THE BIG INDUSTRIES AND THE LOCAL MILITARY AND NAVAL ORGANIZATIONS OF CAMDEN PARTICIPATED ON NOVEMBER 28th.

THE PARADE STARTED AT NOON AND CONTINUED THROUGH THE ENTIRE AFTERNOON UNTIL TWILIGHT. THE SCENE ABOVE SHOWS THE **RCA VICTOR EMPLOYEES' BAND,** FOLLOWED BY A PROCESSION OF THE OTHER EMPLOYEES OF THE COMPANY, STRETCHING DOWN COOPER STREET TO THE DELAWARE RIVER. THE TALL BUILDING AT THE EXTREME LEFT IS THE RCA VICTOR EXECUTIVE OFFICE BUILDING.

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 37—Cathode Ray Modulation Indicator

Bulletin 38—"Terra Wave" Police Radio Equipment

Bulletin 39—High Quality Monitoring Equipment

Bulletin AVB-1—Airport Receiver, Model AVR-1

Bulletin AVB-2—Aircraft Radio Beacon Receiver, Model AVR-2

Bulletin AVB-3—Airport Receiver, Model AVR-5

Bulletin AVB-4—Airport Radio Traffic Control Transmitter, Model AVT-1

SEND FOR YOUR COPIES