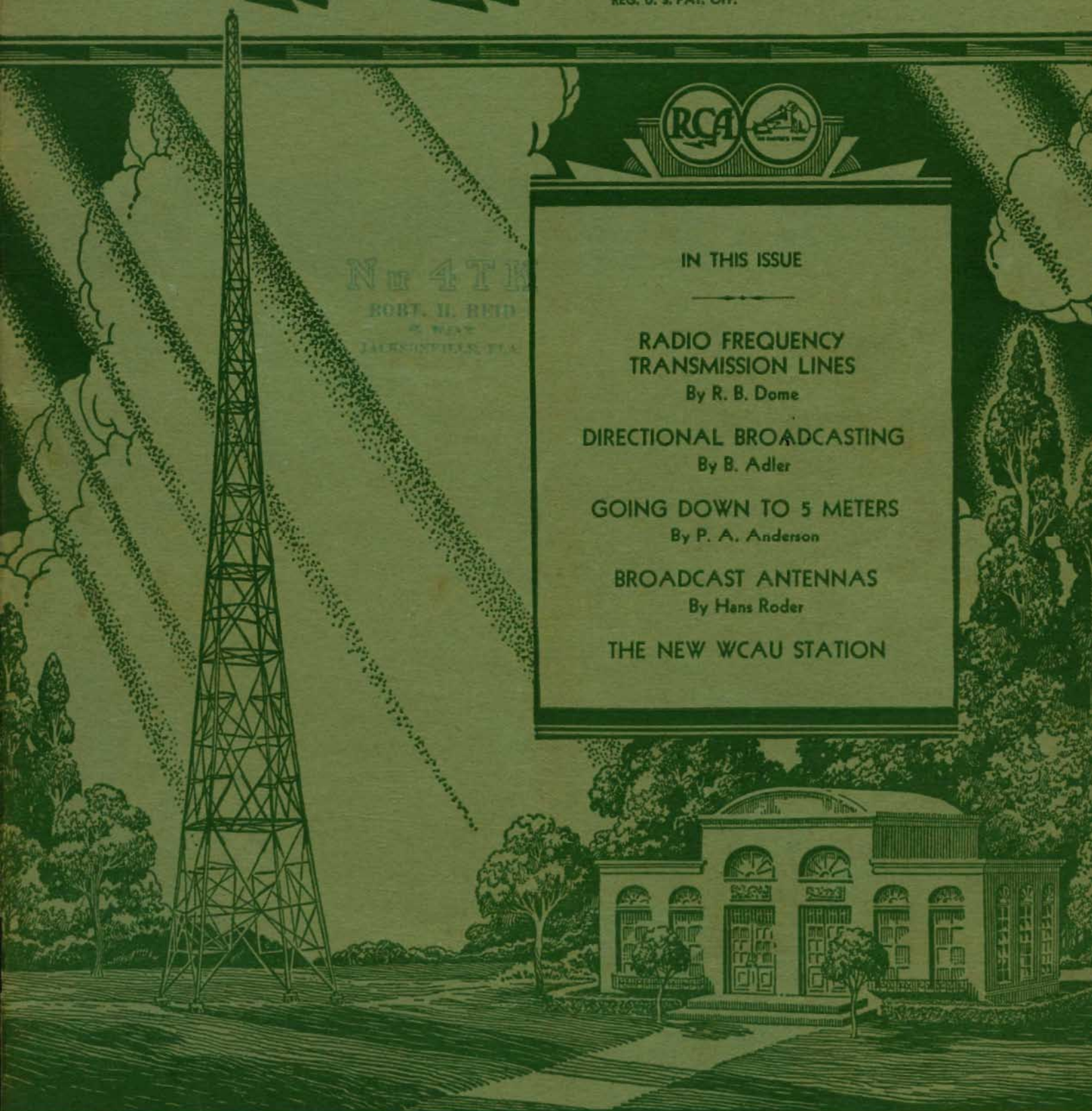
BROADCAST NEWS

REG. U. S. PAT. OFF.



IN THIS ISSUE

RADIO FREQUENCY TRANSMISSION LINES
By R. B. Dome

DIRECTIONAL BROADCASTING
By B. Adler

GOING DOWN TO 5 METERS
By P. A. Anderson

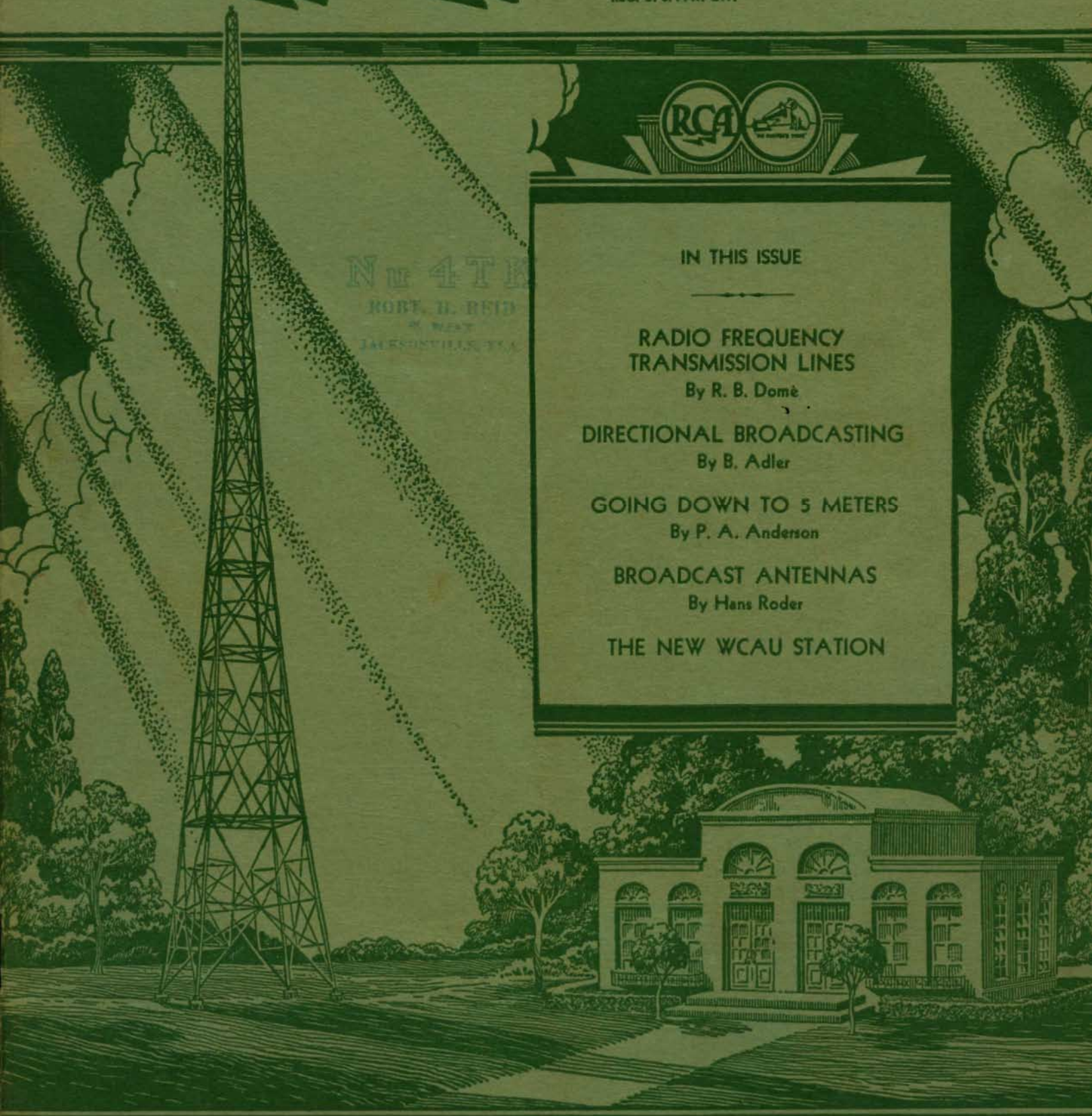
BROADCAST ANTENNAS
By Hans Roder

THE NEW WCAU STATION

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

BROADCAST NEWS

REG. U. S. PAT. OFF.



IN THIS ISSUE

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

BROADCAST NEWS

Edited by
E. JAY QUINBY

NUMBER 4 JULY 1932

INTERIOR OF RADIO BROADCAST STATION **WPEN**, AT WOODSIDE PARK, PHILADELPHIA, PA., —OPERATOR **THOMAS F. RYAN** ON WATCH.

THE NEW RCA FREQUENCY MONITOR PANEL IS SHOWN AT THE LEFT, AND THE 100 WATT RCA TRANSMITTER AT THE RIGHT.

Published Occasionally and
Copyrighted 1932 by
RCA VICTOR COMPANY, INC.
CAMDEN, N. J., U. S. A.

New WCAU Station Nears Completion

Tower Visible Twenty-five Miles

THE new home of WCAU, Philadelphia's first building to be erected solely for radio broadcasting purposes, at 1622 Chestnut Street, will be completed during the first part of September.

There are many features of the new radio center that will be watched with interest because they represent distinct innovations in radio building far in advance of the methods now being used. To the average layman the graceful tower that will top the building will receive a great share of attention, for unlike many of the scientific changes it is one of the features that can readily be noticed and appreciated.

The completed tower will be one hundred feet in height and rearing above the eight stories of the building, it will be an imposing addition of beauty to famous Chestnut Street.

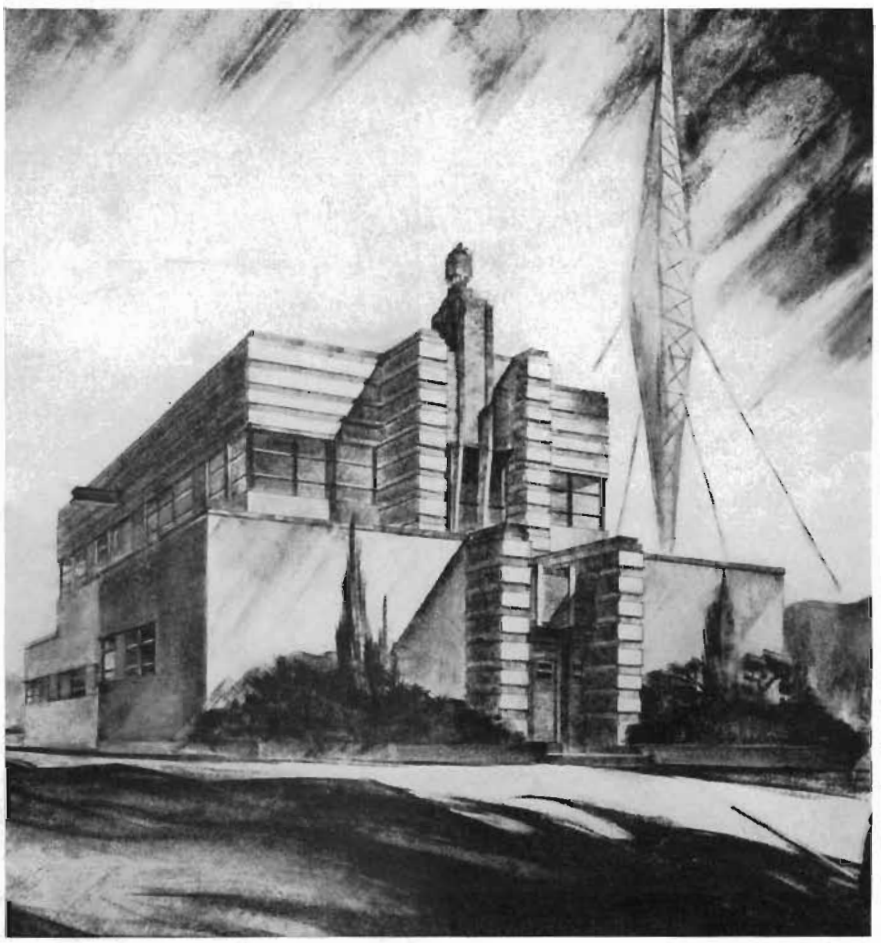
The WCAU building tower will be composed of a specially prepared glass and a new stainless steel and bronze that will form the frame work. New Cooper-Hewitt low voltage lamps only recently developed in the General Electric Laboratories will be used to illuminate the structure at night. The frame work is now in place and it is claimed that when completed the structure will be visible from a distance of twenty-five miles. In addition, the tower will serve as another Philadelphia beacon of the sky to guide air travelers.

Although the tower will be one of the city's architectural ornaments it will, also, have a very practical use. An emergency transmitter is being built to insure against any temporary trouble in the regular station transmitter ensuring continuation of the program. The big tower will serve as one of the two supports for this emergency transmitter antenna.

The mammoth project requires space for such an extensive network of ground wires and auxiliary equipment in addition to the transmitter building, that it was necessary to secure a twenty acre section of land. A survey shows this section to be within ten feet of the highest point of the entire County. The total expenditure for this project will be $300,000. The main building alone will require an expenditure of $50,000.

The building will be composed of a dark rose colored brick and stainless steel. The first floor will house the rotating machinery, cooling unit and the power transformers. The second floor will house the transmitting equipment, reception rooms, control rooms, offices, dining rooms and also the new 1,000 watt short wave equipment which has also recently been authorized by the Federal Radio Commission. The entire plant, which will include many modern conveniences, will be electrically operated throughout including an elaborate heating system.

Although the project will be more modern and comprehensive than any in existence, a plan will be followed to provide for any growth of WCAU in the future, by the addition of building wings whenever needed. These wings when built will all conform with the general architectural scheme now being followed.



THE NEW WCAU TRANSMITTER BUILDING

ARCHITECT'S DRAWING OF THE BUILDING WHICH IS NOW BEING ERECTED IN DELAWARE COUNTY PENNSYLVANIA, TO HOUSE THE NEW 50,000 WATT TRANSMITTER OF WCAU WHICH WAS RECENTLY AUTHORIZED BY THE FEDERAL RADIO COMMISSION. RCA VICTOR EQUIPMENT WILL BE INSTALLED THROUGHOUT

As a protective measure for airplanes flying in this section, the specifications issued by the Department of Airways of the United States Government will be followed. An observation beacon will be placed on the roof of the building with a twenty-four inch revolving aeronautical beacon light. The mast will be painted in alternating sections and a double system of lighting will be installed so that should any light fail, the emergency system will automatically turn on.

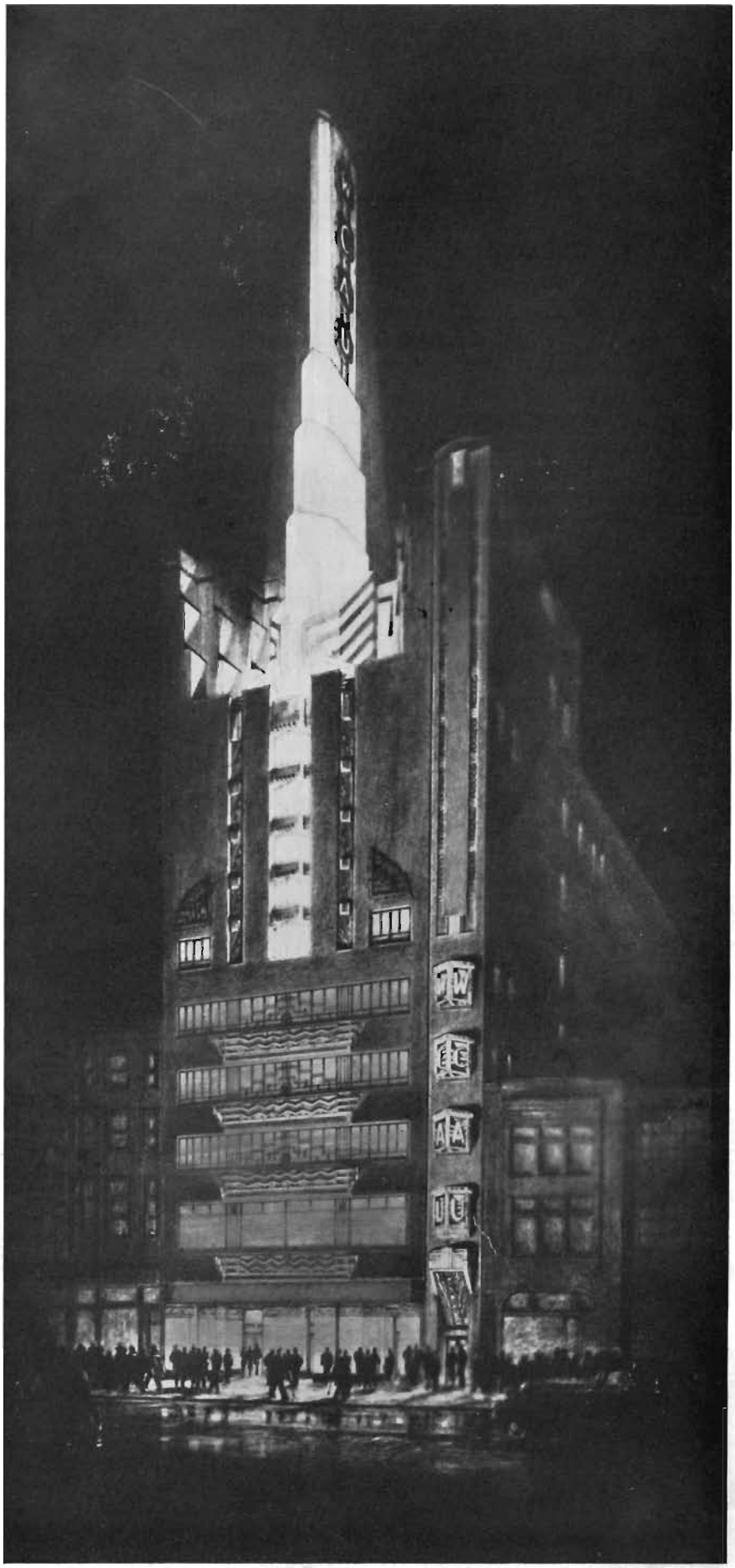
Completion of the building is scheduled for July 1st, and the operation of the 50,000 watt transmitter is scheduled for the latter part of July.

Wark and Company have been awarded the contract for the building, and Mr. Gabriel Roth appointed the Architect.

Another new building, thoroughly modern in setting and reality, is being erected in Delaware County, Pennsylvania, by station WCAU to house the new 50,000 watt equipment which has recently been authorized by the Federal Radio Commission. WCAU now operates on a power of 10,000 watts. Its present location at Byberry will be abandoned and the equipment disposed of. RCA Victor Company have been awarded the contract for the complete new installation.

A 500 feet vertical boom shaped radiator of structural steel that represents the most advanced findings in the field of radio will serve as the antenna system. This huge mast is supported on a cast-iron ball only eighteen inches in circumference supported by four guide wires. Radiating from this mast will be almost ten miles of wire forming the ground network.

The new building which is to house the studios and the executive offices of Station WCAU, is now being erected at 1618-20-22 Chestnut St., Philadelphia. This will be the first building designed for the specific purpose of radio broadcasting to be completed in the United States. It includes seven of the most modern broadcasting studios in the world, in



THE NEW WCAU STUDIO BUILDING

Surge Impedance and Series Resistance of Radio Frequency Transmission Lines

By R. B. DOME, Radio Engineer
General Electric Company, Schenectady, N. Y.

A TRANSMISSION line in general can be defined as the conductors which connect a generator of electrical energy to its load. The commonest forms of lines are the overhead line and the telephone cable. Other forms of lines are: the submarine cable, the concentric tubular line, the flat strip line, and the single wire ground return line. Such lines may vary in length from a few inches to thousands of miles. In radio broadcast practice a line is used to connect the transmitter to the antenna system in such localities where it is not possible nor desirable to place the transmitter at the base of the antenna. Some broadcast transmitters have lines 1500 feet long, but the average line is probably not more than 600 feet long.

Basis of Fundamental Theory

In treating the subject of transmission lines it is customary to study a small section of line. Such a line section may be represented by the network shown in Fig. 1. Over this

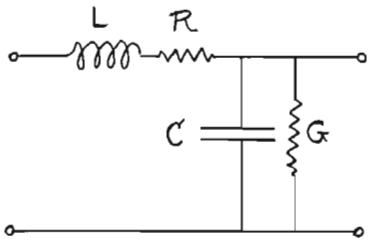


FIG. 1—ELEMENTARY SECTION OF TRANSMISSION LINE

section it is seen that due to the current flowing through L and R a loss in voltage results. It is also observed that the current is less in the line after this section by the leakage current through G and C. The above occurs when the line is infinitely long or when it is terminated in its surge impedance. When the line is not terminated in the proper impedance the voltage and current do not fall off smoothly in the direction of the load, but may rise and fall at regular intervals indicating what is known as standing waves caused by reflection.

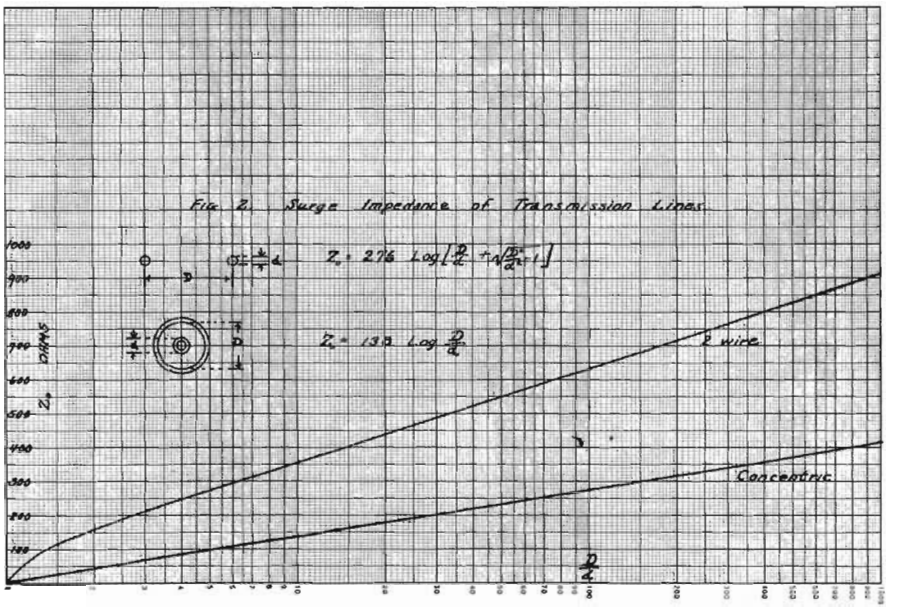


FIG. 2

Surge Impedance

The surge impedance of a transmission line may be defined as that impedance which may be connected at the end of a line of finite length to exactly replace an extension of the finite line from the terminating point to infinity. Since a line of infinite length can have no reflection, because the wave never reaches the end, a finite line terminated in its lumped surge impedance will also be free from reflections.

The surge impedance of a transmission line is mathematically expressed as,

$$Z_o = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$$

and is seen to be complex in the general case. Oliver Heaviside[1] showed that a line can be made distortionless by making RC = LG. Then the above expression becomes $Z_o = \sqrt{\frac{L}{C}} = \sqrt{\frac{R}{G}}$ and it is no longer complex but is now independent of frequency. At voice frequencies the relation RC = LG is not customarily encountered. LG is generally low. In order to balance the equation L is increased by loading the line either at periodic intervals with an inductor inserted in the line or by continuous loading by wrapping the cable with a material of high permeability. The latter practice is now common in the manufacture of telephone and telegraph submarine cables.

At radio frequencies the problem is somewhat simplified since the expression for Z_o as ω approaches infinity becomes $\sqrt{\frac{L}{C}}$. The expression is independent of $j\omega$ so that the termination should be resistive only. The numerical value of the

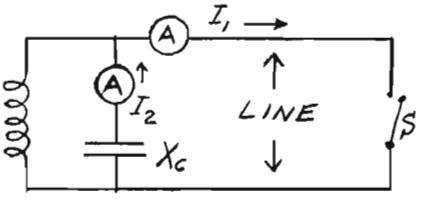


FIG. 3—MEASUREMENT OF SURGE IMPEDANCE

surge impedance can be found either by calculation or by measurement. For a two wire line where D is the distance between conductor centers and d is the diameter of each wire,

$$Z_o = 276 \log \left[\frac{D}{d} + \sqrt{\frac{D^2}{d^2} - 1} \right]$$

A curve is shown in Fig. 2 from which Z_o may be obtained as a function of D/d. For the concentric tube line $Z_o = 138 \log \frac{D}{d}$ and this may also be found from Fig. 2. In this case D is the inside diameter of the outer tube and d is the outside diameter of the inner tube.

The surge impedance of a transmission line can be calculated from electrical measurements taken on the line. Disconnect the receiving end of the line from any equipment and allow the line to remain open circuited. At the sending end measure the impedance of the line Z_1 by the ammeter-voltmeter method. Next short circuit the line at the receiving end and again measure the sending end impedance which we shall call Z_2. Z_o then is given by

$$Z_o = \sqrt{Z_1 Z_2}$$

These measurements can be made at any frequency, but they should preferably be made at the operating frequency and in most cases this is most practical. Figure 3 illustrates the equipment needed.

$$Z_1 = \frac{l_2 X_c}{l_1} \text{ with S open} \quad X_c = \frac{1}{\omega C}$$

$$Z_2 = \frac{l_2 X_c}{l_1} \text{ with S closed}$$

Terminal Networks

The termination of the transmission line into the load is generally done by means of a suitable transformer or impedance matching network for seldom does the load happen to be equal to the line surge impedance. Where the load is a fixed resistor, transformer coupling is generally used, as in the case of telephone lines. However, in case the load is variable with frequency and operation is confined to one frequency, as in broadcast practice, there are several optional circuits to choose from.

The circuit used in the RCA Victor 50B 50 kilowatt transmitter equipment shown in figure 4 consists of a primary circuit made up of a capacitor and inductor in parallel. The secondary circuit consists of a series circuit including antenna, series tuning condenser, coupling inductor and ground. The antenna is tuned and the coupling between primary and secondary increased until the effective resistance of the primary circuit looking across the primary parallel units is equal to the line surge impedance. The condition of zero load reactance is obtained by tuning the parallel circuit so that the complete circuit has a resistive component only when looking from the load end of the transmission line.

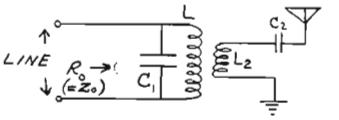


FIG. 4—BROADCAST TRANSMISSION LINE TERMINATING NETWORK

Another type of matching network is shown in figure 5. In this case — X_4 is used to tune the antenna to resonance. X_1, X_2, and X_3 are then determined. In most broadcast installations $R_a < R_o$. In such a case we may let $X_1 = O$. If we let X_3 be inductive, the inductance is equal to

$$L = \frac{R_a}{\omega} \sqrt{\frac{R_o}{R_a} - 1} \text{ henries}$$

and X_2 is capacitive, the value of capacity being

$$C = \frac{1}{R_o \omega} \sqrt{\frac{R_o}{R} - 1} \text{ farads}$$

Line Losses

Losses in the line are chiefly confined to losses due to "skin effect". The a.c. resistance of round copper wire transmission line per centimeter length is given by

$$R = \frac{4 \times 10^{-9}}{d} \sqrt{f\rho}$$

and includes both wires in the transmission line.

d = conductor diameter in cm.
f = frequency in cycles.
ρ = 1800 for copper.

As an example of the loss to be expected let us assume a transmitter has a net output of 1000 watts. Next assume the line from the transmitter

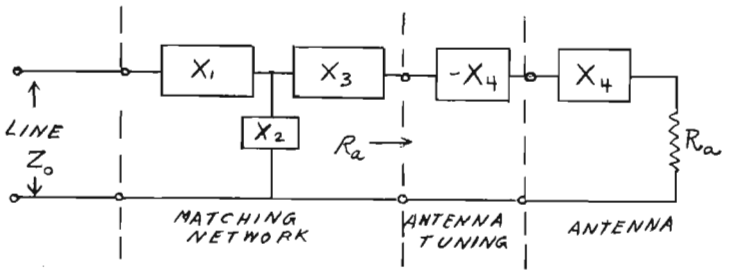


FIG. 5—LINE TERMINATING NETWORK

to the antenna tuning house is 350 feet long and that the frequency is 1000 KC. The line is made up of two #8 wires spaced 14 inches between centers. The diameter of #8 wire is 0.128". Thus $\frac{D}{d}$ becomes $\frac{14}{0.128} = 109$. Referring to figure 2, Z_o = 640 ohms. The line resistance is

$$R = \frac{4 \times 10^{-9}}{0.13 \times 2.54} \sqrt{10^6 \times 1800} \left[350 \times 12 \times 2.54 \right] \text{ ohms}$$

$$= 5.48 \text{ ohms}$$

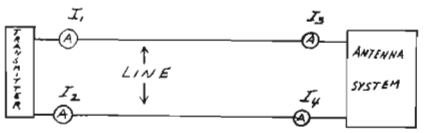


FIG. 6—SET-UP FOR TESTING LINE ADJUSTMENT

The line current in the case of a balanced line is

$$I = \sqrt{\frac{\text{Watts}}{Z_o}} = \sqrt{\frac{1000}{640}} = \sqrt{1.56}$$

$$= 1.25 \text{ amps.}$$

The line loss is thus $I^2R = 1.56 \times 5.48 = 8.55$ watts. Thus 991.45 watts will be available at the end of the line. The line is 99.15% efficient. The current in the line at the load end of the line will then be

$$\sqrt{\frac{\text{Watts}}{Z_o}} = \sqrt{\frac{991.5}{640}} = \sqrt{1.55}$$

$$= 1.245 \text{ amps.}$$

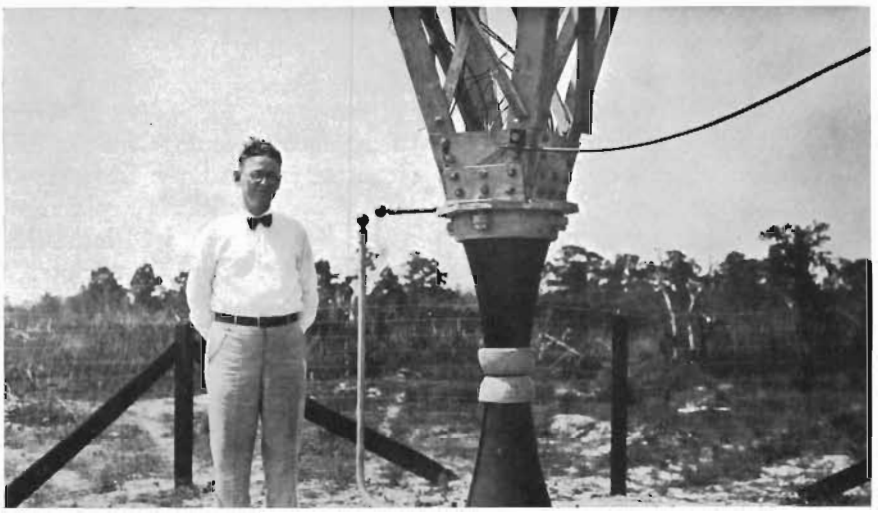
This is seen to be so little different from the current of 1.25 amperes at the beginning of the line that the two currents may be considered equal.

(Continued on Page 10)

Directional Broadcasting at WFLA—WSUN

By BENJAMIN ADLER, Sales Engineer
RCA Victor Co., Inc.

THE success of Walter Tison's new antenna system at Clearwater, Florida will determine whether or not the jointly operated station of WFLA-WSUN will be permitted to resume operation at a power of one kilowatt. The station was required to reduce its power to 250 watts last year in order to restore the 620 kc channel, occupied by both WFLA-WSUN and WTMJ of Milwaukee, Wisconsin, to its former condition prior to the placing of the Florida station thereon. The Milwaukee station's service area was, by this reduction in power, restored to normal but this arrangement did not prove satisfactory to WFLA-WSUN, and Walter Tison, director of the station proceeded, with the permission of the Federal Radio Commission, to conduct tests with a directional antenna system.



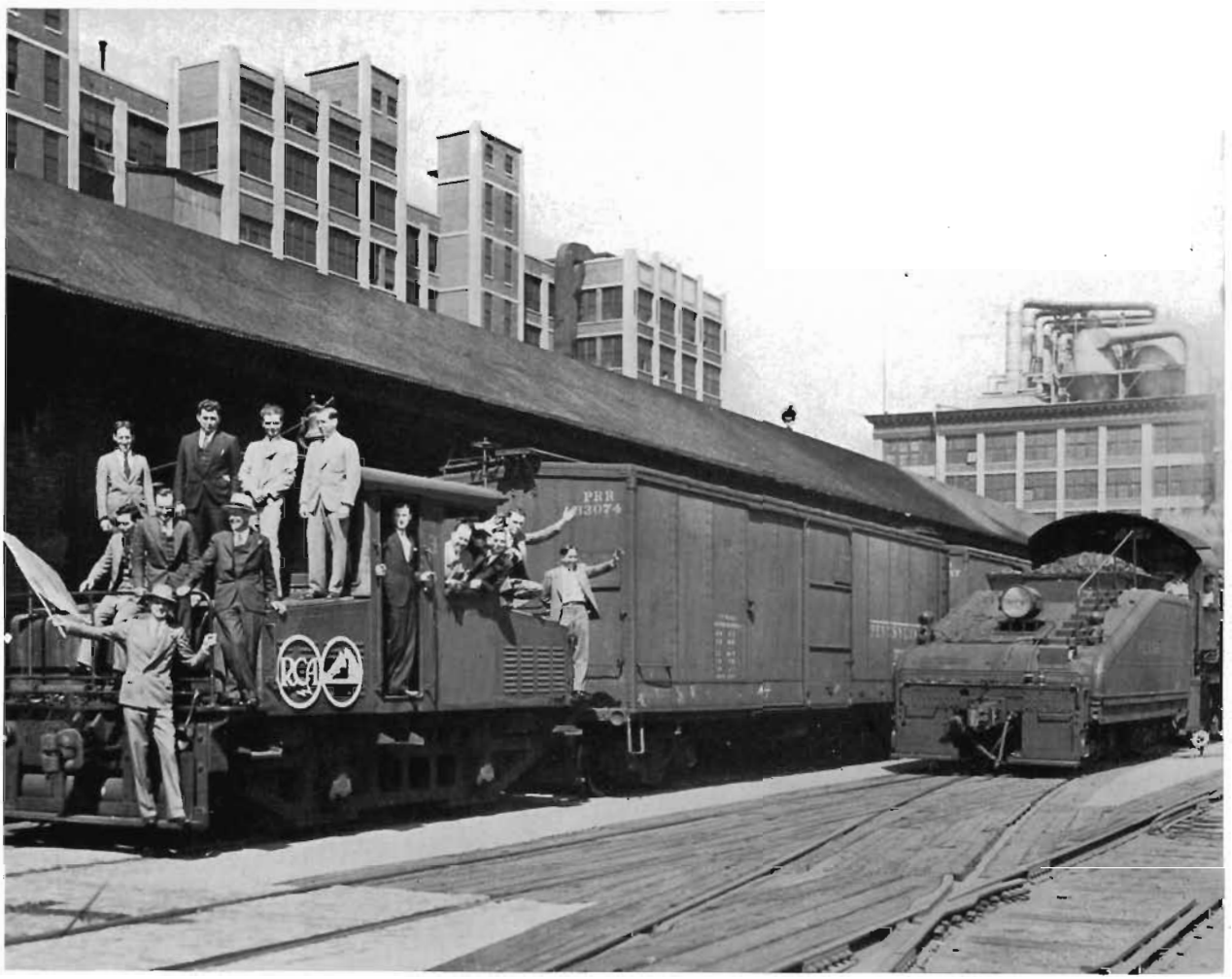
WALTER TISON
STANDING BESIDE THE BASE OF ONE OF THE 200' STEEL TOWERS OF STATION WFLA-WSUN.

The system now in use at Clearwater as shown in the illustrations, was designed by Raymond Wilmotte, a radio engineer of Great Britain. It consists of two steel towers, insulated at the base and guyed half way up. Each is 200 ft. high and resonated to act as a quarter wavelength radiator. They are spaced exactly one quarter of a wavelength apart and excited from the transmitter thru a phase shifting circuit so that the current in the reflector tower leads the current in the radiator tower by 90°, or a quarter of a wavelength. A line drawn thru the two towers follows the great circle path between Milwaukee and Clearwater. Transmission lines are used to transfer the radio frequency energy from the phase shifting equipment in the attic of the transmitter house, to a tuning house located at the base of each tower. The tuning houses contain the necessary equipment for properly terminating the transmission lines and for loading the antennae to resonance. The phase shifting equipment is arranged so that the towers may be fed either in phase or ninety degrees out of phase without interruption of service. The plan is to operate the towers in phase during the day when no interference is had around Milwaukee and out of phase at night when suppression in the direction of Milwaukee is required.

Preliminary tests made by Mr. Tison indicate that a distinct dark sector covering about ninety degrees is obtainable thru the use of this system. The service area of the Florida station is so situated with respect to Milwaukee that only a few local listeners will suffer by the introduction of this no-signal area. A large portion of it extends out over the Gulf of Mexico. It is interesting to note how clearly defined are the boundaries of this sector. A receiving set in an automobile driving across its boundaries, loses volume almost instantaneously. It requires

(Continued on Opposite Page)

GENERAL VIEW OF STATION WFLA-WSUN
STATION BUILDING AND ANTENNA TOWERS.



VISITORS SPEED THE DAY'S OUTPUT

MEMBERS OF THE RCA VICTOR TRANSMITTER SALES SECTION FROM NORTH, SOUTH, EAST AND WEST, WERE CONDUCTED ON A TOUR OF "RADIO HEADQUARTERS" DURING THE WEEK OF JUNE 6TH.

THEY ARE SHOWN HERE SWARMING ONE OF THE ELECTRIC LOCOMOTIVES OF THE RCA VICTOR PLANT, AS IT MOVES A FEW BOX CARS ONTO THE SHIPPING TRACK, WHERE THE PENNSYLVANIA LOCOMOTIVE WAITS TO TAKE OVER THE DRAG.

LEFT TO RIGHT (TOP ROW) **DR. I. WOLFF,** OF CAMDEN, **I. R. BAKER,** OF CAMDEN, **W. M. WITTY,** OF DALLAS, **L. F. JONES,** OF CAMDEN. (NEXT ROW) **J. P. TAYLOR,** OF CAMDEN, **B. ADLER,** OF DALLAS, **J. M. SAWYER,** OF CAMDEN, **C. F. COOMBS,** OF SAN FRANCISCO, **T. A. SMITH,** OF NEW YORK, **H. C. VANCE,** OF CHICAGO, **W. H. BELTZ,** OF NEW YORK, AND **DR. H. F. OLSON,** OF CAMDEN, AND (ON THE STEP) **E. JAY QUINBY,** OF CAMDEN.

Directional Broadcasting at WFLA—WSUN

(Continued from Opposite Page)

but thirty or forty feet of travel to encounter a change in signal intensity from one that is capable of producing good loudspeaker volume, down to a signal well below the noise level. One resident of Clearwater whose home is located about three miles from the station and exactly on one boundary of the no-signal area, was unable to receive anything from the Clearwater station until he changed the direction of his receiving antenna so that it ran into the signal area. Previous to this change, his antenna was entirely in the no-signal area.

The results of measurements made by the Department of Commerce on the Florida station's signal intensity in Milwaukee, have not yet been revealed. Everyone is anxious to learn whether the system is suppressing the sky wave in the direction of Milwaukee as well as it has eliminated the direct or ground wave in that direction.

This scheme of setting up an additional antenna to serve as a reflector for the purpose of controlling the direction of propagation of radio waves has long been known to the art of radio, and has for many years been used in the design of short wave directional antenna systems for both transmission and reception in the communications field. However, the experiment at Clearwater is an absolutely new application in that it is the first attempt to eliminate interference between broadcast stations operating on the same frequency, by the use of directional transmission. The staff of WFLA-WSUN is to be complimented on their initiative and foresight in starting this investigation.

Modern Station at Worcester, Mass.

By TED HILL, Director, Broadcast Station WORC

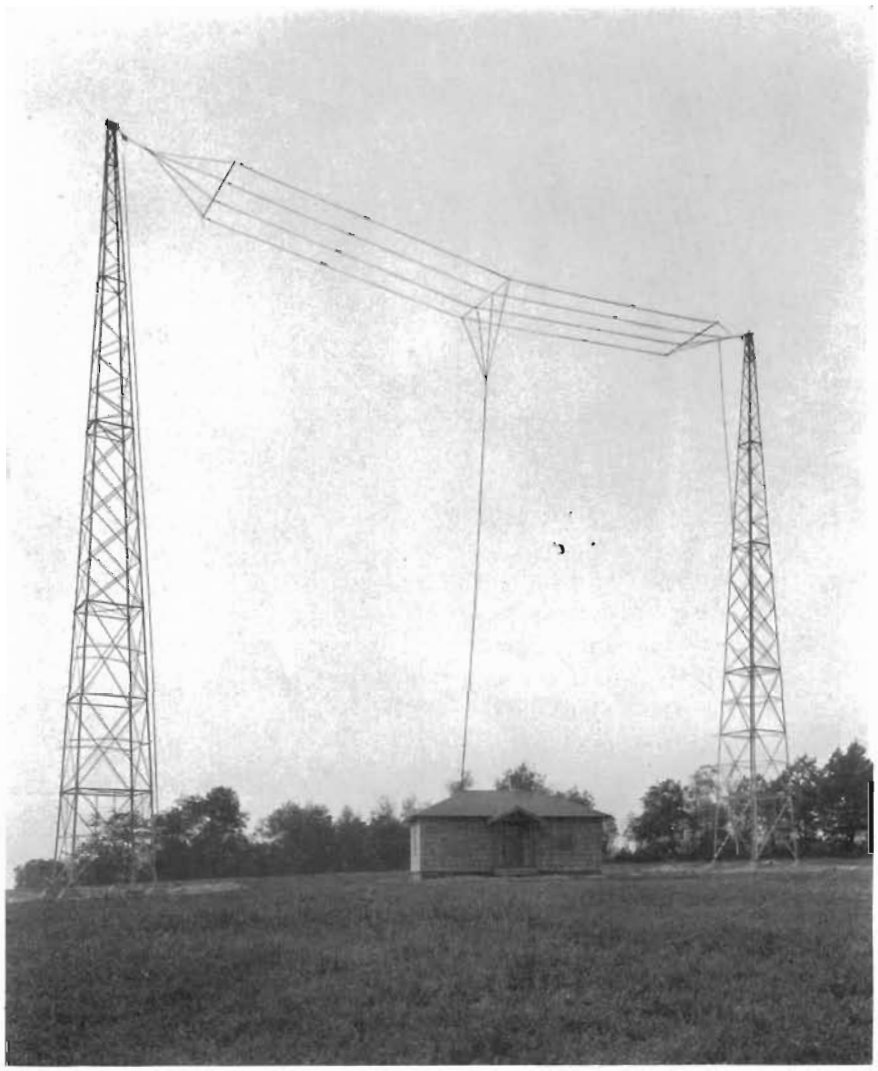
THE accompanying photographs show an exterior view of the WORC transmitting station, which is located on Pakachoag Hill, about two and one-quarter miles from the center of the City of Worcester; also the new RCA transmitter recently installed within the building.

The Station is owned and operated by Alfred F. Kleindienst and began operation in Webster, Mass., in 1925. In 1929 the Station was moved to Worcester, at which time studios were established in the Bancroft Trust Building and land was purchased on Pakachoag Hill for the erection of the transmitting station. The building was built especially for the purpose and has the most modern equipment throughout.

The towers used are 103 foot Milliken towers. The composite transmitter, originally built by Mr. Kleindienst, was used until October, 1931 when the installation of a type 100 W, RCA, 100 watt transmitter

TRANSMITTER AT WORC

was completed. This transmitter has now been in use for eight months and has given extremely satisfactory service. Reproduction of tone quality shows marked fidelity, the frequency range being from 30 to 10,000 cycles.



ANTENNA AND TOWERS

AT STATION WORC, WORCESTER, MASS.

The transmitter operates with marked stability, as indicated by the fact that since its installation, constant checks have been made by the Radio Supervisor for this district, which show maximum deviation of 10 cycles from the assigned frequency and an average of 3 cycles during this entire period.

With reference to the studio equipment,—RCA condenser microphones are used exclusively and the program amplifier is also RCA equipment. A type EX-4180 frequency monitor is to be installed at the transmitter.

WORC is happily situated in one of the most important trading areas of the country. It is in almost the exact geographical center of the population of New England, there being, within a fifty mile radius of the transmitter, population in excess of four and one-half million.

The City of Worcester is the second largest city in Massachusetts and the third in New England.

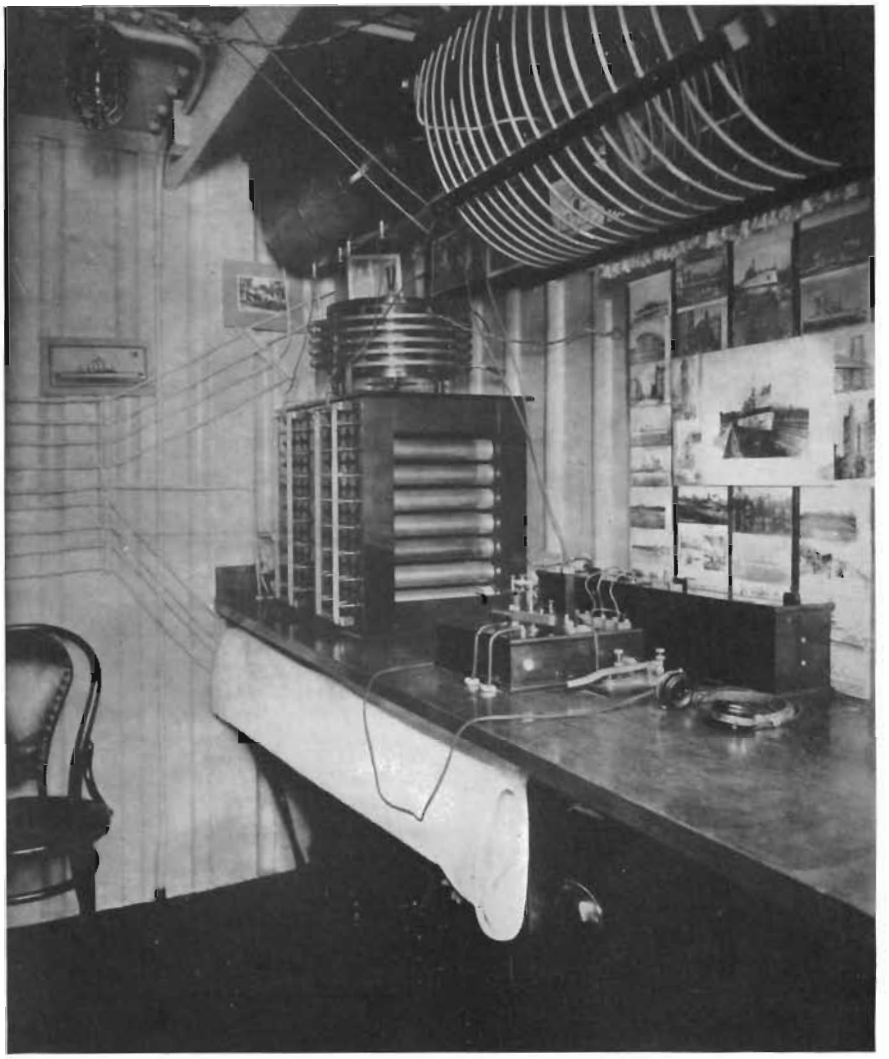
Station WORC is a member of both the Columbia Broadcasting System and the Yankee network and is relied upon by the people of central New England for reception of the programs of these two networks.

Radio in the Palmy Days

THE accompanying view shows the "Wireless" room aboard the U.S.S. "Maryland", Call Letters HG, one of the vessels of the Great White Fleet which President Roosevelt sent on the famous cruise around the world. The installation of this 1¼ K.W. Shoemaker system equipment was made by Mr. J. M. Sawyer in 1906 at the League Island Navy Yard, Philadelphia, Penna.

Note the Leyden Jar condensers in the big rack on the bench, over which is mounted the Helix, with a straight Spark Gap within. The big coil overhead is the Antenna Loading Inductance. The rectangular box on the table mounts the send-receive Transfer Switch and a long since forgotten "Primary Cell Detector"—a form of electrolytic detector with the Wollaston wire sealed into a glass tip. Directly behind this unit may be seen the "Two Slide Tuner."

Under the bench is the open core Power Transformer and the Motor Generator. The canvas apron (rolled up in this view) was designed to prevent the operator from getting oil splashed all over his "regulation whites."



Whenever this transmitter was set in operation, there was plenty of blue fire flying around—and it wasn't always at the spark-gap. The pyrotechnical display was accompanied by an earsplitting din of crash-banging which, echoing around the ship, never failed to attract a curious but cautious crowd to the door of the "shack" as the operator flashed out his message in *American Morse*—or the now obsolete "Navy" code. Although he knew comparatively little of radio theory in those days, the Wireless Operator had already learned to discreetly remove his head-phones before touching the key. However, he was considered a wizard of the first order, and his weird explanations of the mysterious art rarely were questioned by his spellbound audiences.

Radio operating was then a spectacular and dramatic profession—and each message sent and received was considered a masterful accomplishment. *Them* were the Happy Days!

New WCAU Station Nears Completion

(Continued from Page 3)

addition to the administrative offices and experimental laboratory for Dr. Leopold Stokowski, where this noted musical authority will continue his studies and experiments in the trans-

An aluminum shaft, extending from the sixth floor, developing into a monumental glass enclosed tower, is to be the dominant external feature. From the top of the tower, the antenna for the emergency 1000 watt

shaft of light, 150 feet high, will form a landmark in Philadelphia, which after nightfall will be visible more than 25 miles.

It is expected that this building will be ready for occupancy in

RADIO FREQUENCY TRANSMISSION LINES

(Continued from Page 5)

Diagnosis of Line Misadjustment

After a transmitter has been connected to the antenna system by means of a transmission line it is sometimes found that the currents at the two ends of the line are not equal. This can be traced to several causes. Referring to Fig. 6, first, the line may not be terminated in the proper impedance. This may be checked by the relation

$$0.85 \leq \frac{I_1 + I_2}{I_3 + I_4} \leq 1.15$$

In case the current sum $I_3 + I_4$ is greater than $I_1 + I_2$, the indication is that the terminating impedance is less than the surge impedance. This can be corrected by decreasing the coupling to the antenna circuit in the case of the circuit shown in Fig. 4. In case the current sum $I_3 + I_4$ is less than $I_1 + I_2$ the indication is that the load impedance is too high. In order to decrease the impedance the coupled in resistance should be increased.

Inequalities between I_1 and I_2 and between I_3 and I_4 are sometimes caused by the flow of antenna current into the transmission line wires as a part of the ground system current. Such a condition is not always avoidable. No particular harm is done, however, by such a condition existing. What is more important is to have $I_1 + I_2 = I_3 + I_4$.

The term transmission line is defined, and the basis of fundamental theory explained. By the use of the equations given in this paper, it is possible to determine the surge impedance and loop resistance of a radio frequency transmission line from the conductor size and the spacing between conductors. With these values known it is possible to compute terminating networks and the line efficiency.

COMPLETE WAIVER

Judge—"Rastus, have you anything to say before the court passes sentence upon you for your offense,—namely, driving while intoxicated, resisting arrest, and using profane and abusive language to an officer of the law?"

Rastus—"Ah pleads guilty, Suh, and ah waives hear."

Judge—"Guilty and WHAT?"

Rastus—"Guilty, and ah jes natchely don't want to hear no mo' about it, Suh."

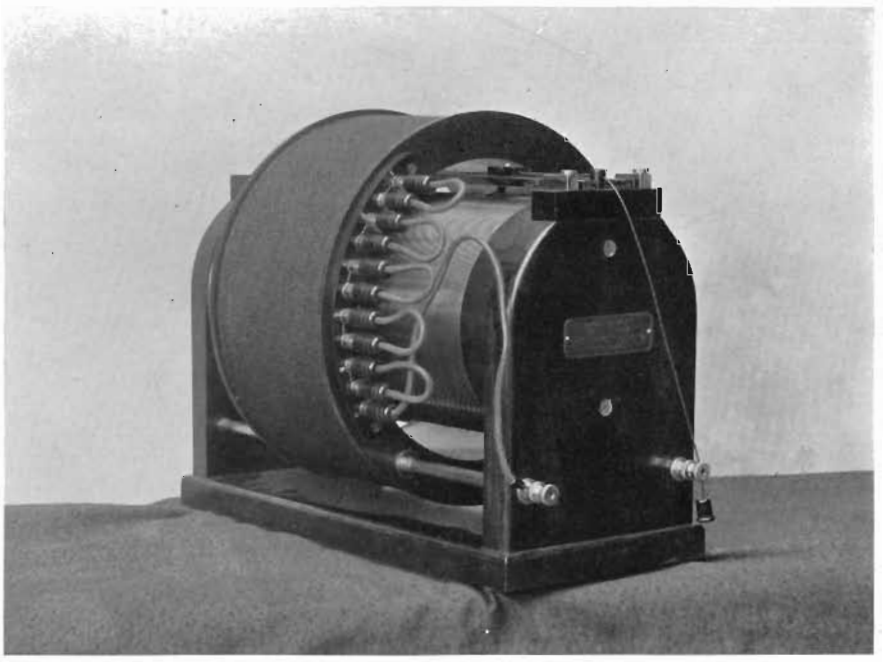


Photo from Collection of J. M. Sawyer.

WHAT IS IT, OLDTIMER??

CURIO NO. 1—CAN YOU IDENTIFY IT?
LOOK FOR THE ANSWER IN THE NEXT ISSUE OF "BROADCAST NEWS".

CHANGE OF ADDRESS

Future correspondence to the Chicago district office of the RCA Victor Company should be addressed to Room 1000, Butler Brother's Building, 111 North Canal Street, Chicago, Ill. Former offices at 100 West Monroe Street have been discontinued.

SELF EXPLANATORY

April 22, 1932

Radio Victor Corporation of
America,
Santa Fe Bldg.,
Dallas, Texas.

Att.: Mr. Benjamin Adler

Gentlemen:-

Please ship by express c.o.d. two UV-204-A radiotrons.

These are to replace two old soldiers that have been giving first class service in our transmitter for a little over 9000 hours. This is exceptional service and only RCA tubes could have done it. At any rate RCA tubes are the only ones I have ever known to run 10,000 hours. These tubes are still doing business too.

Kindly accept our appreciation for this service, and for your prompt delivery.

Sincerely,
JAS. R. DONOVAN, *Chief Engr.*
Savannah Broadcasting Company
(Station WTOC)

McCune on the Telephone—
(With apologies to Cohen)

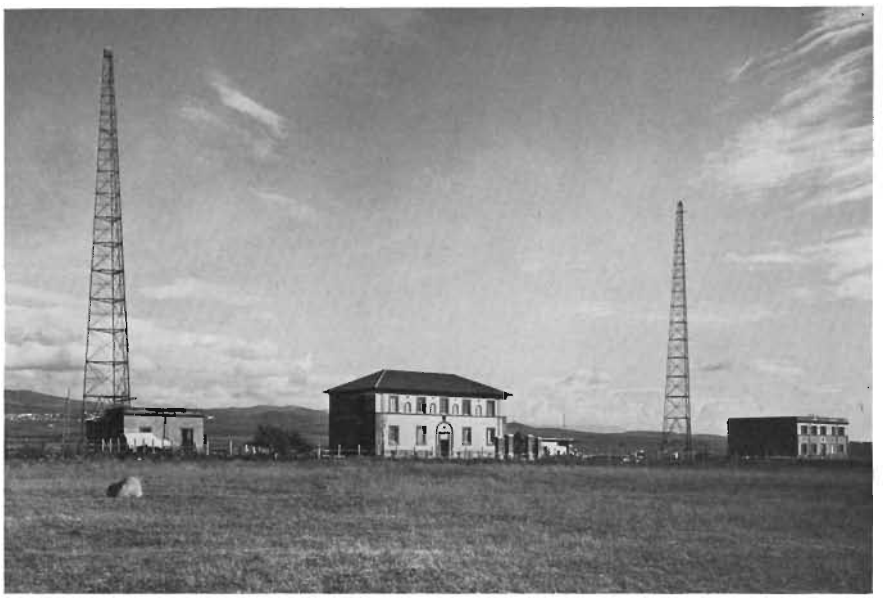
Date, June 16th, 1932
Time, 3:15 P. M.
Place, the Camden, N. J., Office

Bob McCune's phone rings. He picks up the receiver. "What! Stone calling from Dallas, Texas?—COLLECT??? Listen, Operator—tell him to send a telegram . . . a NIGHT LETTER . . . it's the sales tax he's calling about probably. What? . . . You can't deliver such a message without charge?—Alright then I'll hang up,—but don't let that guy start to talk. What? . . . He wants to place an *order??* Put him on quick—Operator! Hello, Hell—Operator!—Listen please, I wasn't swearing at you—Let me talk to the party in Dallas—Dallas, Texas—his name is Stone,—*Mr.* Stone!" (Aside) "What we want is *orders.*"

Milan and Rome Stations

By FRED MULLER, Export Sales Engineer,
RCA Victor Co., Inc.

DURING 1930, the 50 kilowatt broadcast transmitter designed and installed by the RCA Victor Company for Rome, Italy began its record of steady service. Since that time, it has been operating in such a manner as to make for itself an enviable reputation among European broadcasting stations, particularly in economical operation, coverage and quality.

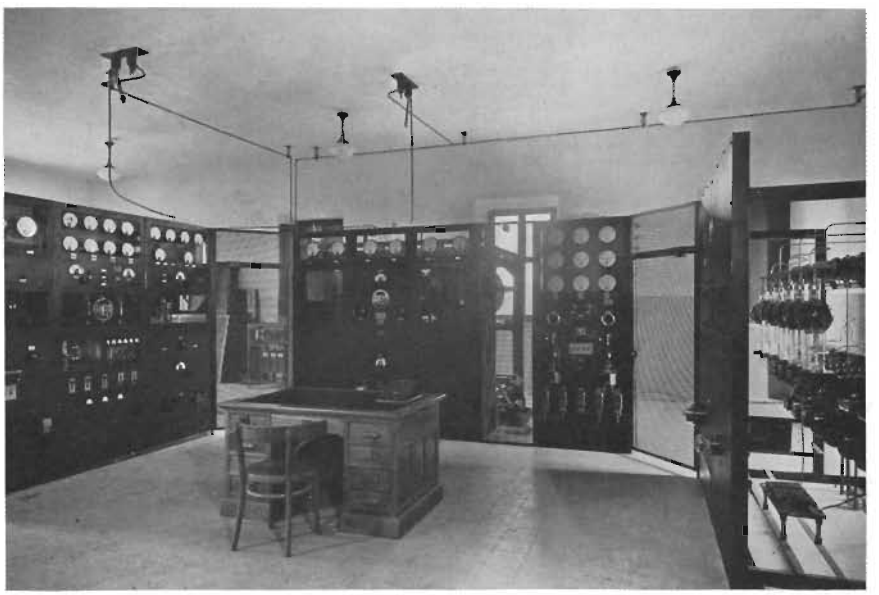


VIEW OF ANTENNA TOWERS AND TRANSMITTER BUILDING OF THE ITALIAN STATION AT ROME.

It is a well-known fact that Italy is a nation of music lovers who desire and recognize the best in the reproduction of all forms of voice and music. To have such a genius as Pietro Mascagni, composer of the opera "Cavalleria Rusticana" call the transmitter at Rome "a truly marvelous station" would ordinarily be considered sufficient reward. However, when the Italian Broadcasting Company placed its order for another 50 kilowatt broadcast station to be installed at Milan, the RCA Victor Company felt that it had been paid the highest possible compliment.

This latter station will be located at Siziano, a small suburb of Milan. Studios are located in Milan proper, and microphones will be placed in the famous La Scala Opera House and other locations; in order that only the highest quality programs may be provided. The installation is under the direction of Mr. J. A. Biondo, the RCA Victor engineer to whom a great share of the credit for the success of the Rome installation is due. The technical features are being carried out by Mr. E. A. Laport with the aid of engineers of the Italian Broadcasting Company.

The latest advances in transmitter design have been incorporated in the units and the complete installation will be the equal of the finest American stations. This is the more noteworthy when it is considered that the station has been shipped 4,000 miles over sea, then transported by railroad, over and under the Alps. Yet because of the vast experience of the Foreign Department of the RCA Victor Company in handling such matters, the engineer in charge is able to install the station with the same ease and speed as if it were located close to the factory.



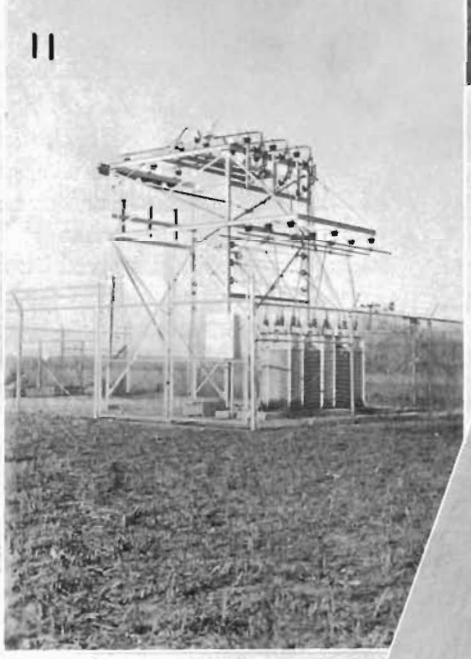
INTERIOR VIEW OF TRANSMITTER CONTROL ROOM OF THE STATION AT ROME, ITALY

THE NATURAL MISTAKE

We take pleasure in quoting the following from the April 12th issue of *Variety*—

"Impression that KMPC, Los Angeles, had jumped from 500 to 1,000 watts, brought an investigation from government radio sleuths. Station absolved itself, proving it was sticking to the old power. Difference in effect caused by new transmitter recently installed".

It was a new RCA 1-C Transmitter.



Some Sunny Sou

1—Handsome station building
2—Broadcasting Station WFAA
Texas.
3—WOAI, San Antonio, Texas
4—Ben Adler, of RCA Victor,
Texas.
5—Harold Nebe, at the entrance
6—Artistic treatment of the stati
7—WOAI, San Antonio, Texas
8—Left to right—Ray Collins ar
RCA Victor, at the entrance
Texas.
9—The tidy transmitter station
Miss.
10—J. G. Cummings, Manager at
11—Outdoor substation at WOA
12—Antenna counter weight at
13—Antenna towers, WOAI, Sa
14—Walter Tison, helping to hol
of Mexico, at Station WFLA

hern Station SnapShotS

VJDX, Jackson, Miss.
the Dallas News and the Dallas Journal, Dallas

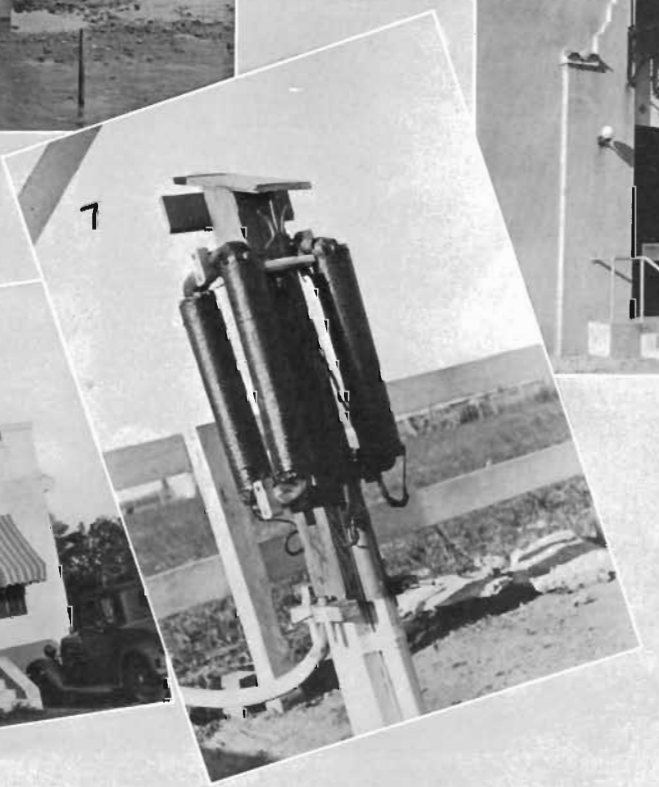
tF Transmission Line.
ng field intensity measurements, somewhere in

WSMB Broadcasting Station, New Orleans, La.
uilding for WOAI, San Antonio, Texas.
tF Chokes in Tower Lighting Lines.
.ee Wilkinson, of WFAA, and Bill Witty, of
he unique broadcast station building, at Dallas,

ding for Broadcast Station WQBC, Vicksburg,

OAI, San Antonio, Texas.

AI, San Antonio, Texas.
ntonio, Texas.
own one of his antenna guy anchors in the Gulf
SUN, Clearwater, Fla.



LET'S GET ACQUAINTED

CHARLES G. ROBERTS

THE BOYS WHO HANDLE THE FOREIGN SALES OF THE TRANSMITTER SECTION. CHARLIE SEELS COMMUNICATION APPARATUS AND AIRPLANE EQUIPMENT. HE CAME TO US FROM THE GENERAL ELECTRIC COMPANY AT SCHENECTADY, AND IS ONE OF THOSE LUCKY BIRDS WHOSE WIVES LET THEM PLAY AROUND WITH AMATEUR RADIO, ONCE IN A WHILE.

FRED MULLER

FRED (OR FREETZ) TAKES CARE OF BROADCASTING MATTERS, PORTABLES, AND SUCH. HE JOINED THE RCA EXPORT DEPARTMENT SOME THREE AND A HALF YEARS AGO. HE WAS BORN AND EDUCATED IN SWITZERLAND, AND SPENT HIS YOUNGER YEARS IN CEYLON AND JAPAN. HIS HOBBY IS "PHANCY PHOTOGRAPHY".

Broadcasting Personalities

MARTIN CAMPBELL now manager of WFAA, formerly was manager of WHAS, Louisville, Ky. David Brinkmoeller, formerly of WGST, is now manager of WJTL.

Jack DeWitt, formerly Transmitter Development Engineer of Bell Laboratories, has recently returned to his home at Nashville, Tenn., where he has taken up his new activities as Chief Engineer of WSM. He is now busily engaged supervising the installation of WSM's new 50 K.W. RCA Transmitter.

Father Wallace Burk, director of Loyola University's Radio Station WWL at New Orleans, expects to have his new RCA 10 K.W. Transmitter on the air some time this summer.

Harold Nebe, Chief Engineer of WSMB, spends most of his time at present recuperating from the effects of moving his transmitter back to the roof of the Maison Blanche Building in New Orleans.

BON VOYAGE

R. V. BESHGETOOR, who is on his way to Buenos Aires to assume the duties of Managing Director of RCA Victor Argentina, Inc.

Mr. Beshgetoor was selected for this position because of his wide experience both in RCA organizations and in the General Electric Company, at Schenectady, N. Y., where he completed the student engineering, or "test" course, and subsequently entered radio commercial work.

With the General Electric Company, he handled commercial transmitters, U. S. government apparatus, equipment built for the Victor and Brunswick Companies, and the original RCA Photophone apparatus, including that which was built for the pioneer sound-movie "Wings".

In August, 1928, he transferred to the RCA organization to manage the Component Parts sales.

He is a graduate of Alma College, Alma, Michigan, with B.S. degree, and also the University of Michigan, with M.S. degree.

While we shall all miss him around the Camden office of the RCA Victor Company, where he has been contact man with General Electric, Westinghouse, and Graybar, we all extend hearty congratulations to him in his new position.

Mr. Beshgetoor has promised to act as South American correspondent for BROADCAST NEWS magazine, and we hope to hear from him frequently, as radio history is being made rapidly these days in South America.

25th, with a special program dedicated to the occasion. WFAA and the Dallas News are to be congratulated in behalf of the service they have rendered to the Southwest. This station is one of the pioneer broadcast stations of the Southwest, and is the first radio station owned by a newspaper to install and operate a 50,000-watt transmitter in the South.

"Eddie" Zimmerman of KPRC, Houston, Texas, attended and "participated in" the celebration of

MR. AND MRS. EARL C. HULL
WKY, OKLAHOMA, CITY

MR. EARL C. HULL OF WKY, OKLAHOMA CITY, OKLA., ASIDE FROM OPERATING "ONE OF THE BEST 1 KILOWATT STATIONS IN THE COUNTRY" (THE LAYOUT OF WHICH, INCIDENTALLY, LOOKS MORE LIKE A FLOWER GARDEN THAN A RADIO STATION), IS ALSO A VERY CAPABLE YACHTSMAN. HE HAS A VERY ABLE ASSISTANT IN BOTH LINES OF ENDEAVOR, NAMELY THE "MISSUS."

Jack Temple, General Manager of KCMC, Texarkana, U. S. A., was among the first to place an order for the new RCA Precision Frequency Control equipment,—another indication that Jack is also a believer in that old axiom, "An ounce of prevention is worth a pound of cure."

Mr. Martin B. Campbell is the new General Manager of WFAA, Dallas, Texas. Mr. Campbell formerly was General Manager of the Courier-Journal Station WHAS at Louisville, Kentucky, and hardly needs any further introduction to broadcasters.

WFAA, the Dallas News Station, Dallas, Texas, celebrated its Tenth Anniversary Saturday evening, June

WFAA's Tenth Anniversary, Saturday, June 25th. Station KPRC also broadcasted the dedicatory program.

"Frank" Marx of WMCA is busy planning to move the station from New Jersey to Long Island.

"Phil" Weiss of WSYB, up in Rutland, Vermont is not a successful fisherman, but manages to catch lots of sunburn.

George Milne of NBC doesn't have to go outside for that browned, Palm Beach appearance, with sunlamps available. He reports a successful trip to Italy and back.

A. B. Chamberlain of CBS has returned to the office after a sojourn in the hospital. He listened to WABC

W. L. Davis who is in charge of the transmitter at WPHR (formerly WLBG) Petersburg, Va. raises grapes under the antenna and believe it or not, they are superior to grapes grown without the stimulating influence of radio frequency. We are familiar with radio frequency currents, but this is the first time we have had experience with radio frequency grapes.

One of our readers complimented us on the general make-up of BROADCAST NEWS but out of curiosity asked how we had been able to build up such a large paid circulation. Imagine his surprise when he learned he was not paying for BROADCAST NEWS.

Douglas Lee, in charge of technical activities of WSJS, Winston-Salem, N. C. specializes in complicated outdoor pick-ups. His Easter Morning program and the recent Washington Bi-centennial celebration were picked-up from numerous points about the beautiful and historical old city. The excellent Easter morning program brought numerous responses from distant States.

The death of Mr. Delos N. Hicok, transmitting tube expert, was the source of deep sorrow to his RCA friends, who will always remember his humor, sympathy and philosophy.

HAROLD W. ROHER

WHO IS TAKING OVER THE WORK AS MANUFACTURING REPRESENTATIVE, FORMERLY HANDLED BY MR. DELOS N. HICOK

Police Alarm Broadcast News

GOING DOWN TO 5 METERS

With the Model ET-5000 High Frequency Transceiver

By P. A. ANDERSON, Sales Engineer, RCA Victor Co., Inc.

YOU boys of the broadcasting profession are so engrossed in the 1500 to 550 kilocycle band, that perhaps many of you have little time to follow the activities down in the shorter wavelengths. Having spent the greater part of my professional career in broadcasting and having only recently had an opportunity to delve into the ultra-high-frequency portion of the spectrum, I believe that this new field holds promise of some of the most startling developments in the coming decade and that it behooves us all to prepare for them. With this thought in mind, I am going to describe a vest pocket transmitter recently placed on the market by the RCA Victor Company, which operates in the 5 meter band. (60,000 to 45,000 kilocycles.)

Figure 1 shows the complete equipment known as the Type ET-5000

FIGURE 3—COMPLETE "TRANSCEIVER" EQUIPMENT MOUNTED ON TRIPOD FOR FIELD SERVICE.

"Transceiver." The unit to the left is the combination telephone and telegraph transmitter and receiver, while the unit on the right is the battery box, containing a special single block battery which supplies the filament, plate, bias and microphone current. This battery is so designed

that each section has approximately the same life.

Figure 2 clearly indicates the size of the Transceiver unit. The weight of this unit complete with Radiotrons is approximately eight pounds. The battery box, including the battery, weighs approximately fifteen pounds. This is the larger size battery, which will operate the equipment for eight hours in continuous service. To increase the portability feature, a smaller two hour battery may be substituted.

The panel arrangement is clearly shown in Figure 2. The meter indicates filament and plate voltage. One small knob controls the filament voltage, and the other controls the volume when receiving. The two larger knobs and dials control the plate and grid tuning. Provision is made to lock the dials. Jacks are provided for the headset, microphone and telegraph key. A three position switch, by a clever circuit arrangement, permits instant switching to telephone or telegraph,—for transmission or reception.

Figure 3 shows the complete equipment mounted on a tripod for field use. For this purpose a half-wave "Hertz" antenna is used, consisting of two ¼" brass tubes (see Figure 3) of the correct length. By the use of sliders of smaller tubing in this bipolar arrangement, adjustment may be made to the required dimensions. Here a variation of one inch is equivalent to about a ten foot change in an antenna such as is commonly used in the broadcast band. Different types of antennas may be used to meet the requirements of various installations. Usually in planes we use a transmission-line of the voltage-feed type, fed to a half wave "flat top".

In broadcast work we are always striving for distance, but with the Transceiver great distance is not such an important factor. Due to the quasi-

FIGURE 2—THIS VIEW INDICATES THE COMPACT DESIGN OF THE "TRANSCEIVER".

optical effect at five meters, the transmission practically follows line-of-sight. Therefore, we may operate a large number of these transmitters in various parts of the country on a single channel, without interference. On the ground the range varies up to about three miles, depending on the topography of the terrain or structural interference. As either end of the span is elevated, the range in-

creases. Under good conditions, fifty miles between a ground station and a plane have been readily spanned, although such distances are not to be expected under normal conditions.

Now that we have it, what will we do with it? Well, here are a few of the possible applications:—

Broadcast pickup of special events such as Golf Tournaments, etc.
Police and Fire Department alarms and reports.
Forest Fire Control.
Motion Picture Direction on Location.
Aircraft Student Instruction.
Lifeboat Emergency Service.
Railroad Train Communication (between front and rear ends).
Mine Emergency Communication.

In our tests we have communicated between moving autos—auto to plane—plane to plane—plane to ground and between groups of mounted men.

Figure 4 shows Colonel L. Coyle, Chief Fire Warden, New Jersey, using this equipment for the control of ground crews in forest fire work. By the use of radio he can thus direct his men and furnish them with accurate information as to area and direction of the fire's advance, which could not be easily determined from the ground.

FIGURE 4—THE "TRANSCEIVER" TAKES TO THE AIR FOR FOREST FIRE CONTROL.

In a recent police test, a Pitcairn Autogiro picked up a car at random on the road and phoned a description of the car and its location to our automobile. We were able to follow this car and overtake it, guided exclusively by information received from the plane. Colonel Kern Dodge, Director of Public Safety, of Philadelphia, who supervised this test was most enthusiastic over its possibilities for police work.

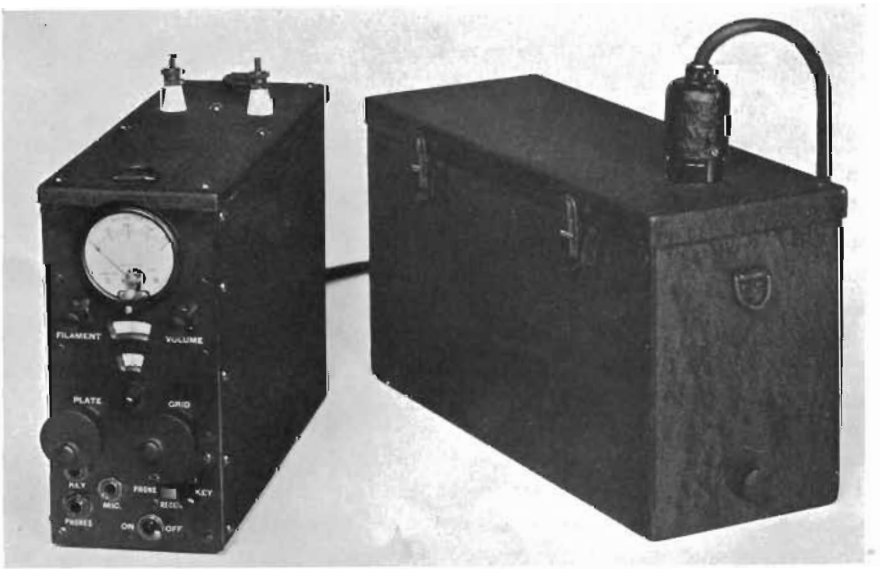


FIGURE 1—COMPLETE EQUIPMENT COMPRISING THE RCA TYPE ET-5000 "TRANSCEIVER".

Upon another occasion, an automobile on the street maintained communication with a transmitter mounted in a subway train and was able to keep in touch as they both proceeded from one end of the route to the other. The maximum distance spanned in this test was about 1,000 feet. At one time the train was running through a bore, where the two equipments were separated by 200 feet of solid rock.

These results are all the more amazing when it is considered that the maximum power is two tenths of a watt!

NOTE:—In a later issue, we hope to publish a description by the same author of a receiver unit only, which fits the pocket, for use with this equipment.—*Editor.*

THE INTERNATIONAL EXPOSITION AT CHICAGO, 1933

Plans are already in progress to include in the 1933 International Exposition a complete display of the products of the RCA Victor Company, Inc. This company intends to enter its display as an instructive or educational exhibition, rather than an advertising medium,—and the evolution of its products from the raw material to the finished article will be featured.

The display of the Engineering Products Division will feature the Color Organ, in appropriate setting, the Electric Carillon, a unique exhibition of the Police Transmitter and Receiver equipment, and the latest models of the Sound Meter, Oscillograph, and Signal Generator.

Broadcast Antennas

By HANS RODER, Radio Engineer
General Electric Company, Schenectady, N. Y.

THE rapid expansion and increased importance of broadcasting during the last decade brought about vast improvements in the audio and radio equipment concerned. The power output of the transmitters has been multiplied many times. Their frequency stability, their audio response, and the quality of their audio equipment correspond to requirements undreamed of in those early times of crystal detector and headphones.

However, one component part of the transmitter has been very little affected by all these modern changes. It is the antenna. We still build it in the same forms which have been developed and used by the early pioneers in wireless to carry the signals of their spark and arc transmitters. Of course, we have learned to build lighter but stronger towers and insulators, but as far as design and dimensions of antennas are concerned, practically no innovations have been made after the World War. Now, it seems the time has come to open a new chapter of broadcast antenna design.

The radiation of an antenna is given by the intensity of the electrostatic field—usually in micro-volts per meter—which exists at a distance d from the antenna. For most forms of antennas the direction of the electrostatic field is perpendicular to the ground. The theory yields for the intensity measured at the ground:

$$E = \left[\frac{120\ \Pi\ (h\ I)}{d\ \lambda}\right] A \ldots\ldots (1)$$

or, if we use frequency, f, instead of λ (wavelength)

$$E = \left[\frac{0.4\ \Pi\ f \cdot (h\ I)}{d}\right] A \ldots (2)$$

E in microvolts per meter, d and λ in kilometers, f in kilocycles. The term (h I) is called meter-amperes; we shall come back to it very soon.

The factor A is called absorption factor. In equations (1) and (2) the bracketed portions describe the field which is obtained if the ground is an infinitely good conductor. In this case, the field would decrease inversely with an increase in distance. Actually, the earth is far from being a good conductor. Therefore, the eddy currents which are induced in the ground by the propagating field cause energy losses. These losses in turn make the field decrease faster than in simple inverse proportion with the distance, a fact which we take into account by introducing the term A. For the computation of the absorption factor we have two formulas available — Sommerfeld's formula for daylight transmission over land and Austin's formula for daylight transmission over water.[1] The absorption factor depends upon the frequency, upon the conductivity and dielectric constant of the ground over which the wave is traveling, and upon the distance. The higher the frequency, the higher is the absorption. The curves in figure 1 give some approximate values of A at broadcast frequencies for distances of

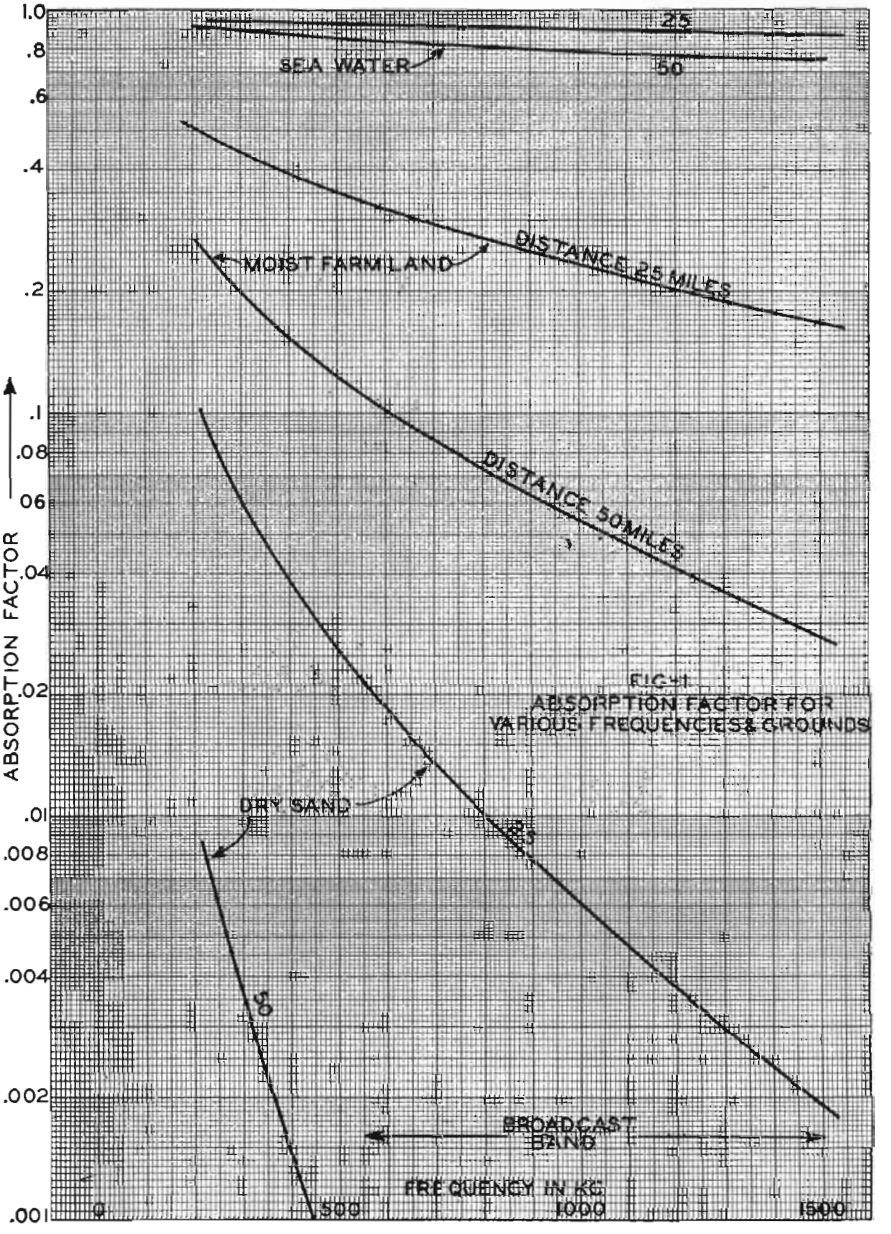


FIG. 1

FIG. 1
ABSORPTION FACTOR FOR VARIOUS FREQUENCIES & GROUNDS

[1] S. S. Kirby and K. A. Norton:—Field Intensity Measurements at Frequencies from 285 to 5400 K.C. Proc. I.R.E.: 20, 841, 1932.

25 and 50 miles respectively. It may be noted how much less low frequencies are attenuated than broadcast frequencies.

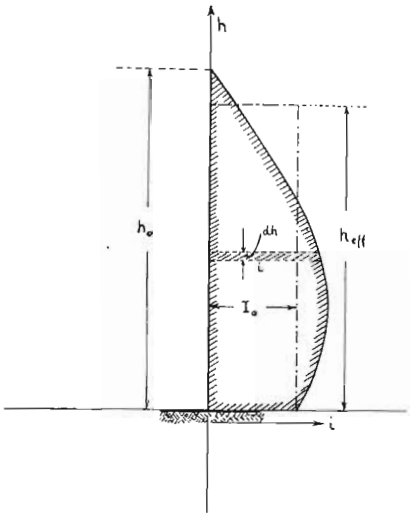


FIG. 2

The term (h I) which also appears in equations (1) and (2) is called meter-amperes. It is defined by:—

$$(h\ I) = \int_0^{h_o} i\ d\ h \ldots\ldots\ldots\ldots (3)$$

Thus, with reference to figure 2, we see that (h I) is the fictitious "current area" which is seen when looking

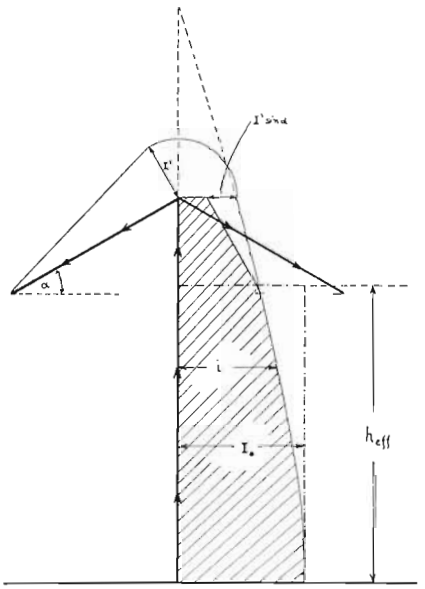


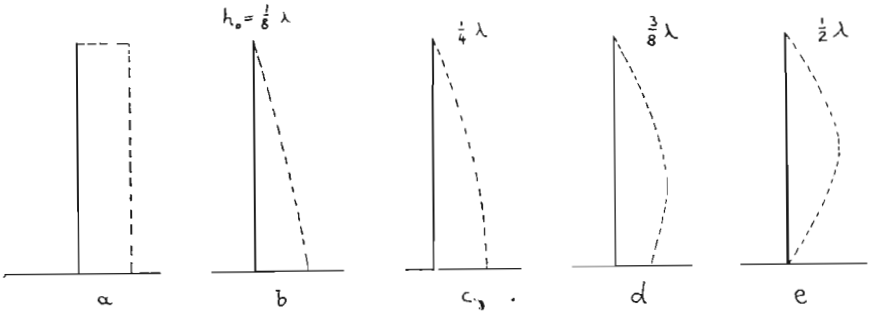
FIG. 3

from a distant point in the horizontal plane towards the antenna. Sometimes, meter-amperes are expressed in terms of "effective height" h_{eff}, where:—

$$h_{eff} = \frac{1}{I_o} \int_0^h i\ d\ h \ldots\ldots\ldots (4)$$

This means: the effective height of an antenna is given by the height of a rectangle the area of which is equal to the current area and the base of which is equal to the antenna current, I_o, measured at the ground. Since, in all practical cases the current distribution along the antenna can be assumed to be sinusoidal the computation of h_{eff} is possible, either graphically or analytically. Fig. 3, as an example, shows how to find graphically h_{eff} for an umbrella-type antenna.

We considered so far, only the field intensity on the ground. But an antenna radiates, of course, also in other directions. Field intensities measured under an angle versus the earth are strictly inversely proportional to the distance since no attenuation takes place. The magnitude of the field depends in a complicated way, upon the form and current distribution on the antenna. It is best shown by the so-called radiation diagram as given in figure 4, for various types of antennas. These diagrams are computed under the assumption that the conductivity of the ground is high. Most broadcasting antennas correspond to types a – c in figure 4; their radiation diagram is practically half a circle.



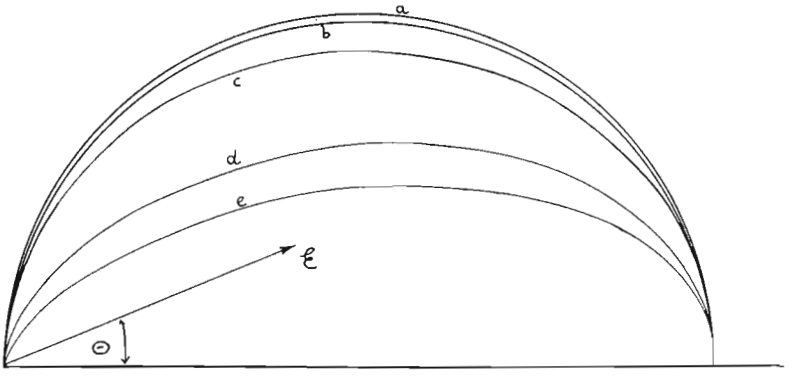


FIG. 4

We have now taken into consider-

field intensity at a distant point. However, we have not mentioned yet one very important factor, viz: reflections from the Kennelly-Heaviside layer. In great heights above the earth—about 100 to 300 kilometers, —where the density of the air is almost as low as in a vacuum tube, a great number of the molecules, mostly hydrogen, are electrically charged. These so-called ions represent a space charge which acts upon the electromagnetic wave as does a mirror upon a light wave. The incoming wave is reflected on the layer and will under proper conditions be directed back to the earth. At the receiver, consequently, the resulting signal will consist of a ground wave G and the sky wave S (Fig. 5). Both components G and S are modulated radio frequencies. Depending on their respective amplitudes and phases the superposition and rectification of both components may yield very bad audio distortion at the receiver. In Fig. 6 a number of diagrams are given showing the distorted modulation which is obtained if two radio frequencies of equal magnitude and of perfect sinusoidal modulation of 80 per cent are superposed. Fortunately, the distortion is hardly noticeable if one

component is considerably stronger, say four times or more, than the other one. The intensity and direction of the reflected ray change frequently, a fact which probably is due to variations in height, density and thickness of the ionized layer.

Now let us consider what effect the reflections have upon the signal obtained at the receiver at various distances from the antenna. The radiation diagram of the antenna is supposed to be a half circle. At short distances, say 10 to 20 miles from the transmitter, (point 1, in Fig. 7), the ground wave is still strong. The sky wave on the other hand, is weak, first, because the upward radiation under the angle Θ is small and, second, on account of the long path (about 300 kilometers)

traveled. Thus, at point 1 practically only the ground wave will be present, resulting in a steady reception free of fading. At point 2 being at a distance of, say, 40 miles, the intensity of the ground wave is considerably decreased (about 7% of its magnitude at point 1). The sky wave, however, is much stronger than before since the path S_2 is not much longer than the path S_1 while the radiation under the angle Θ_2 is about

twice that under the angle Θ_1. In figure 8 the field intensities which are due to the sky and ground waves are given for various distances between transmitter and receiver. The height of the Heaviside layer has been assumed to be 100 and 200 kilometers respectively. One recognizes that the distance at which sky wave and ground wave field intensities become equal—this is the condition for worst distortion—is roughly, at about 100

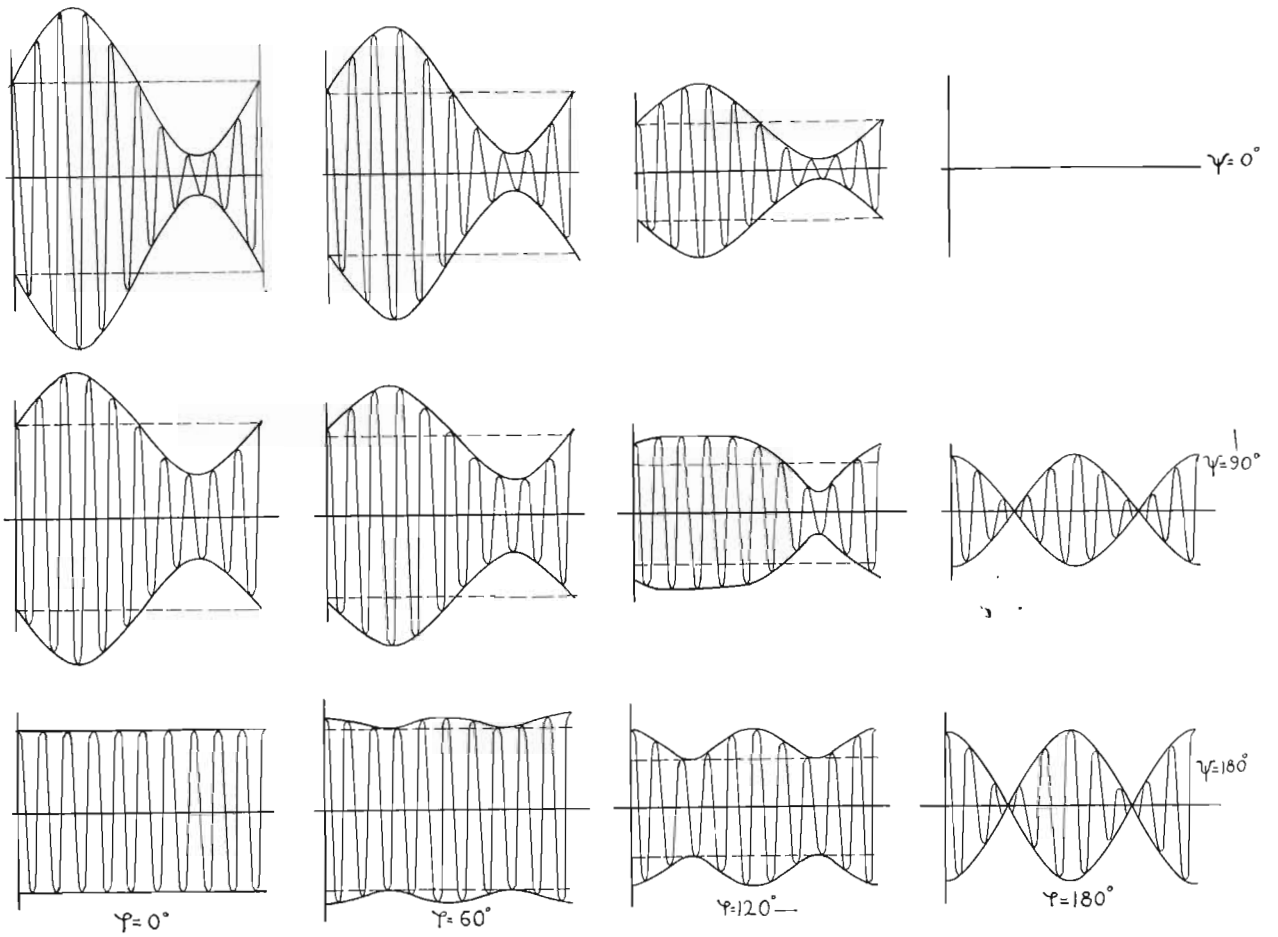


FIGURE 6—RADIO FREQUENCY ENVELOPES OBTAINED BY THE SUPER POSITION OF GROUND AND SKYWAVE. THE FIELD STRENGTH OF SKY AND GROUND WAVE ARE SUPPOSED TO BE EQUAL. THE MODULATION IS OF PURE SINUSOIDAL WAVE FORM, CORRESPONDING TO 80%. THE ANGLES Φ AND Ψ MEASURE THE PHASE DIFFERENCE FOR RADIO AND AUDIO FREQUENCY RESPECTIVELY. THIS PHASE DIFFERENCE FOLLOWS FROM THE DIFFERENCE IN LENGTH OF THE INDIVIDUAL PATHS BY THE FOLLOWING FORMULAS:

$$\Phi = \frac{2\pi}{c} f_1 (S - S_o)$$

$$\Psi = \frac{2\pi}{c} f_2 (S - S_o)$$

WHERE

S_o IS THE LENGTH OF THE PATH (IN KILOMETERS) OF THE GROUND WAVE
S IS THE LENGTH OF THE PATH (IN KILOMETERS) OF THE SKY WAVE
f_1 IS THE RADIO FREQUENCY IN CYCLES / SEC
f_2 IS THE AUDIO FREQUENCY IN CYCLES / SEC
c IS THE VELOCITY OF LIGHT — 30,000 KM / SEC

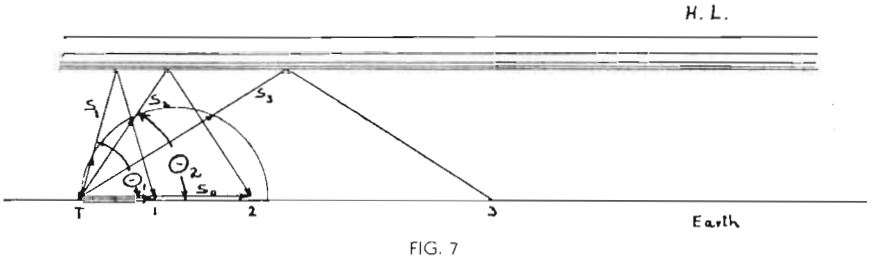


FIG. 7

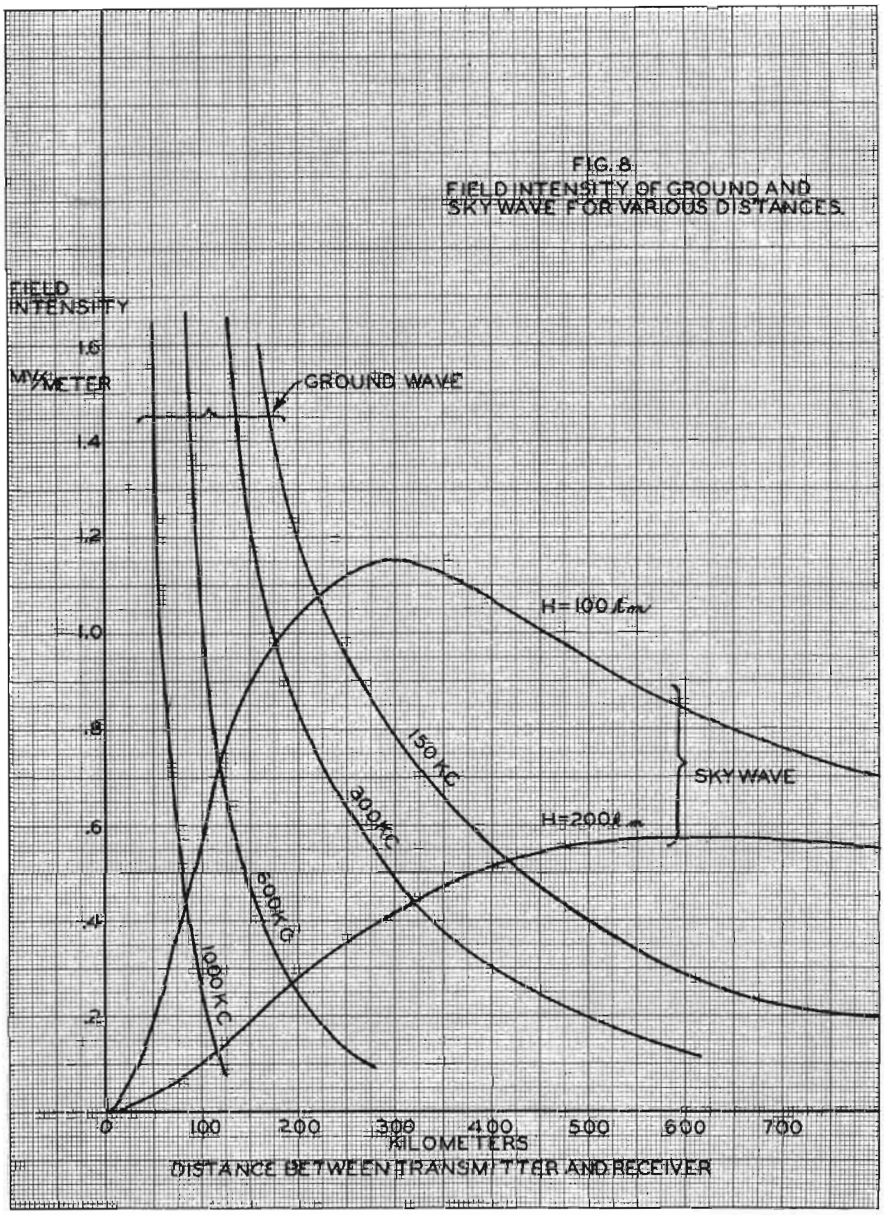


FIG. 8

kilometers (60 miles) for broadcast frequencies. It is easily seen that this critical distance is independent of the transmitter power. Beyond that distance the reception depends practically on the sky wave alone with its inherent irregularities and fading.

The desire to increase the service area of a broadcast station led to the erection of higher powered transmitters during the last decade. Service area means the zone in which always a steady reception free of distortion and fading is obtainable. But this area cannot be increased by increasing the power of the transmitter beyond a certain limit; its radius is given by the critical distance of about 60 miles. A transmitter power of about 50 to 75 KW is sufficient to fill this 60 mile circle with a ground wave of steady intensity. An increase in power would be useless and even detrimental, since beyond the 60 mile radius the high field strengths cannot be utilized any more. One has therefore to look for some other means to increase the service area. One possibility would be to use lower frequencies. At 150 KC, for instance, the radius of the service area is about 150 miles (Fig. 8). Another solution is to change the radiation diagram of our present day antennas. The first method is confronted by the fact that at lower frequencies fewer channels will be available; hence, the second method probably proves to be the way out.

Present day antennas which are usually about ¼ wavelength high have a half circle radiation diagram. With reference to Fig. 4 we see that a *half wave antenna* has a diagram with much smaller high angle radiation. Another possibility is to use an *arrangement of seven vertical ¼ wave antennas* (Fig. 9), which is directive in the vertical plane. Amplitude and phase of the currents in the center and in the outer antennas can be adjusted such as to give small high angle radiation. Methods 1 and 3 have already been reduced to practice, but at present not sufficient experience as to their performance is available.

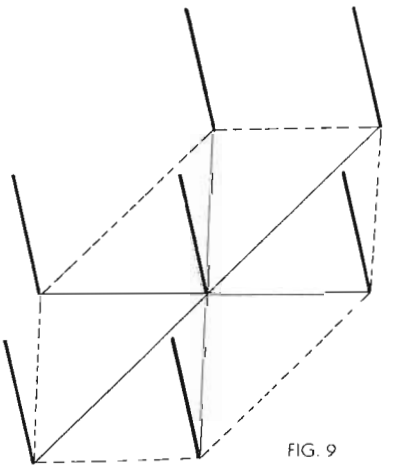


FIG. 9

We thus see that the old type of antenna now in use for almost a quarter century will probably give way to a new type of antenna which provides a stronger ground wave and a weaker sky wave. If this problem is once solved, then there will be justification for the increase in transmitter power in order to supply the increased service area with sufficient field strength for reliable reception.

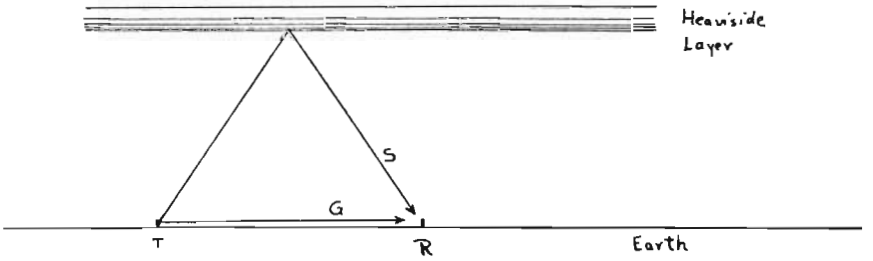
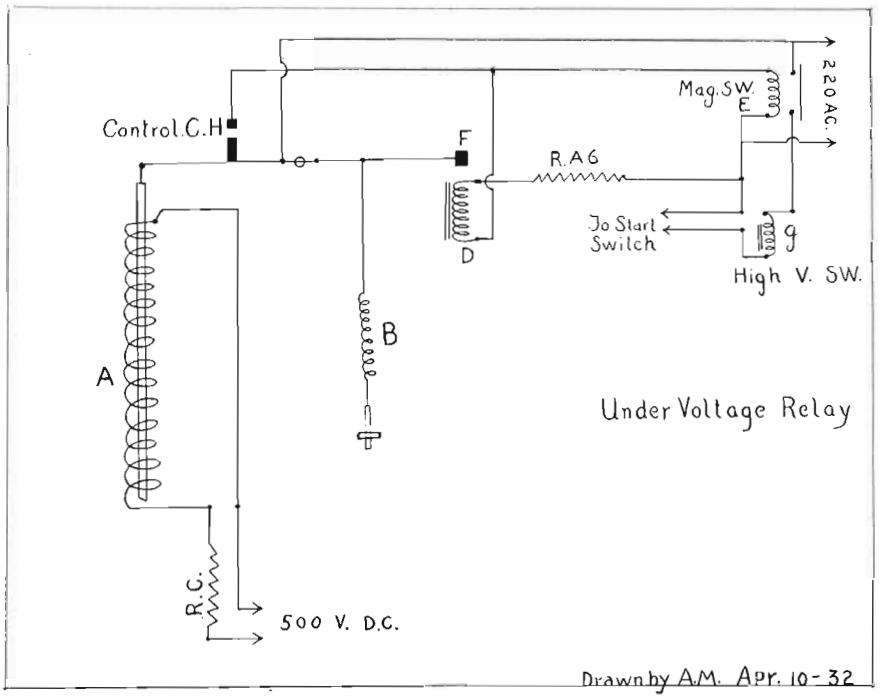


FIG. 5

Under Voltage Relay for Tube Transmitters

By ALBERT MEYER, Chief Engineer, KGBZ



THE D6 under voltage relay is a protective device which can be readily applied to vacuum tube broadcast transmitter, although the sets being manufactured by some of the larger companies, are equipped with such a device. It consists of a solenoid and a movable core, partly supported by spring "B" and partly by the current through solenoid "A". The current in solenoid "A" depends on the voltage impressed on the solenoid terminals, and limited by the resister "RC". The core in the solenoid is connected to one end of a lever and is pivoted at the center, and carries the movable control contact. When the voltage through the solenoid "A" is not of a normal value the core is down and the control contact "H" is open. When the voltage approaches within 1% of normal operating voltage the core rises and closes the control contact "H".

Coil "D" is excited by alternating current and the current through it is limited by the resister "A6", and it attracts the armature "F" and holds it under minor voltage fluctuations in solenoid "A". It would be undesirable if the control contact opened with small voltage changes. The of an adjusting lock screw and through this the force acting on armature "F" can be increased or decreased. The holding force through coil "D" is not sufficient to hold the armature "F" if the voltage across the solenoid "A" is decreased by 5% of the normal operating voltage. If the airgap between coil "D" and armature "F" and the tension of spring "B" are properly adjusted, the control contact will open with snap action on a definite decline of the voltage across the solenoid "A".

This instrument is a protective device and is connected in the bias can be applied to the plates of the transmitting tubes if the bias voltage is not of the right value, determined by the setting of the relay. As can be seen from the diagram the 220 volt circuit through the holding coil "G" for the high voltage switch, is completed through the control contact "H" and if this contact is open the high voltage switch cannot be closed. If the bias voltage should fail for some reason the tubes are protected from overloads. Tube life is prolonged if the tubes are protected from overloads and the addition of a relay of this type to a transmitter not so equipped is a good investment.

WLBG CHANGES HANDS

EFFECTIVE, Wednesday, May 25th, announcements were made concerning the sale by Dr. R. A. Gamble of Norfolk, Va., of his entire interests in radio broadcasting station WLBG. The new owners, who formally took possession of the station on that date (May 25th), are well known Petersburg Businessmen. The new officers of the radio company will be—Charles H. Goodman, President; William B. Beach, Vice President; and W. J. Allen, Sec'y.-Treas. The new stockholders of WLBG Incorporated, owner and operator of Station WPHR are all residents of Southside Virginia, Messrs. Goodman and Beach being prominent

NEW BULLETINS ISSUED

The following bulletins have just came off the press, and are available to those interested in the subjects upon request to the Transmitter Tubes Section, RCA Victor Company, Inc., Camden, New Jersey:

Bulletin No. 18—Transmitter, Type 250-W.
Bulletin No. 19—Control Panel, Type 26-B.
Bulletin No. 20—Supply Panel, Type 28-B.
Bulletin No. 21—Studio Speech Input Equipment, Type S-2
Bulletin No. 23—Microphone Control Panel, Type 11-B

SEND FOR YOUR COPIES

A New Installation for Western North Carolina

STATION WWNC, located in Asheville, N. C. went on the air June 12th, with a new RCA 1 KW transmitter. This station, owned by the Citizen Broadcasting Company is associated with the Asheville Citizen-Times newspapers and is a member of the NBC network.

WWNC is well-known throughout the south as a progressive station. Besides chain programs, it has broadcast many unique features originating in its own local studios. Mr. G. O. Shepherd, general manager, has used great originality in putting programs on the air which are of great interest because they avoid the usual stereotyped pattern.

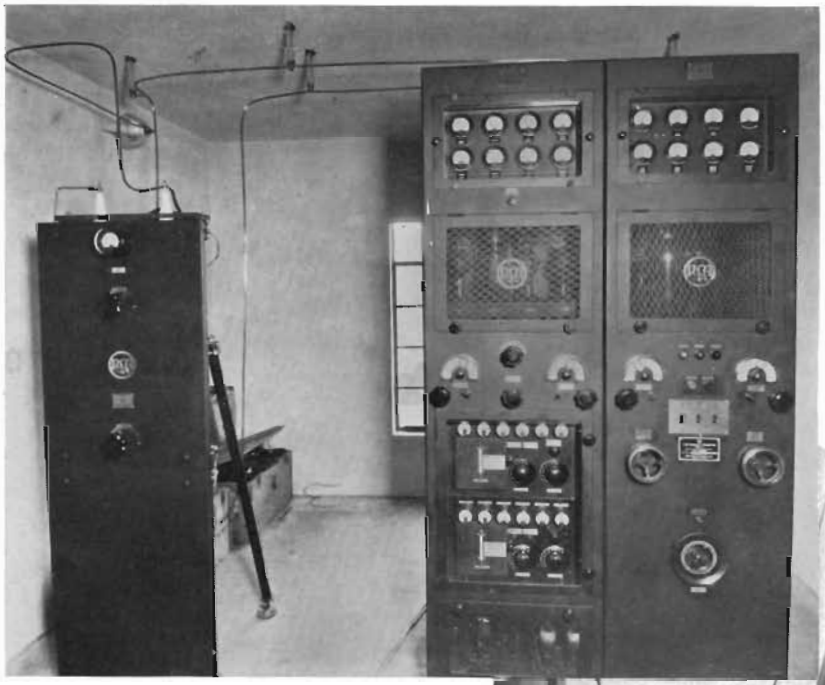
G. O. SHEPHERD
DIRECTOR OF STATION WWNC

stories from the street level. The accompanying photos show this stage of construction.

Already many favorable reports have been received by listeners in Western North Carolina and in other parts of the southeast commenting on the excellent quality and signal strength. Business and civic leaders in Asheville have joined in congratulating the station for its plant improvements, which will enable WWNC to render even more valued service than in the past.

G. O. Shepherd, Director of Station WWNC, is one of the outstanding pioneers of the southern radio industry. He has dabbled with broadcasting since its infancy, and for the past six years has been director of the Asheville station. His was the first newspaper radio column conducted in the South, and he was widely known for his newspaper and magazine articles on radio long before he became actively identified with WWNC.

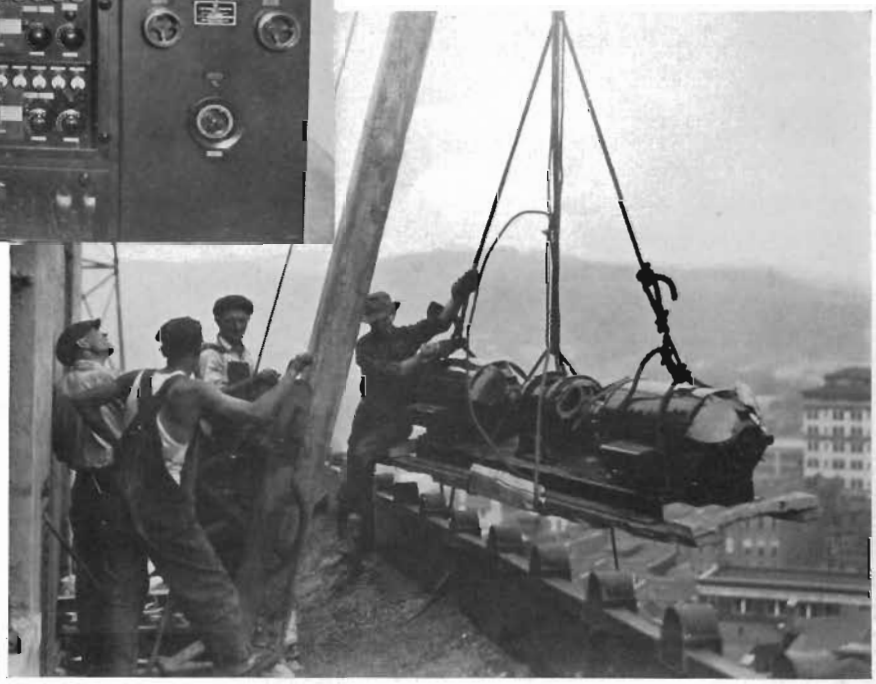
The old station WABC, which was located in Asheville with a power of 20 watts, knew many programs staged under his sponsorship before its call letters were taken over by the Columbia key station in New York City.



RCA TRANSMITTER AT WWNC

The studios and transmitter of WWNC are atop the Flatiron Building in Asheville. To house the transmitter, an addition to the existing penthouse was built, and the new equipment installed without disturbing the operation of the older apparatus. Credit is due to Cecil Hoskins, chief operator, and to the electrical contractors, for an excellent installation.

In order to place the equipment on the roof, it was necessary to hoist it by block and tackle nine



A CRITICAL MOMENT IN THE INSTALLATION OF THE NEW RCA TRANSMITTER AT STATION WWNC, IN ASHEVILLE, N. C.

Public to Hear Organ in Schwab Mansion on Radio

ONE of America's largest residential pipe organs—never before heard over the radio—is being placed at the disposal of the public through the National Broadcasting Company for weekly recitals.

The organ was used for private concerts in the palatial home of Charles M. Schwab, the steel king, which occupies the entire block at Riverside Drive and 73rd Street, New York City, overlooking the Hudson and the Palisades. The instrument will be played by Archer Gibson, noted organist, each Wednesday beginning June 29, at 11.30 P. M., E. D. S. T., for a 15 minute recital over NBC-WEAF networks. The programs will be known as "Echoes of the Palisades." During the broadcasts NBC artists will assist the organist.

This instrument, often called by organ manufacturers the parent of all great modern residence organs, was installed in the Schwab home some twenty-five years ago. It has four manuals and occupies an immense room in the chateau-like dwelling. The console is located in a miniature chapel at the head of the grand staircase, where the organist sits isolated from guests gathered in the great music hall.

Believing that the music from the organ will be appreciated by listeners everywhere, especially at this time, Schwab has offered the instrument to the NBC for regular public recitals. Schwab's only stipulation was that Gibson, who has played the instrument for years, should preside at the console. All musical arrangements are being left in Gibson's hands.

Special technical facilities will carry the music to NBC listeners, since the peculiar structure of the instrument involves the installation of several microphones. The pipes are completely hidden from view and there are numerous invisible units secreted in the room. Echo organs are concealed in the floor, the ceiling and in other places. These are controlled from the single console in the chapel.

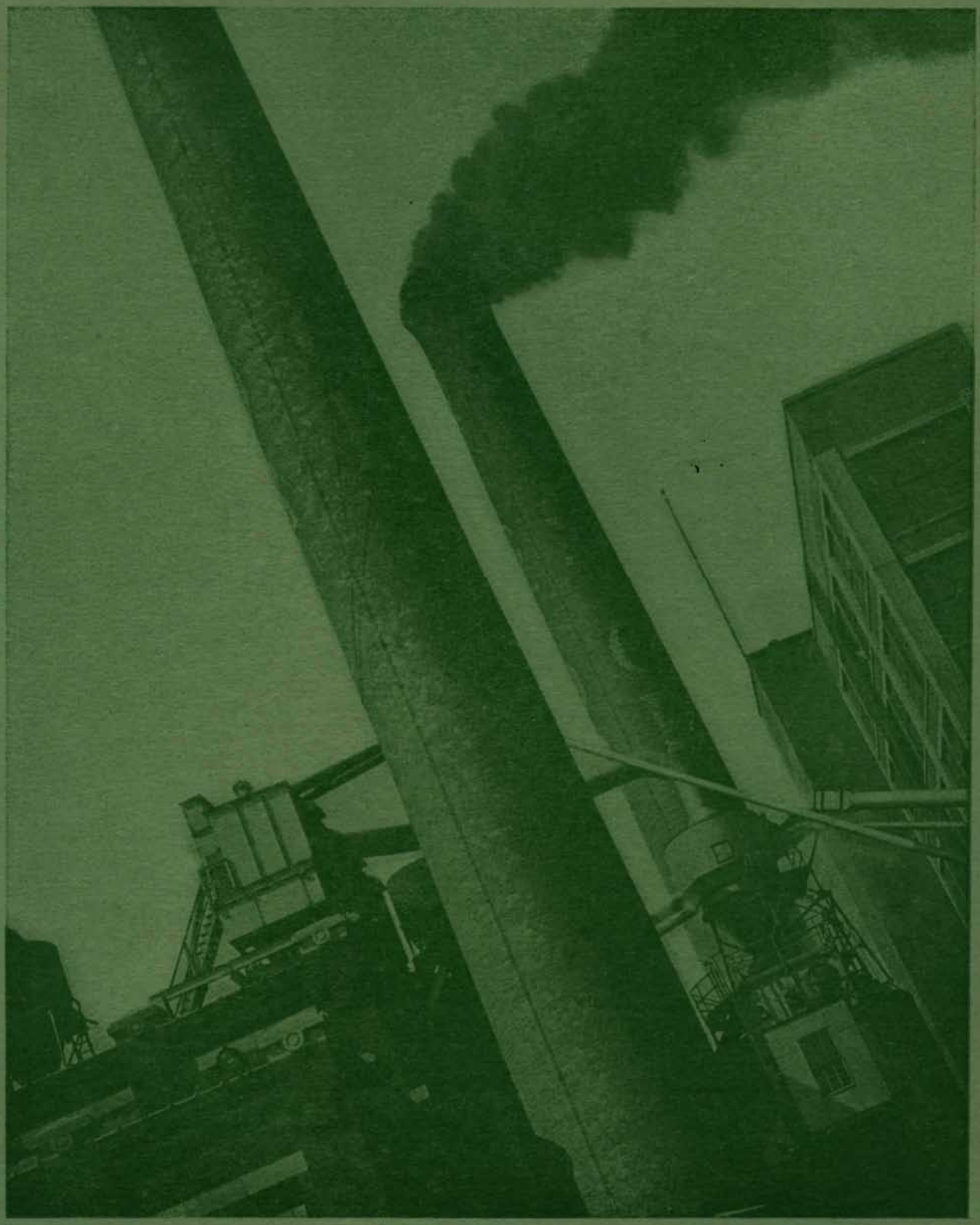
Although many of the world's greatest singers and musicians have appeared from time to time in the Schwab home for private concerts and recitals, this is the first opportunity given the public to peer beyond the turreted walls of the imposing Riverside mansion.

This series will be heard in the West through an NBC-KPO network including stations KPO, KGA, KJR and KEX.

S. W. GOULDEN who is an accomplished organist, and is familiar not only with the harmonics of electrical engineering, but also with the higher harmonics of music, graduated from Norfolk, Va., Academy and completed his education at the University of Virginia where he specialized in electrical communication. In 1914 he completed the student course in telephone engineering at the Hawthorne Shops of the Western Electric Company.

From 1914 to 1919 Mr. Goulden was associated with the laboratories of the Western Electric Company in New York, and in 1919 he joined the staff of the Marconi Wireless Telegraph Co., which Company was later acquired by the Radio Corporation of America. He is at present Commercial Engineer for the RCA Victor Company, and in this capacity has had an extensive and diversified experience with the sale of radio equipment for broadcast transmitting and other purposes.

The first RCA 1, 5 and 50 KW broadcast transmitters were sold by Mr. Goulden. He is a member of the Institute of Radio Engineers and a Fellow of the Radio Club of America.



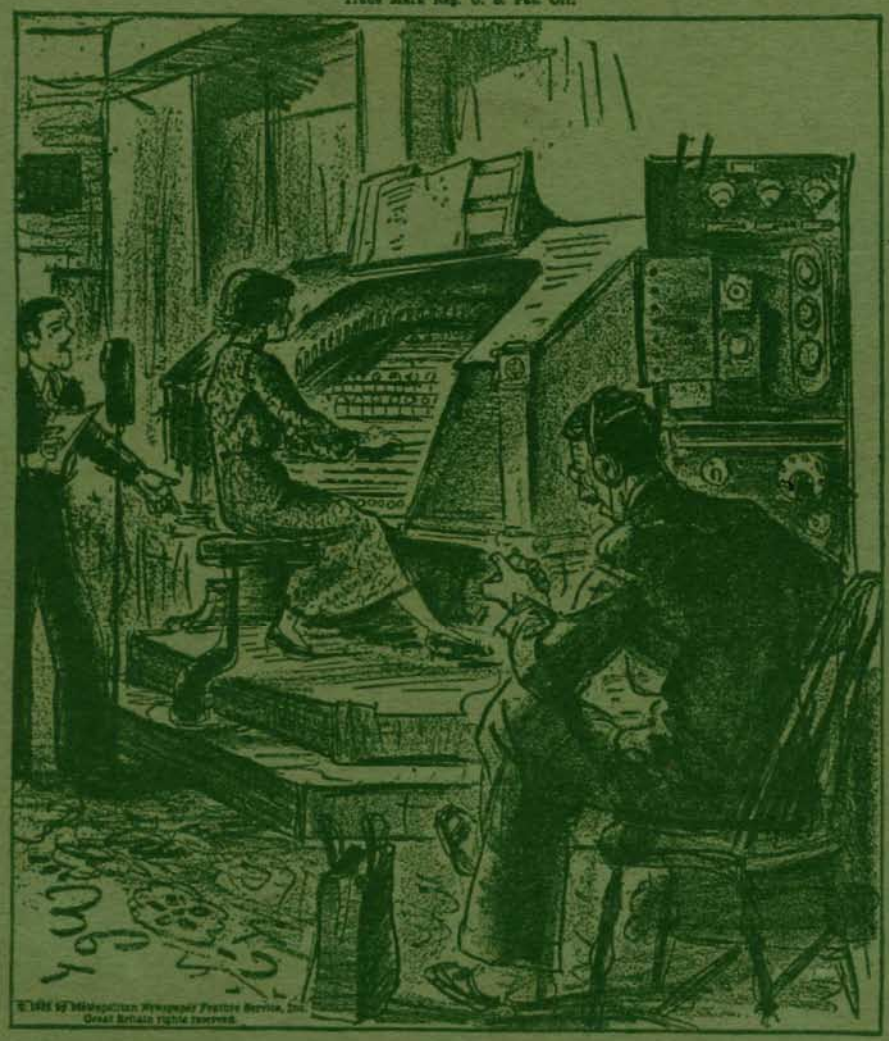
(Photographed by a guest.)

**ANYWAY YOU LOOK AT IT—IT'S A GREAT PLANT,
MADE POSSIBLE BY A GREAT INDUSTRY . . .**

VISITORS TO "RADIO HEADQUARTERS" USUALLY CARRY AWAY MENTAL PICTURES THAT BAFFLE DESCRIPTION,—BUT THEIR CAMERAS TELL THE STORY WHEN WORDS FAIL.

METROPOLITAN MOVIES

Trade Mark Reg. U. S. Pat. Off.



SHOW BIZZNESS.

"Only fifty seconds left Miss Brown; if you want to finish it, you'll have to make that largo movement 'prestissimo'."

Reproduced by permission from the New York World-Telegram, of June 15, 1932.

"BROADCAST NEWS" IS NOT ON SALE

If you wish to be placed on our mailing list, please notify the editor, at the RCA Victor Co., Inc., Camden, N. J.