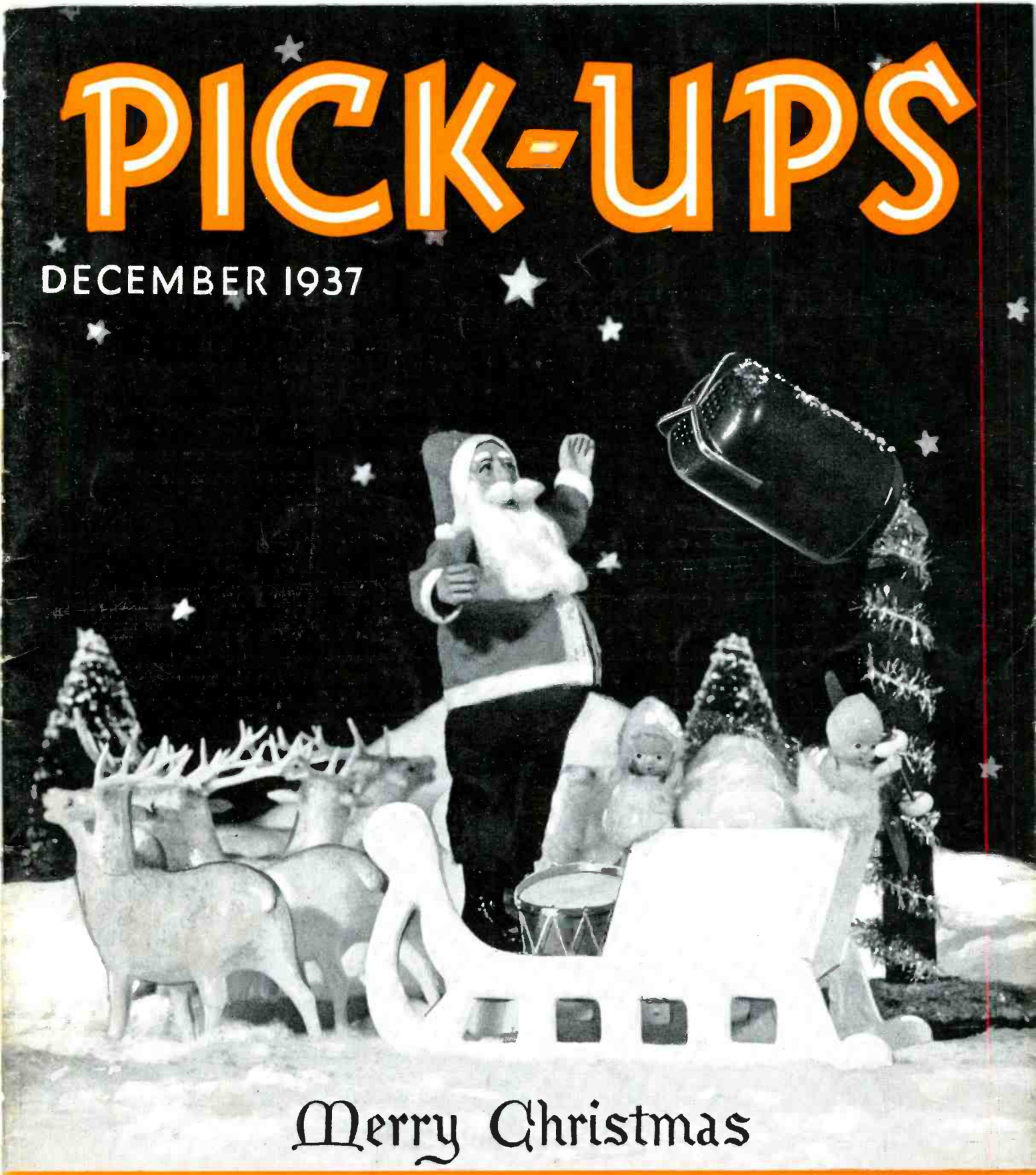
PICK-UPS

DECEMBER 1937



Merry Christmas

Radio's Proving Grounds

"The Public Is the Broadcaster's Governor," Says Truman Ward, WLAC

Camera Preview of New 50KW Transmitter

PUBLISHED BY · · · Western Electric · · · NEW YORK CITY

— PICK-UPS —

BEING A PERIODICAL DEVOTED TO DEVELOPMENT IN SOUND TRANSMISSION. PUBLISHED BY THE

Western Electric Company

195 Broadway, New York, N. Y.

EDGAR S. BLOOM . . . . . *President*
H. B. GILMORE . . . . . *Secretary*
F. H. LEGGETT . . . . . *Treasurer*

WILL WHITMORE, *Editor*
M. M. BEARD, *Assistant Editor*

DECEMBER, 1937

As this old year comes to an end, it is interesting and worthwhile to look back on a year of thrilling achievements rung up by radio. Radio fighting flood waters and winning; cutting the loss of life to almost nothing. Radio giving the world the farewell speech of an abdicating king. Radio giving an eye-witness picture of the Hindenburg in flames. Radio on the spot wherever an episode contributed its part to the history-in-the-making of an entire nation.

It is, however, more interesting and far more worthwhile to think of radio's everyday achievements. Its day by day coverage of every phase of American life. The countless programs which are broadcast in the public interest. The daily job of smaller stations which have to use every resource of mind and man power to fill out the daily program—and how magnificently most of them succeed.

As this is written, a window cleaner hangs precariously from his safety belt on the sixteenth floor of the Woolworth building across the way. How different his perspective and his life horizon must be from that of a lonely farmer whose visual perspective seldom rises above the tops of the trees that border his farm. And yet radio gives them both what they want when their day's work is over.

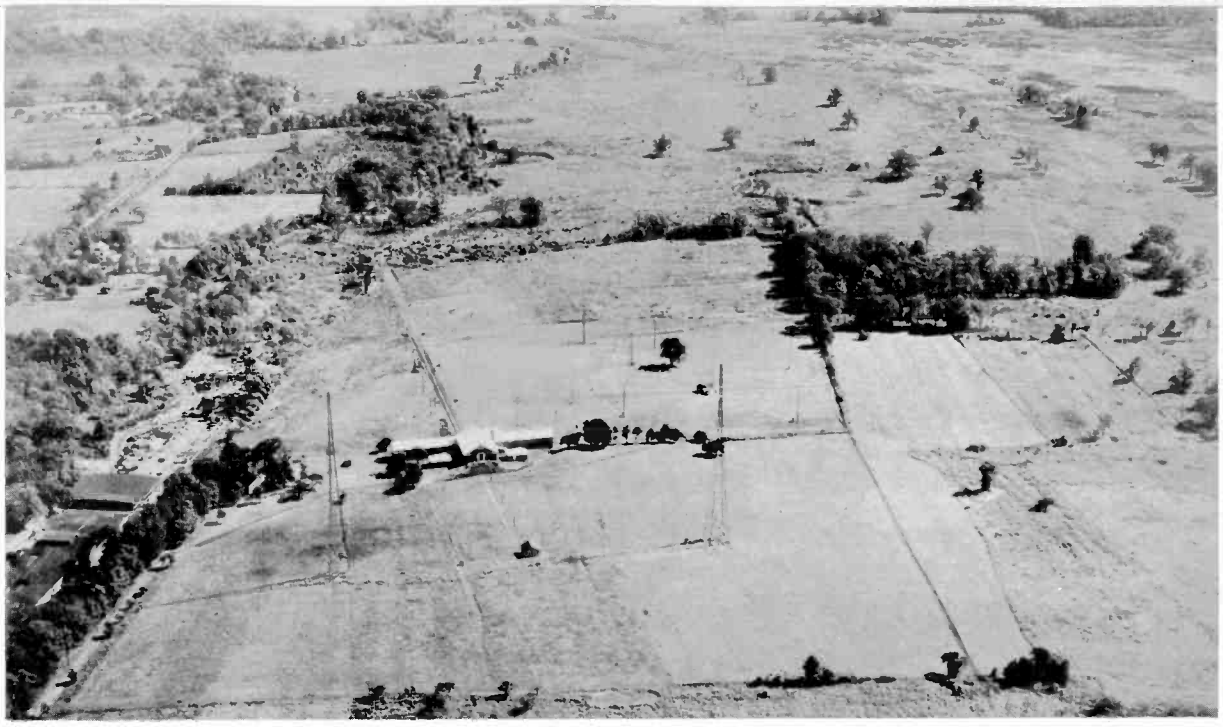
To realize just what a tremendous job broadcasting is doing, get in an airplane and fly from coast to coast. You leave New York where millions of people are cooped up on one little island and before you know it you are flying over broad country where habitations may be a mile apart. Far below you is the twinkling light of a farm house and in it are people getting pleasure and spiritual sustenance from their radio. The next moment the country gives way again to a roaring city where people are no more than feet apart. Again the open country and below you see the lights of an automobile whose driver perhaps is listening to his favorite station miles away.

Cities, villages, mountains, deserts, and plains glide beneath you and down below life is always different; customs, desires and ambitions change with the passing miles. Yet broadcasting serves all of these people.

There's a five kilowatt station down in Nashville, Tenn., that is doing a particularly good job of serving its listeners. *Pick-Ups* brings you in this issue the story of WLAC.

Pick-Ups also tells you how Bell Telephone Laboratories revamped a dairy to make a radio proving grounds.

This Issue



Radio's Proving Grounds

Quiet New Jersey Countryside Now Bell Telephone Laboratories' Field Station for Radio Testing

By R. V. FINGERHUT

From dairy farm to experimental radio laboratory is the transformation that has overtaken a section of the countryside near the little town of Whippany, in northern New Jersey. Though the huge barn still stands, no longer does the bovine herd wander out each morning to graze on the hillside. And on that hillside now stand two tall structures that nature never grew. Inside the long building the whickers and grunts of placid animals have been replaced by the clicking of relays and the muffled whine of powerful generators. The posts that mark the place where stalls once stood now support a wicket fence that bears the warning sign, "Do not enter unless all power has been turned off." Instead of milk, the "farm" now turns out sound, and no farmer was ever as much concerned with the purity and quality of his milk as Whippany's engineers are with the purity and quality of their "product."

Early in 1926 a new transmitter, powered at 50 kilowatts, was nearing completion at the Philadelphia plant of the Western Electric Company. Following the design of Bell Telephone Laboratories' engineers, Western Electric craftsmen had set up racks and frames, installed coils and meters and performed the innumerable tasks necessary for the construction of the most powerful broadcasting transmitter ever manufactured on a commercial basis.

Back in New York, engineers at the Laboratories' headquarters were faced with an unusual problem. They wanted to operate the new transmitter for testing purposes, measure its signal strength, design antennas, conduct any number of exhaustive tests and experiments. But to install it at the West Street laboratories was out of the question. Fifty thousand watts of radio frequency power would raise havoc with thousands of receiving sets in New York City, besides interfering seriously with other work going on in the engineers' own building—delicate tests and measurements that demanded the utmost precision.

It was finally decided that the solution lay in using a field laboratory, away from the crowded metropolis and suitable for high powered transmission, where experiments could be carried on without interfering with radio reception. Three men were detailed to find such a place and spent two months in exploring New York's neighboring countryside before they found it at Whippany.

The selected spot was a dairy farm, owned by R. V. McEwan, operator of one of the nearby paper mills. Unused at the time, it consisted of fifty acres of grassy land bordered by miles of rolling country. A main highway passed nearby and four miles away, in Morristown, railroad connections were available, making the spot only a little over an hour

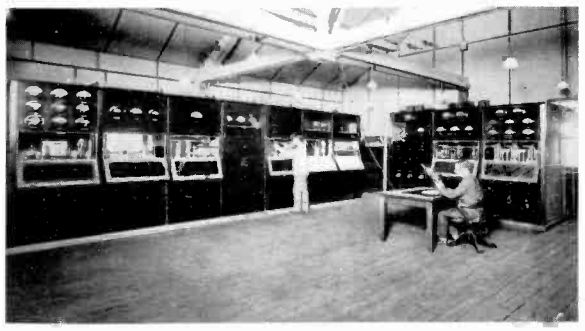
by train from the Laboratories in New York. The farm's one large building, a huge barn and two smaller ones, a pig pen and a carriage washing house, stood at the crest of a slight rise. The barn was a two-storied structure, the lower part of field stone and the upper story covered with shingles. It was a well constructed, good looking building, needing only interior remodeling to make it suit the needs of a field laboratory. That its walls were strong and solid was demonstrated later when the engineers found it took hours to drill every one of the many holes used to lead in the various power lines.

An initial force of four engineers was sent out to prepare the place for use and set up the transmitter which had been shipped to Whippany. These men were faced by a number of problems which one by one they solved by plenty of hard work and a great deal of ingenuity. For a time they ceased being engineers and became carpenters in charge of removing the stalls in the main building. Much time and elbow grease were consumed in destroying the clinging odor that betrayed the building's past history.

After this job had been finished, they became foremen of a gang of ditch diggers during the laying of the extensive ground system, a criss-cross bed of wires buried in the ground over 7,000 square yards in extent. Always willing to substitute brain power for man power, these engineers figured out a method of laying the wires underground that has since been widely adopted. They rigged up a plow with a hollow blade through which wire was threaded and fed from a reel so that when drawn by a tractor the plow would slice deeply into the soil, laying the wire along the bottom of the cut. Across the parallel rows of wire laid by this method ditches were dug and the transverse wires placed, soldered at every point where they crossed. Needless to say it was a tough and muddy job and the sale of hip boots in northern New Jersey reached a new high.

The engineers next became steeplejacks, superintending the erection of the two 250-foot antenna towers which still dominate the scene. These towers were placed well to the front so that the building would be away from the denser portion of the antenna field.

Flowers, shrubs and wooden walks give charm to the spacious surroundings at Whippany.

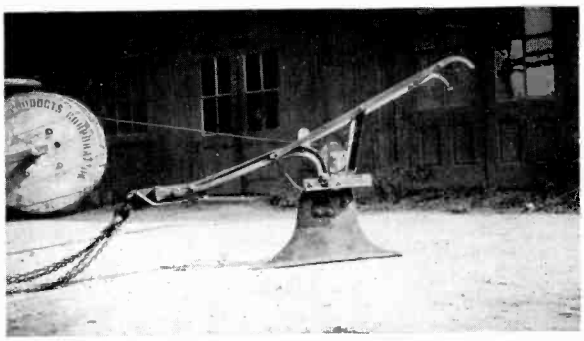


The first 50 kilowatt transmitter, installed in 1927. A comparison between it and the new model can be made by studying the photographs on pages 16 and 17.

All this time the installation of the transmitter had been going on and where cows had munched their cuds and horses buried their noses in mangers, racks were raised and panels mounted. The snicking of wire cutters and the rasp of metal against metal replaced the thud of kicking hooves and the creak of harness leather. Panel by panel, rack by rack, the transmitter grew, until the completed apparatus stood ready to send out over the air the words, "This is radio station 3XN, Whippany, New Jersey."

As soon as the installation had been completed, it was decided to use it for a demonstration of television by radio, coincident with a wired television program scheduled for April 7, 1927. A five kilowatt transmitter that had been installed in New York was moved out to Whippany and adjusted for use as the image transmitter. The 50 kilowatt transmitter was used for the speech channel. This was the first time that a television program had ever been successfully broadcast by radio and Whippany received its initial taste of newspaper headlines.

Following this spectacular work, the engineers settled down to testing and experimenting with the 50 kilowatt transmitter. Starting in May, 1927, a number of test broadcasts were made after midnight, according to commission regulations. Rabid radio fans in all parts of the country, listening in late at night, would suddenly run across a musical program at an unusual spot on their dials. So clear and loud was the signal that many thought they had picked up a local station. Sooner or later they would hear an announcer's voice saying, "This is a test broadcast from 3XN, an experimental station at Whippany, New Jersey." The engineers took turns announcing at the microphone until one night one of them grew too enthusiastic and broke into the forbidden realm of advertising by adding ". . . . , a 50 kilowatt station developed by Bell Telephone Laboratories and manufactured by the Western Electric Company." From that time on, Artie Dolan had the job of announcer



The "contraption" that was developed to lay-in the ground system. The reel is attached to the tractor that draws the plow.

and the faux pas was never repeated.

DXing was at its height at this time and mail from radio fans flooded the local post office. Thousands of letters were received asking for verifications and many were the variations applied to the spelling of "Whippany" by distant listeners unable to find this small town on their maps. At one period, despite the fact that listeners were asked not to write in, 13,000 letters were received from all over the United States and from many distant foreign countries as a result of only ten test broadcasts.

Another task that occupied Whippany's engineers was that of developing and learning a technique for antenna tuning with their powerful transmitter. In this research one set of engineers would erect an antenna and another group had to figure out a formula for its tuning. It became the great delight of the antenna-erecting group to make the task of the others as hard as possible. This friendly contest resulted in an unexpected discovery. While using all sizes and shapes of antennas a single wire, supported vertically by a balloon, was tried. This form, the original "vertical radiator," had astonishing results. The field strength measuring equipment, sent out in trucks during all tests, showed that with the vertical antenna an increase of more than 40 per cent over the then conventional types could be obtained. The outcome of this was the first vertical radiator, installed at WABC in 1928 followed by other installations in all parts of the country.

Another contribution to the art of radio came as the consequence of these experiments in that they developed and improved a technique for field strength measurement and the correlation of the data obtained for use in selecting transmitter sites. This technique has been used in selecting sites for transmitting stations all over the world.

By this time the necessity for and value of a field laboratory had been well demonstrated. The removal of higher powered radio broadcasting equipment from headquarters had eased the problem caused by the increased amount of radio energy dissipated throughout the building. The concentration of broadcasting activities had made it possible to carry on experiments and tests that could never have been conducted in New York. The success of the work at Whippany had definitely shown it to be an ideal site for the field laboratory. So it was, that although it had been established primarily for the operation of the 50 kilowatt transmitter, more and more of the radio activities were transferred to the field, and the force of engineers found their scope of work broadened.

In 1928 Whippany's engineers took to the air. At this time Bell Laboratories had completed the first of the new aviation radio telephone transmitters. Elaborate tests of the new equipment were made culminating in a number of demonstrations that attracted nation-wide newspaper headlines. In one, a representative of every metropolitan New York newspaper was taken up in the Bell Laboratories' plane, each reporter talking to his city editor from the air. In another demonstration the Graf Zeppelin was guided to its landing by a plane equipped with the new aviation equipment. In a third demonstration, a three-way conversation was held between Whippany, the Laboratories' plane and a meeting of scientists at the Massachusetts Institute of Technology. These were the first public demonstrations of plane-to-ground commercial radio telephone equipment.

The next important task of Whippany's engineers was that of testing a circuit designed to improve the operation of all types of radio equipment. This circuit has since become known to the radio world as stabilized feedback. The first broadcasting apparatus in which it was installed was a one kilowatt experimental transmitter. After thorough testing in this and other transmitters, it was installed for commercial use for the first time in the 50 kilowatt transmitter at WOR.

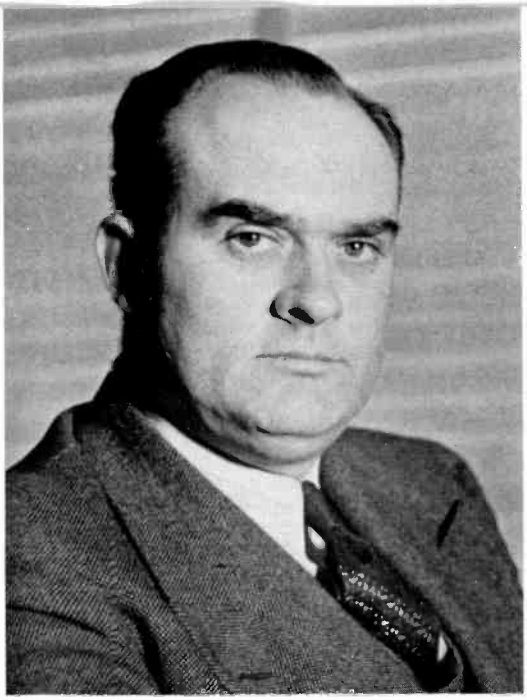
In 1933 William H. Doherty, stationed at Whippany, began experimenting with a circuit designed to increase the efficiency of broadcast transmitters. When perfected, it became known as the Doherty Circuit, and in 1937 was awarded the Liebman Memorial prize by the Institute of Radio Engineers. The first application of this circuit is in the new line of transmitters now being manufactured by the Western Electric Company in the five and 50 kilowatt range.

The present force of engineers, led by A. W. Kishpaugh and R. E. Coram, has just completed the installation of one of the new 50 kilowatt transmitters, replacing the old model which was sold to a commercial broadcasting station and is still doing an efficient job. The new transmitter will be used as was the old one, as a testing medium for the many improvements that result from the Laboratories' never ending research work.

It is just a little over ten years since the first 50 kilowatt transmitter was installed at Whippany. But to compare the new transmitter with the model of 1927 is like comparing one of this year's automobiles with one of a decade ago. The transmitter of today

(*Continued on Page 28*)

Ward and F. C. Sowell, General Manager, confer.



J. Truman Ward

Work moves fast but smoothly across Ward's desk.

"The Public Is the Broadcaster's Governor," Says Truman Ward, WLAC

By WILL WHITMORE

A giant plane glides gracefully to a landing at Nashville Municipal Airport. As the first passenger alights a man with a microphone walks up to him. In a moment an interview with the passenger is being broadcast over Station WLAC, Nashville, Tennessee.

Tim Sanders, Production Manager for the station, is the interviewer. Out to the airport he goes three times each week to interview passengers flying from Coast to Coast on American Airlines crack transcontinental planes. Tim never knows whom he will interview. He just takes a chance, but one thing he is sure of—the people he interviews will make interesting "copy," for they are of every type. They represent slices of life from all corners of the world.

The day I saw him conduct his broadcast, the first person out of the plane was Randolph Scott, movie star. The second was an Atlanta business man, and the third a California housewife. Famous people, unknown people, politicians, movie stars, the private pilot of a maharajah, a French cotton broker on a tour of the South, a world-renowned banker, a polo star—all step out of the plane into the range of Tim's microphone and, what is more important, into the homes of WLAC's listeners. They bring news of the whole wide world, fresh viewpoints, more understanding, a wider life horizon to people who have to live and work in one place.

That is the sort of program WLAC strives to get and does. It is the type of program every energetic, modern radio station is getting. It is one picture of what radio is doing for the public. Radio has accepted the responsibility of presenting, picturing, and interpreting life in all its amazing facets to the American public. WLAC is doing a particularly good job.

Here's another WLAC program, a sharp contrast to the one just related, but just as interesting, and every bit as fascinating in its revelation of human behavior. Once each week F. C. Sowell takes a microphone into the State Penitentiary and interviews a prisoner whose life is circumscribed by gray walls rather than the limitless horizon afforded an air traveler. This program has become extremely popular, not because of any morbid curiosity on the part of the public, but because of its sociological purpose of revealing the causes of crime, and its inevitable futility.

Sowell, formerly a newspaperman, entered radio in Detroit with station WMBC. He became connected with WLAC in 1929 serving first on the sales staff, then as announcer, later as production manager, and today holds the position of vice president and general manager. In addition to his duties as an official of the company, he continues to do some microphone work.

WLAC, a five kilowatt station, makes its primary appeal to the Nashville territory, and effec-

(*Continued on Page 27*)

This new station situated in the heart of Kansas is already making a name for itself in the broadcasting field. It is Western Electric equipped. The transmitter building (at right) is erected on bottom land at the junction of three creeks radiating in different directions approximately 120 degrees, which is the reason for the tower being set on a pedestal. The land may flood to a depth of eight feet and the station still be on the air as all equipment is above high water level. Engineers Brown and Seymour are shown at right of the transmitter building.

N. E. Vance, Jr., Chief Engineer (left), is particularly enthusiastic about the 110A Amplifier shown below in the center panel. KSAL was one of the first stations to purchase this equipment. The 310 type transmitter appears at right of amplifier.

KS

Salina,

Below: Twin 23A speech input equipments afford maximum flexibility of control. For remote programs KSAL uses the 22A.

Hundreds of enthusiastic fans attend KSAL's Saturday night barn dance — a popular feature program. Below: Seventeen of the 22 staff members who are doing fine work for the new station. R. L. Laubengayer is the owner.

Below: One of KSAL's attractive studios which are situated in the Journal Building in downtown Salina. Eight-ball microphones are used — both floor and desk stand models are shown here.

New Police Transmitter Has Many Features of Advanced Design

By WILLIAM K. CAUGHEY

Commercial Products Development,
Bell Telephone Laboratories

The use of ultra high frequency radio communication for police has been steadily increasing since the entrance of the Western Electric Company into this field back in 1930. The line of transmitting equipment for police use up to the present has included a 5-watt car transmitter, and station house transmitters of 5, 50 and 500 watts power. The car transmitter has proved its effectiveness and is extremely popular due to its compact and efficient design. The 5-watt fixed station transmitter is also equally popular particularly in towns of small area. The 50-watt transmitter and 500-watt amplifier are of more elaborate design and meet the requirements for installations in the larger communities. Lately, however, a demand has arisen for a station transmitter of medium power, which would be low enough in cost to be economical for the many medium size towns, and which would yet incorporate many of the recent advances in radio transmitter design.

The new transmitter, known as the 22A, delivers 25 watts of carrier power into a coaxial rransmission line over the frequency band 30-42 megacycles. Aside from the power output rating, the transmitter differs in many respects from other existing Western Electric transmitters for police service. A new mechanical design was followed, which makes possible a low price and at the same time results in a modern appearance. A high-gain audio amplifier permitting the use of the low level, high quality, dynamic type of microphone; and an automatic gain control circuit reduces overmodulation and provides better coverage by keeping average modulation at a high level.

As can be seen from the illustration at the head of this article, the transmitter consists of a single chassis upon which all apparatus is mounted with the exception of the output current meter. The equipment mounted on the upper surface of the chassis is partitioned by means of three boxes having removable covers. Besides providing the necessary shielding, the compartments group the apparatus according to its function in the circuit. As viewed from the front, the left-hand compartment contains the power supply apparatus; the center compartment, the radio-frequency equipment; and the right-hand compartment, the audio-frequency equipment. The operating controls are located on the front of the transmitter and consist of a filament on-off switch with signal light, and a carrier control key which turns on the carrier when operated downward and provides a tone-signal attention call when operated upward. The radio-frequency output meter, located on the front panel, indicates the transmission line current.

All connections to the transmitter are made through the bottom. The power supply and control conduits are run through holes in the table top and terminate underneath the transmitter. The wires are provided with sufficient slack beneath the trans-

mitter so that it can be readily tilted back for inspection. The antenna transmission line connection presented an interesting problem due to the inflexibility of the 7/8-inch diameter transmission line and the requirement that this line must terminate very close to the output current meter, which in this case is located near the top of the transmitter. Any appreciable length of open lead to the meter would prevent it from indicating actual transmission line current. A satisfactory solution was obtained by terminating the antenna transmission line in a junction box mounted on the bottom side of the table top directly below the transmitter and employing a short removable section of transmission line between the box and the output current meter. Figure 1 shows the short section of transmission line and the 22A Radio Transmitter, tilted back for inspection of the apparatus beneath the chassis.

The audio amplifier section of the transmitter has a gain of approximately 100 db. Although this is considerably more gain than is used in the other existing police transmitters it was made possible without undue expense by the use of resistance coupled voltage amplifier stages employing high gain receiver type tubes and an A.F. power amplifier using beam type power tubes. The gain is sufficient for satisfactory operation with a dynamic microphone such as the No. 633A. In addition, a DC microphone supply is incorporated so that either a double-button carbon microphone or a single-button, high-level microphone can be used. Provision for telephone line input is also made.

Although automatic gain control circuits have been applied to radio receivers for many years, the 22A Radio Transmitter is the first commercial transmitter to incorporate such a device. In this transmitter, the control is effected in the audio amplifier and has the characteristic of varying the gain of the amplifier inversely with the applied signal for input levels exceeding a certain fixed amount. The circuit compensates to a large extent for excessive variations in speech level input, reduces distortion due to overmodulation, and allows an increase in the average percentage of modulation. For police application where a monitoring operator is not ordinarily employed, this feature is a distinct advantage, since it enables the operator to pay less attention to how loud he speaks and to the distance he maintains from the microphone.

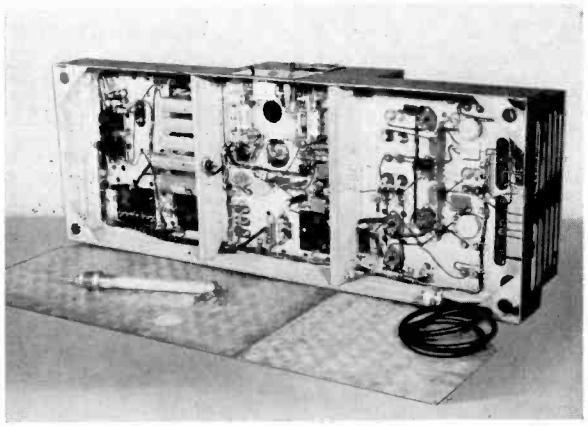


Figure 1

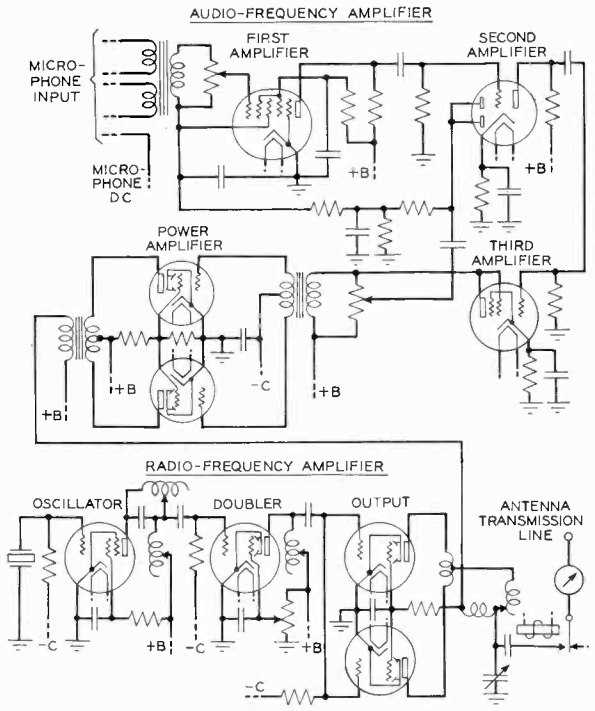
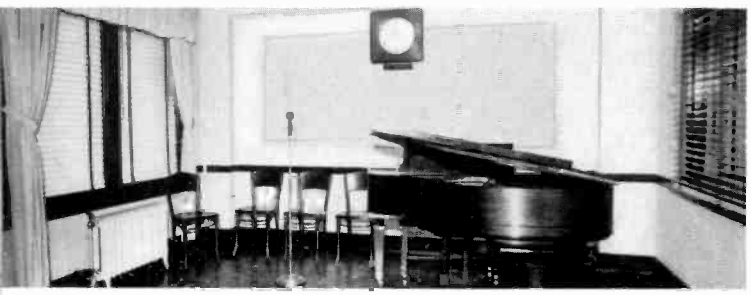


Figure 2

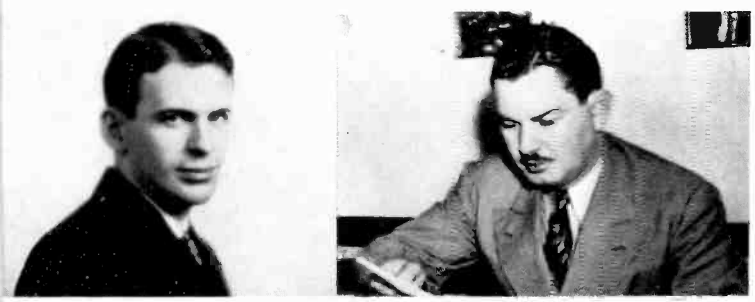
Figure 2 shows a simplified schematic of the transmitter. The audio-frequency amplifier shown in the top section of the diagram supplies the necessary audio power to completely modulate the carrier. It consists of four stages of amplification, two resistance-coupled and two transformer-coupled. The automatic gain control is effected by feeding back a portion of the AC voltage in the plate circuit of the third-amplifier tube, rectifying it in the diode section of the second-amplifier tube and applying the resultant DC voltage as a bias voltage to grids numbers 1 and 3 of the first-amplifier tube. The characteristics of this tube are such that the amplification can be varied over a large range without introducing excessive distortion simply by varying the bias voltage applied to the first and third grids. Figure 3 shows the automatic gain control characteristics of the transmitter. The diode rectifier in the second amplifier tube is biased by the voltage drop across the cathode resistor, so that rectification occurs only for signals having a peak amplitude in excess of this voltage. This produces the change in slope in the characteristic. The amplifier operates normally and at full gain until a signal sufficient to give a high level of modulation is applied, after which the gain of the amplifier is automatically reduced.

(*Continued on Page 22*)

Portion of transmitter room showing studio speech input equipment.

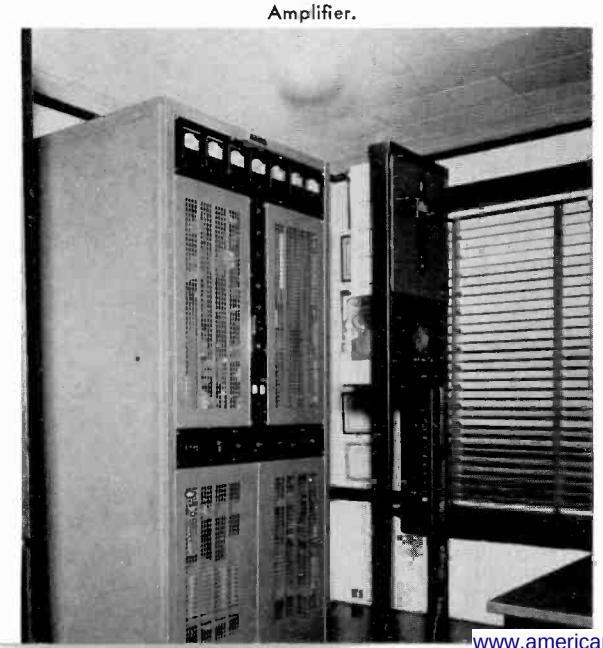


One of WATL's studios, modern in design as well as in equipment.



Jim Comer, Chief Engineer, and Maurice Coleman, Station Manager.

Below: The Western Electric 23A Transmitter and 110A Amplifier.



WATL

Atlanta, Georgia

Atlanta's "Friendly Station," WATL, in Atlanta, Georgia, recently broadened its service to listeners by inaugurating a news broadcasting program designed to keep them constantly informed on the latest news of the world. Out of every hour of the nineteen hours it is on the air, WATL devotes five minutes to news broadcasting.

This service rounds out a program of improvement that started in April with the installation of Western Electric transmitting and control equipment. A 310B transmitting equipment, consisting of a 23A transmitter and its associated vacuum tubes and antenna coupling equipment, was placed in operation at that time. It is supplemented by a 110A amplifier and a 23A speech input equipment, all located in the transmitter room. The latter, six modern studios, work shop and office space, occupy the second floor of the 15-story Henry Grady Building. Atop this building, the highest point in Atlanta, is located the antenna, a 154-foot structure which dominates the entire area.

Looking over the program schedule of WATL it becomes evident that music still holds first place in popularity. The "Good Morning Man" greets listeners every week-day with two hours of popular music. The "Mid-Day Merry-Go-Round" brings an hour of luncheon music each day. On Saturday night the "Dancing Till Dawn" program entertains the stay-up-lates with dance music from midnight until six in the morning. And in between times a number of fine orchestras as well as a wide selection of transcribed programs keep listeners musically entertained.

To secure the pleasing variety of programs that have made WATL so popular, the number of remote pick-up points has been increased to 26. For this work, WATL also uses Western Electric 22A portable remote pick-up equipment. Of this equipment Jim Comer, Chief Engineer of WATL writes: "Our operators are particularly pleased with the operation of the 22A remote amplifier recently purchased from Graybar. The design and performance of the 22A is so far ahead of a competitive amplifier we were using, that I highly recommend it to anyone contemplating the purchase of remote equipment."

Since the installation was completed and regular programs begun on April 7, WATL's carrier has never been interrupted by the failure of any piece of Western Electric equipment.

KRE

Berkeley, Cal.

Keeping step with the steady progress of the broadcasting industry during the past 16 years KRE, Berkeley's only station, now joins the ranks of those up-to-date smaller stations which are broadcasting their programs through the medium of a Western Electric 310 type high fidelity transmitter.

Arthur Westlund

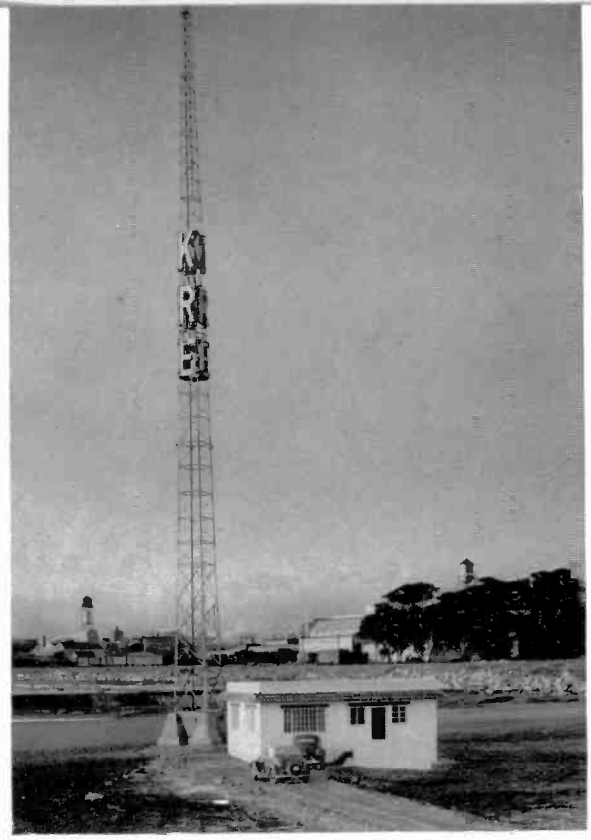
KRE's history dates back to June, 1922, when broadcasting was a haphazard venture. On the air only part time the station progressed slowly until 1931 when Arthur Westlund took over the management and immediately put in motion plans for enlarging broadcasting facilities. New studios were constructed in the Glenn Connoly Building and increased time was requested from the Federal Communications Commission.

Before long KRE started operating on 24 hour schedule. Early this year it was decided to install a complete new transmitting plant. The management selected the Western Electric 310B Transmitter, 23A Speech Input Equipment and salt shaker microphones. K. Gordon Morrison, Chief Engineer, assisted by Jack Dundin of Graybar, did the job.

The new transmitter building was erected on a plot of land on the Berkeley waterfront in what will be the "Garden of Nations" in the city's Aquatic Park. The structure is early California architecture, with sound proof control room and is completely air conditioned. Over 32,000 feet of wire were used in the ground system for the Blaw-Knox shunt-excited vertical radiator, 180 feet high.

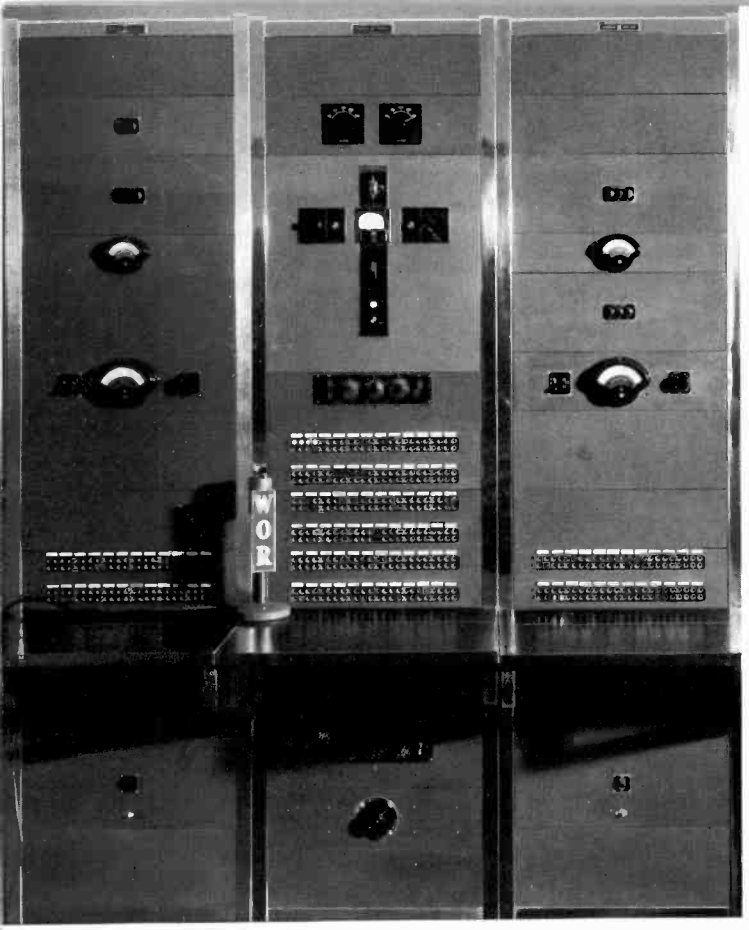
According to station officials the operation of the new equipment, which went on the air without a hitch, has resulted in greatly improved quality of signal as well as increased coverage. It is estimated that KRE's primary coverage now includes the entire San Francisco Bay Metropolitan area.

Following the modern trend of furthering educational broadcasts KRE features among its programs "News for the Blind," Berkeley public school broadcasts and the University of California's "Collegian Pictorial."



The shunt-excited tower rises 180 feet in the air. Below: Transmitter site on Berkeley's water front.

Below: The 310B Transmitter (seen through wall panel) 23A Speech Input equipment, salt shaker mike on desk.



The 110A Amplifier

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Station Engineers Acclaim New Radio Development

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IN February, 1937, Bell Telephone Laboratories, announcing the development of the 110A Amplifier, promised it would bring a number of extraordinary benefits to broadcasters. Within four months, relying only on that promise, over 150 chief engineers and station managers had sent in orders for this equipment. In June, 1937, deliveries started and stations began to install the new amplifier. Again a few months passed and *Pick-Ups,* desirous of knowing if, in the opinion of these stations, the 110A had lived up to the promises of its developers, sent out a questionnaire asking for details and information on its performance.

Replying to this questionnaire, 19 chief engineers sent in their answers, telling, with facts and figures, just how the 110A Amplifier had aided their particular stations. All of the letters include compliments for the unit, varying from short remarks such as the one from G. W. Ray, Chief Engineer of WICC, Bridgeport, Connecticut, who says, "It is doing all that Western Electric claims," to more positive statements such as H. V. Anderson's, Manager of WJBO, Baton Rouge, Louisiana, who writes "We consider the 110A Amplifier the outstanding development in radio broadcasting during the past five years."

What increase (if any) in service area has been reported? was the first question, and the most important, too, since any increase in coverage means money in his pocket to a station owner.

Many of the stations answering had not conducted a survey during the short time their amplifiers have been in operation. Those who had, however, indicated that the modest words "if any" in this question were completely wasted. R. J. Stark, Chief Engineer of WMBH, Joplin, Missouri, tells of a survey they had made to determine the performance of the 110A Amplifier. "The results of this check were very encouraging, the coverage actually being more than doubled over that which had formerly been determined by a field intensity and coverage survey." Chief Engineer W. P. Moore of WDAE in Tampa, Florida, says that while they had made no actual measurements "we believe that our normal coverage has been increased not less than 25 per cent."

H. H. Newell, Chief Engineer of WTAG, Worcester, Massachusetts, bases his praise on verbal reports from listeners, showing an increase in area served, and in the signal in the previous area. Julius Hetland, Chief Engineer of WDAY, Fargo, North Dakota, contributes a contour map on which he has marked the increase in service area resulting from the use of the 110A Amplifier. He reports that "this is equivalent to a 25 per cent increase in area within our .5 millivolt contour, or 10,000 additional square miles with a population of 160,000. It is equivalent to a 21.6 per cent increase in area within our .1 millivolt contour or 19,000 square miles with a population of 304,000."

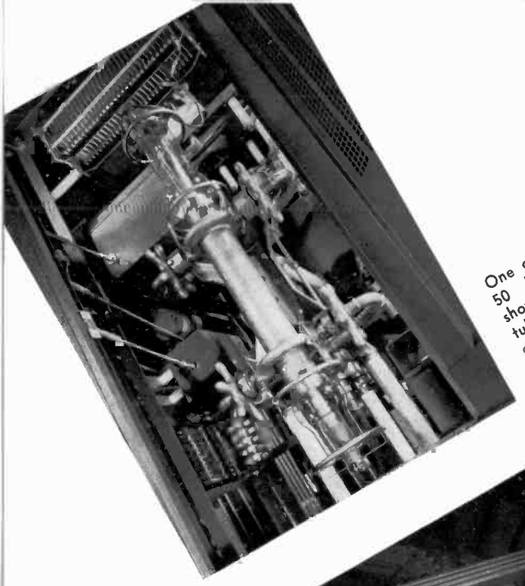
Next to increasing coverage, the greatest objective of radio stations is to increase the signal strength in their present territory. *Pick-Ups* covered this subject with its second question, *Has there been an improvement in signal delivered in your regular service area?*

This must have been an easy question because every reply had an answer for it, the only difference between answers being the number of words it took to say "Positively." Chief Engineer W. M. Boher of WINS in New York, N. Y., writes, "there has been marked improvement in the signal delivered to our service area. Quite a few reports indicate that

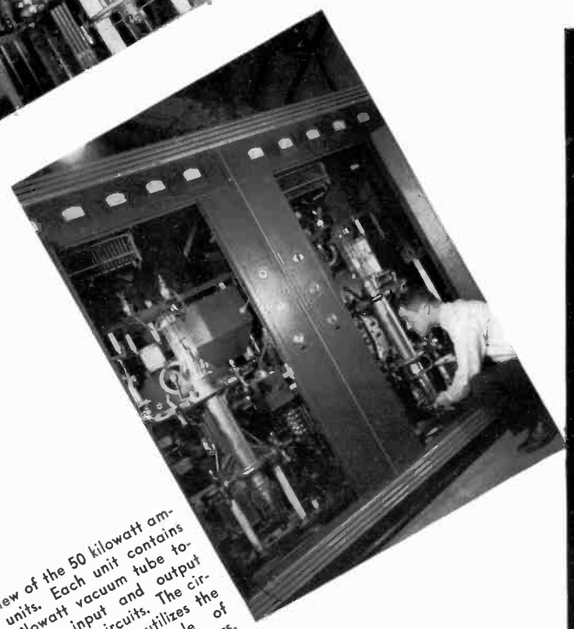
(*Continued on Page 25*)

PREVIEW!

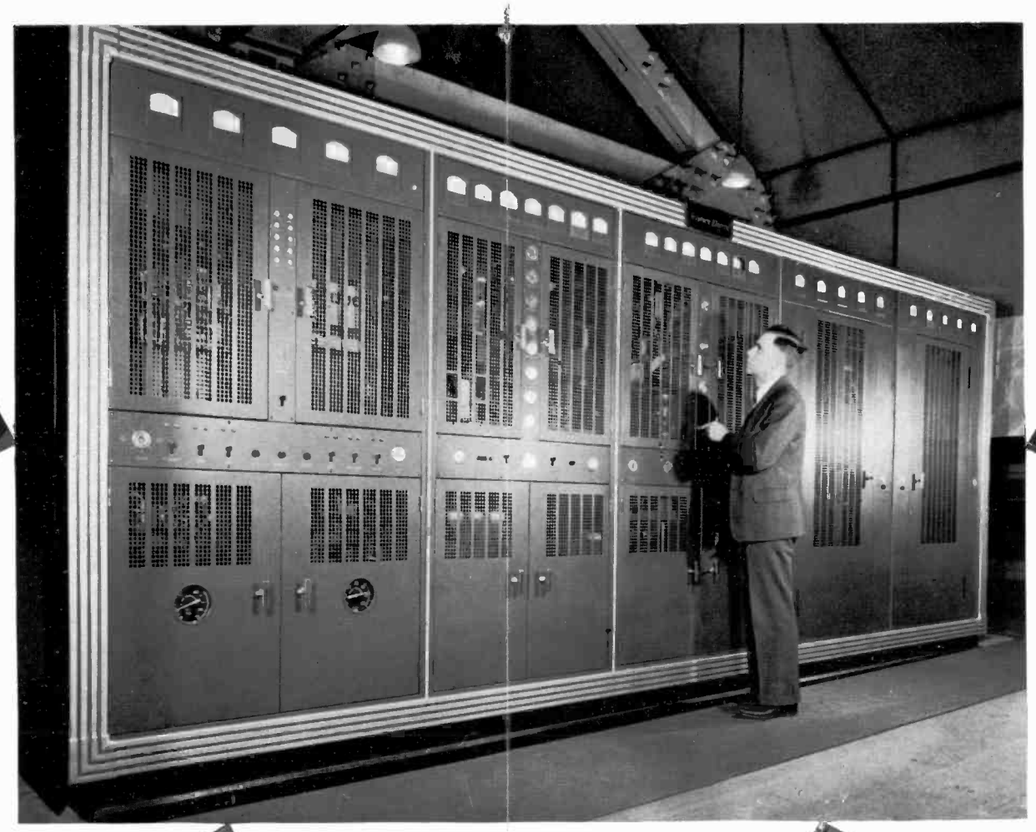
Introducing, gentlemen, Western Electric's New 50 Kilowatt Broadcast Transmitter — the 407A. 'Pick-Ups' gives you this camera preview of the transmitter now being put through its paces at Bell Telephone Laboratories' radio proving grounds at Whippany, N. J. The 407A marks a new era in high-quality, high-efficiency broadcasting.



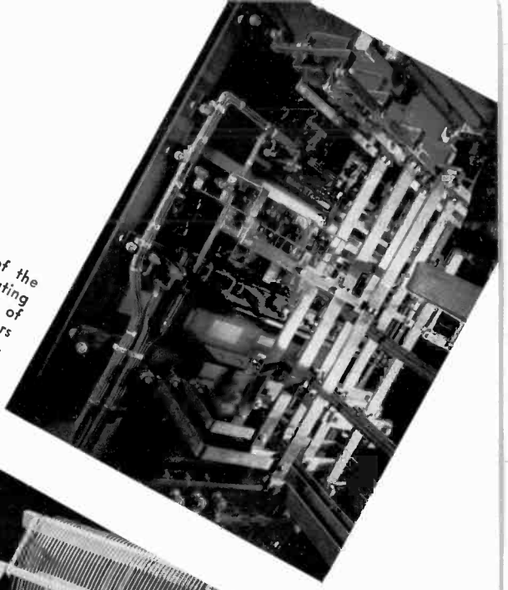
One of the units in the 50 kilowatt amplifier, showing the 100 kilowatt tube in its mounting. The connections for the water cooling system are clearly visible in photo.



Front view of the 50 kilowatt amplifier units. Each unit contains a 100 kilowatt vacuum tube together with input and output radio frequency circuits. The circuit of this amplifier utilizes the famous Doherty principle of high efficiency linear amplifiers.

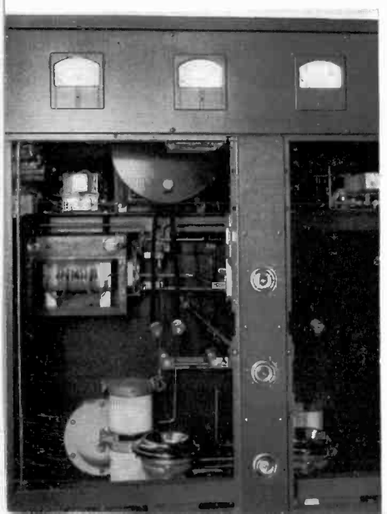


The 407A, 50 kilowatt, high efficiency radio transmitting equipment. The units are (from left to right) the power control unit, the radio frequency driver, the modulating amplifier and, in the last two units, the 50 kilowatt amplifier.

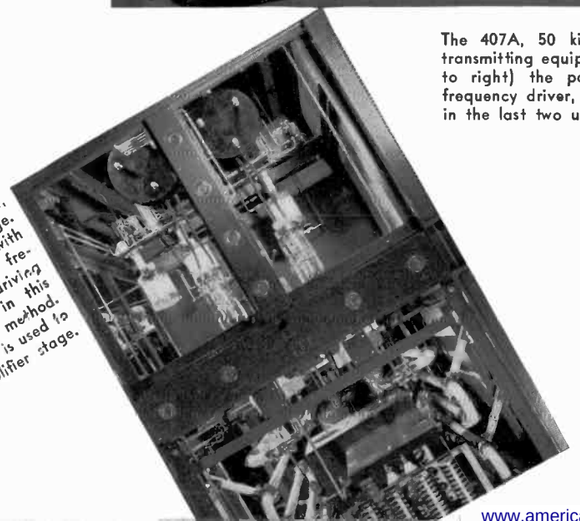


An interior view of the low voltage distributing panel containing all of the heavy contactors and circuit breakers associated with the complete transmitter system.

A close-up view of the output circuit of the 50 kilowatt amplifier showing a section of the harmonic filter. In this, as well as in other photographs on these pages, the wide use of ceramic insulating material is apparent.



The upper section of the modulating amplifier with the tubes removed. This photograph clearly illustrates the accessibility of all parts of the equipment.



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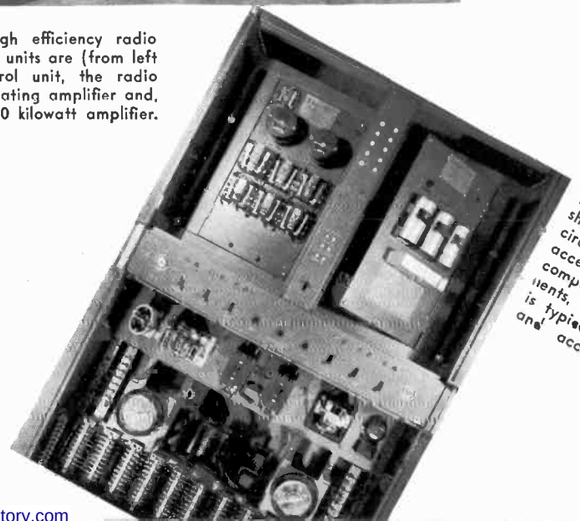

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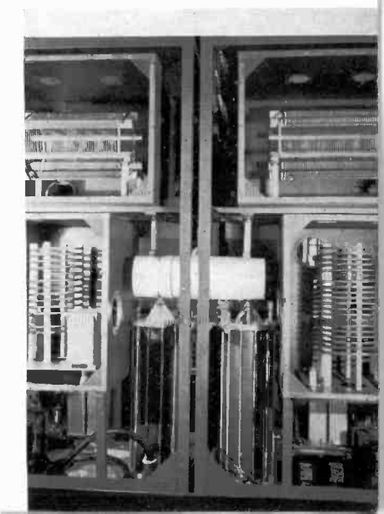

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New
Control Circuit
for
High-Power Broadcast Transmitters

By N. C. OLMSTEAD

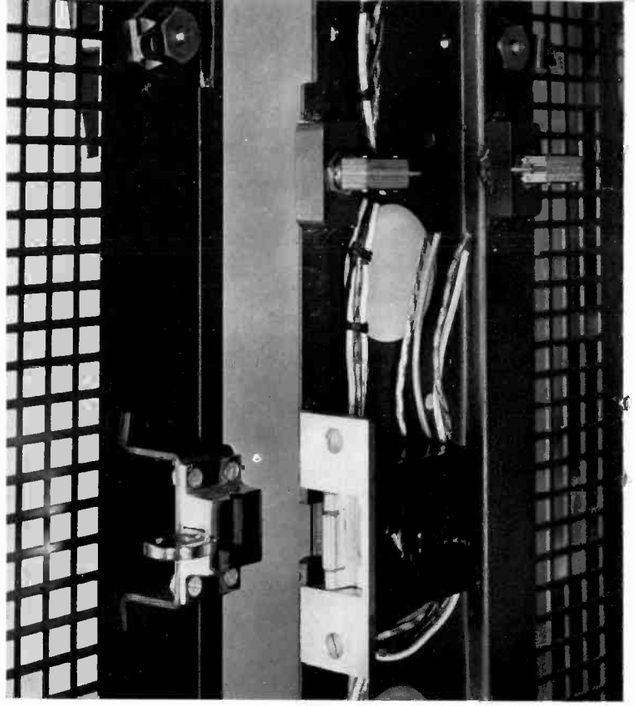
Commercial Products Development,
Bell Telephone Laboratories

The functions of the control circuit in a radio transmitter may be broadly classified as energizing the apparatus in the proper sequence, protecting the equipment from overload and abnormal circuit conditions, and protecting the personnel operating and maintaining the transmitter. The design of the control circuit for the new Western Electric broadcast transmitters involved not only these fundamental requirements but also that the basic circuit be readily adaptable, by minor modifications and additions, to the control of any size transmitter having one or several stages of water-cooled tubes.

Some of the important features of the new control circuit are: independent control of power to the various portions of the transmitter, reheating of filaments of mercury-vapor rectifier tubes proportional to the cooling time for brief power failures, electrically-operated circuit breakers for the control of high voltage, positive overload tripping and automatic reclosing of plate power, complete signal lamp indication, emergency manual controls to release the rectifier filament delay and reclose the plate power after overload lockouts.

To maintain full flexibility for transmitters of various powers, the control circuit is separated from the power circuits so that it energizes the necessary relays, contactors and signal lights but does not directly supply power for any portion of the transmitter.

Occasions may arise in the maintenance or test of the equipment when it is desirable to energize only a portion of the transmitter. To secure this flexibility, the control circuit is sectionalized into independent circuits. A series of toggle switches on the control unit which energize contactors permit (a) energizing the driver unit alone, (b) energizing the water system or the water system and amplifier filaments, (c) energizing the filaments of all rectifier



Electric door locks are typical of the many safety features which protect operating personnel. The photograph was made during transmitter construction.

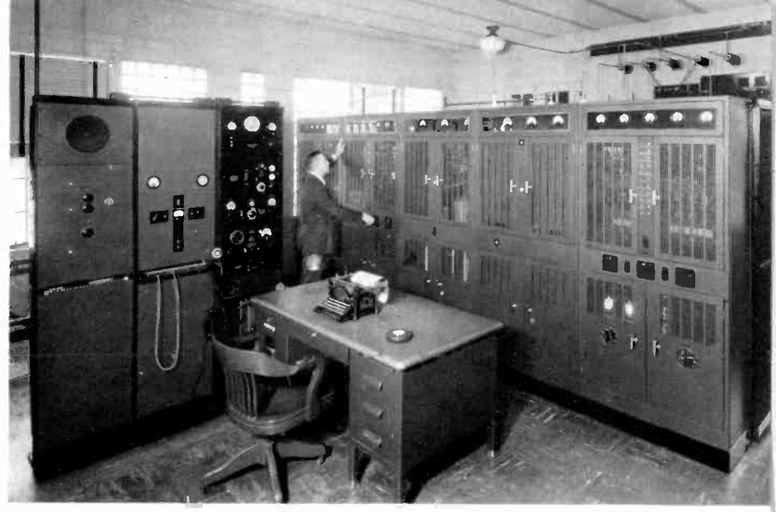
tubes or the filaments of the rectifier tubes and the bias rectifiers. Plate voltage, of course, cannot be applied unless all of these sections are energized.

Energizing the water system starts the pump and the fans on the radiator coolers. Controllers in each branch of the water system prevent energizing the particular amplifier filaments until sufficient water flow is obtained through the tubes. Resistors in the primary supply which are shorted out after a definite time delay permit the starting of the filaments of the larger sizes of tubes in two steps.

The independent control of the rectifier filaments from the control unit enables the operator to preheat the mercury-vapor rectifier tubes any desired amount. A time-delay relay in the control circuit prevents the application of plate voltage until after the filament structures have reached normal operating temperature. This delay is usually two or three minutes for the larger tubes. A slow release relay transfers the control in case of power failures of less than about six seconds to another delay relay which has a reclosing time proportional to the de-energized time. The reheating time of the tubes is thus correlated with the cooling time so that the filaments are at operating temperature before plate voltage is reapplied. In case of momentary interruptions in the power supply, this feature will automatically restore the transmitter to operation more quickly than an operator can act. A lock-up relay and an associated push-button permit the operator to eliminate all time delays when a loss of time on the air and a consequent loss of revenue may more than offset the risk of short-

110A Amplifier Installations

The 110A Amplifier has become standard equipment on the racks of broadcasting stations throughout the country. An interesting feature is its use in stations of all sizes. On this page alone are five installations with power ratings of 100, 500, 1,000, 5,000 and 50,000 watts.



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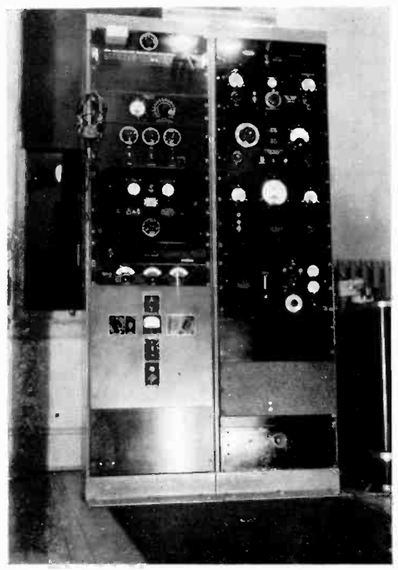

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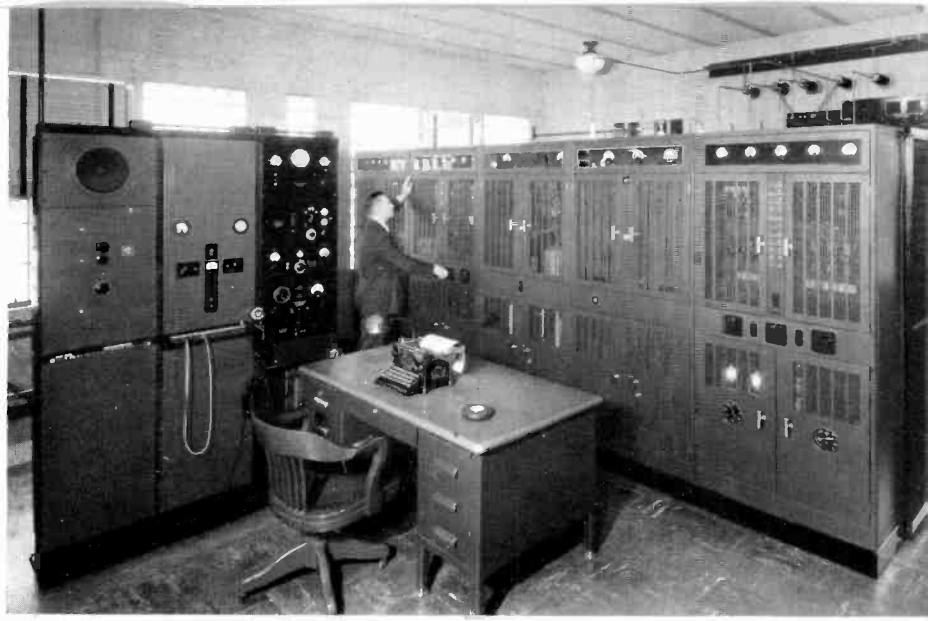

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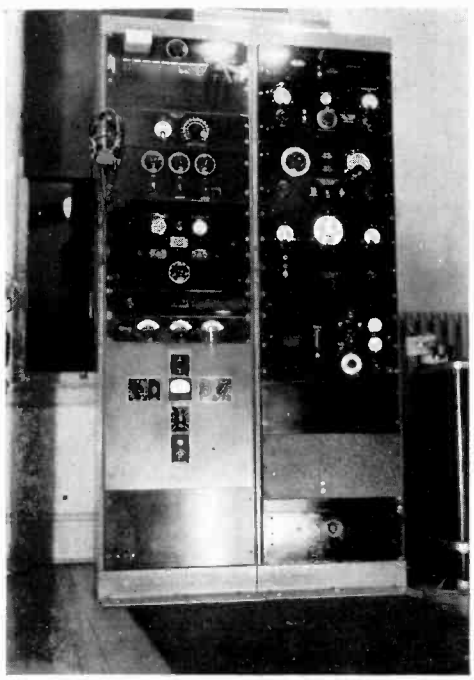

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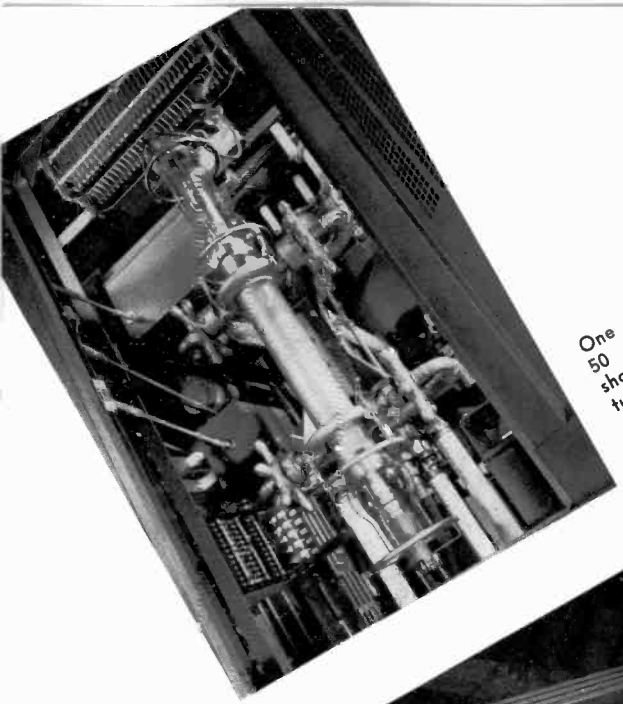

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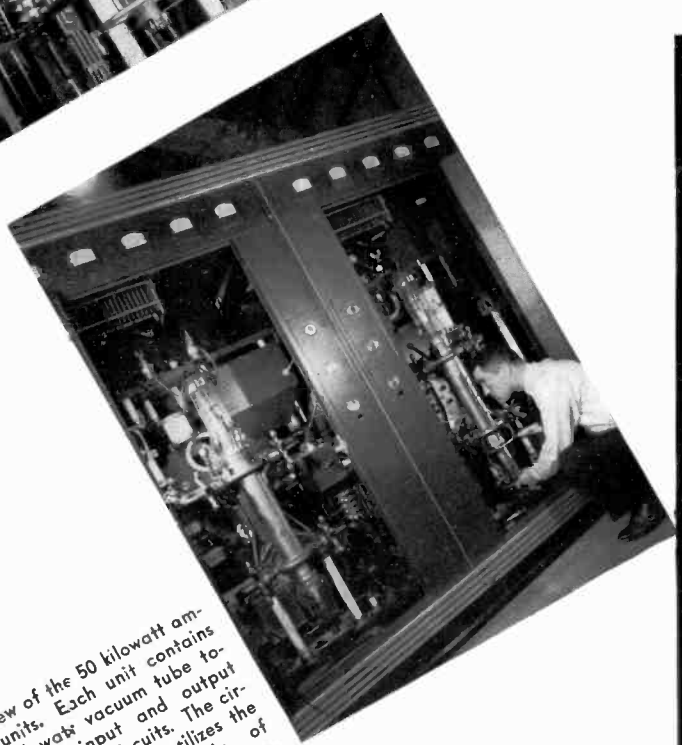

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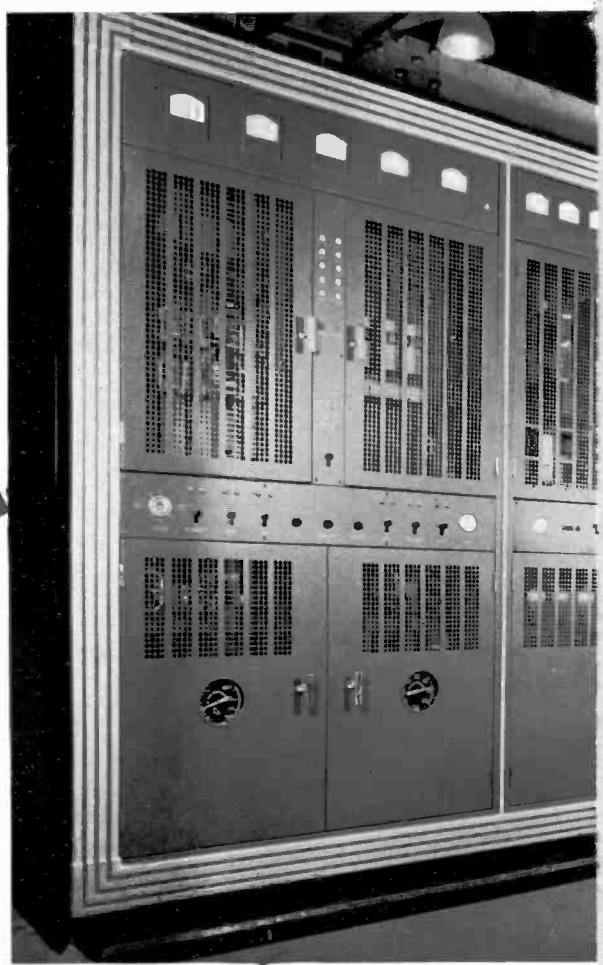

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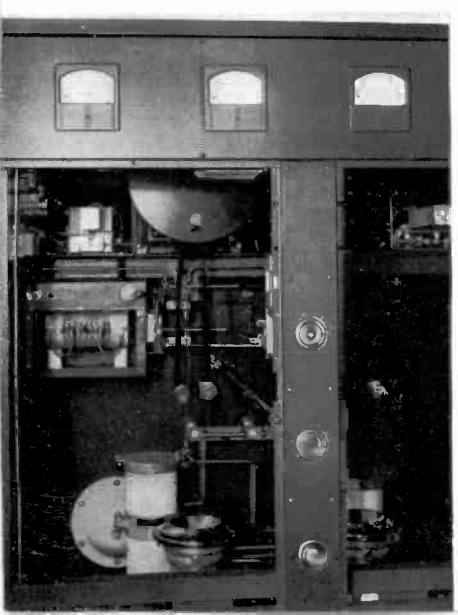

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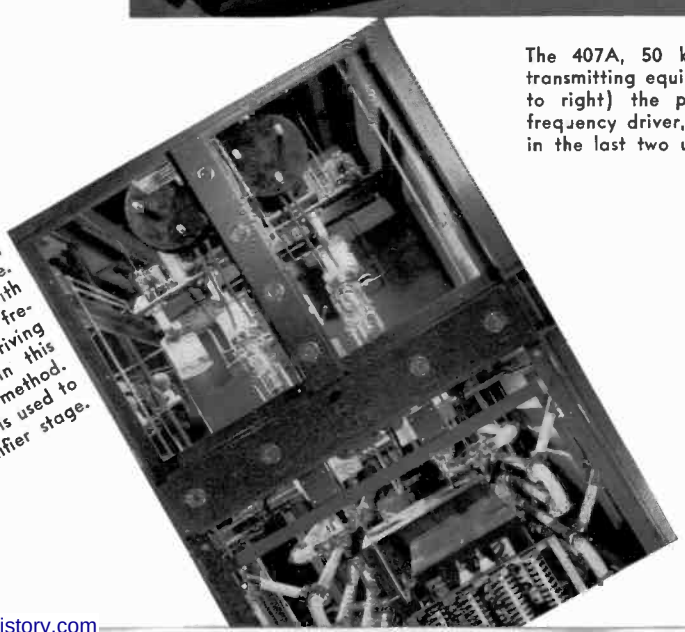

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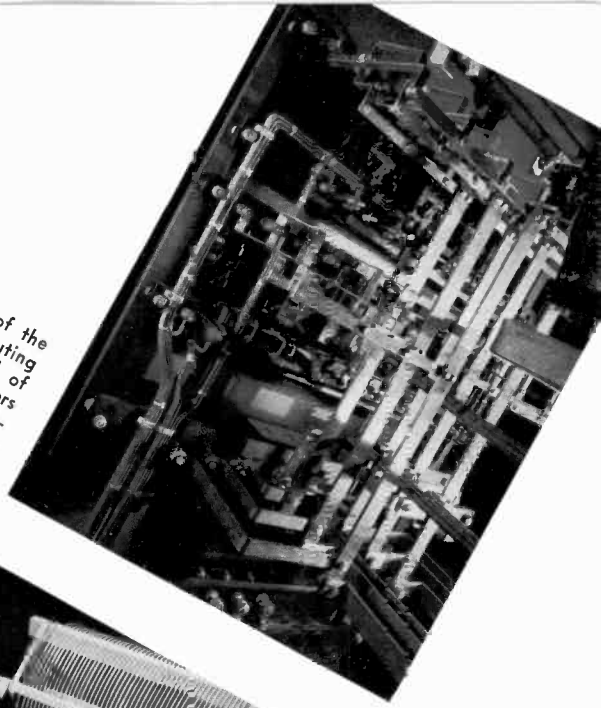

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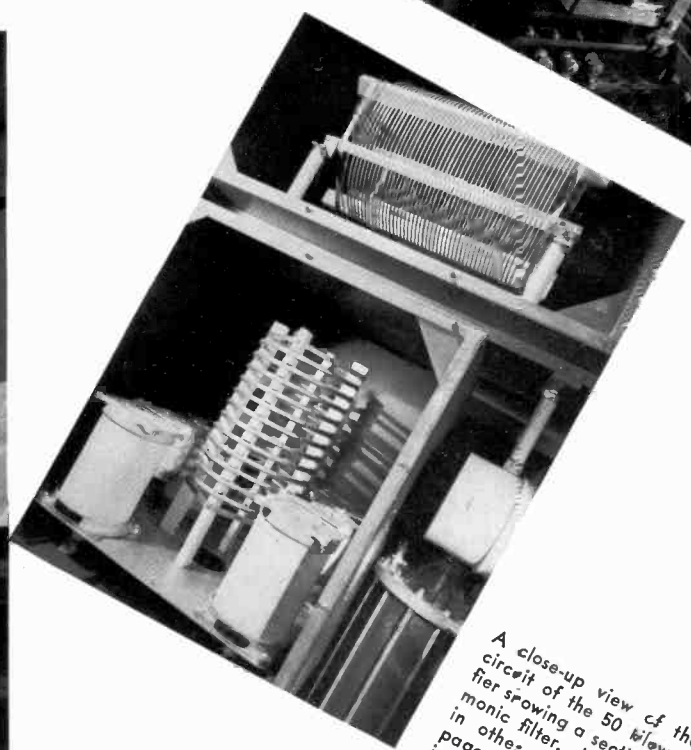

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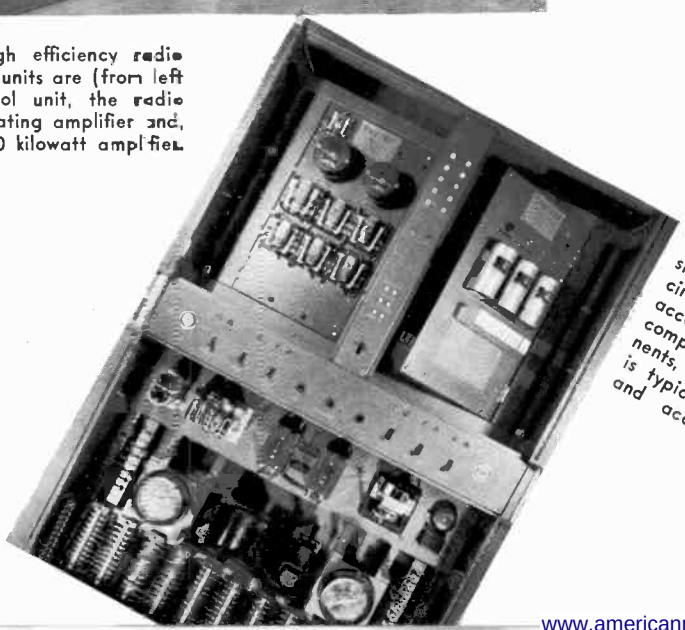

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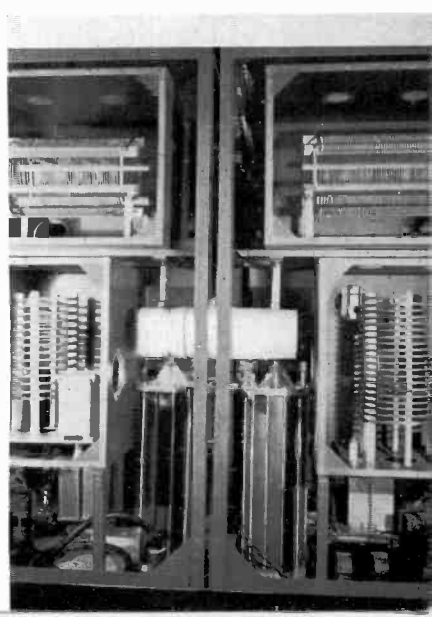

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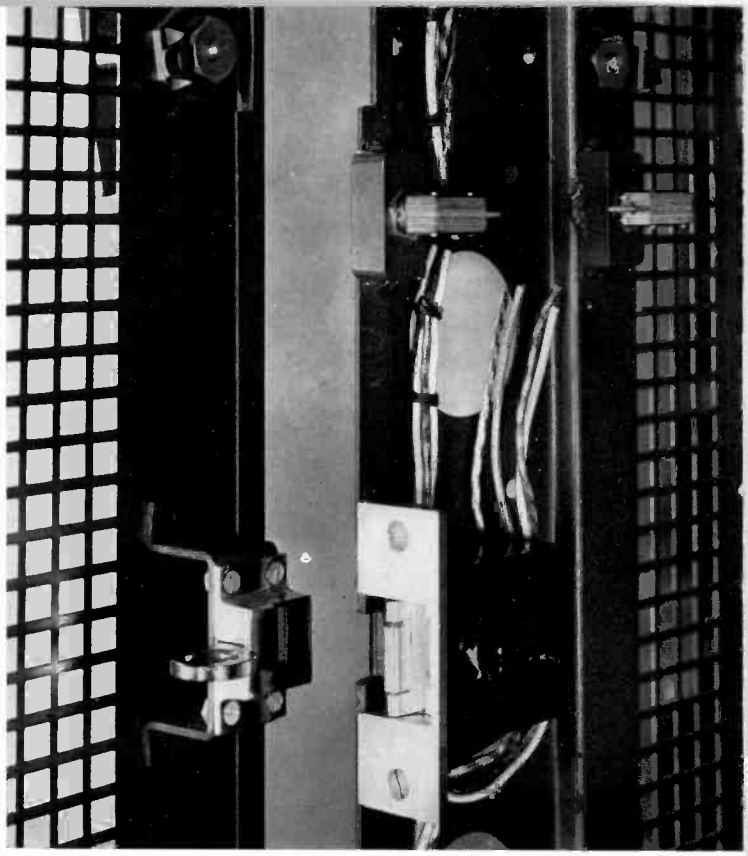

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Some of the important features of the new control circuit are: independent control of power to the various portions of the transmitter, reheating of filaments of mercury-vapor rectifier tubes proportional to the cooling time for brief power failures, electrically-operated circuit breakers for the control of high voltage, positive overload tripping and automatic reclosing of plate power, complete signal lamp indication, emergency manual controls to release the rectifier filament delay and reclose the plate power after overload lockouts.

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Energizing the water system starts the pump and the fans on the radiator coolers. Controllers in each branch of the water system prevent energizing the particular amplifier filaments until sufficient water flow is obtained through the tubes. Resistors in the primary supply which are shorted out after a definite time delay permit the starting of the filaments of the larger sizes of tubes in two steps.

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ening tube life by the premature application of high voltage.

An electrically operated circuit breaker with its inherent capability of opening large overload currents is used for controlling the power to the high-voltage plate rectifiers instead of the usual contactor. The closing circuit for this breaker is interlocked with the filament and bias power supplies. A recloser associated with the closing circuit automatically recloses the breaker once in case it is tripped by any overload. After an operation, the recloser resets itself whenever the breaker remains closed any preset time between 9 and 90 seconds. Although the breaker recloses but once automatically, a push-button enables the operator to further reclose as many times as he wishes.

All branches of the power supply are protected by small manual circuit breakers instead of fuses. These breakers are self-indicating after they have opened an overload, and they may be reclosed, without replacing any elements, as simply as closing a switch.

Power to the high-voltage rectifier is supplied through the electrically controlled circuit breaker. In case of large overloads such as caused by arc-backs in the rectifier tubes, the instantaneous trip element opens the breaker within one or two cycles. Make contacts on overload relays operated by the plate current of each amplifier tube control a trip coil in the breaker directly. The opening time of the breaker including the operate time of the overload relay is only three or four cycles. The use of make contacts in the overload circuit eliminates many false operations due to dust or vibration with their resultant loss of program time. The equipment is amply protected as the overload circuit is backed up by the independent trip elements in the breaker itself.

Complete lamp indication is associated with the overload circuits. The lamp circuit is reset independently after the equipment is restored to normal operating conditions.

The entrance to the high-voltage rectifier enclosure is equipped with a grounding switch for all high-voltage AC and DC circuits. A mechanical interlock between the entrance door and the ground switch prevents the door being opened except when the high voltage is grounded or prevents removing the ground when the door is open. This switch and all doors on the enclosures and units are provided with gate switches which open the bias and high-voltage supplies. All doors not mechanically locked by the grounding switch are equipped with electric locks which can be energized to release the door only if the grounding switch has been operated.

Provision is made for making a power change in a transmitter. Depending on the particular transmitter, the power change may be of the type where either all voltages are changed on the final stage or where the final stage is dropped out and the output taken from a previous stage.

Shunt Excited Antennas Proof Against Lightning

Elimination of equipment damage and service interruptions due to lightning is one of the chief advantages of the shunt excited radiator developed by Bell Telephone Laboratories, reports Paul A. DeMars, Technical Director of the Yankee Network. This type of coupling equipment has been in operation at WEAN, Providence, Rhode Island, since December 12, 1936, when installation of two 325 foot, self-supported Blaw-Knox radiators was completed.

During the past summer exceptionally severe thunderstorms occurred in the Providence area. Despite the intensity of the lightning, WEAN suffered no interruption of service or damage to equipment, while two other Providence stations, each of which also employs directional antennas with two self-supporting towers, but with conventional coupling equipment, suffered both. Furthermore, very little evidence of high potentials was observed in the coupling equipment at WEAN. Protective devices on the transmission line operated only once or twice during exceptionally severe lightning discharges, and it is the opinion of WEAN's engineers that even without these protective features no damage to the equipment or interruption of service would have occurred.

In February, 1937, the guyed tower used by WNAC and WAAB in Boston was changed from an insulated to a grounded radiator shunt fed by both transmitters. This change was made for several reasons, not the least being the desire to minimize trouble from lightning. The Boston stations were not subjected to as severe lightning discharges as WEAN, but here, too, no trouble occurred during thunderstorms. Not only was there no damage or interruption to service at WNAC-WAAB, but there was no evidence of any high potentials at the coupling equipment. The WNAC transmission lines were equipped with a protective device against high potential, but it never operated. WAAB transmission lines were not so equipped, yet they suffered no damage. Other stations in metropolitan Boston suffered damage to equipment and interruption to service.

Paul A. DeMars says: "We appreciate that many factors determine whether or not trouble will occur from lightning. We believe, however, that the freedom from trouble in Boston and Providence during the past summer is due principally to the use of grounded radiators with shunt excitation."

Besides the necessary switch, relays and lamps indicated above, the control unit contains the usual line, bias and plate voltmeters.

KXRO

Aberdeen, Wash.

May your success be as far reaching as your new transmitter, was one of the many congratulatory messages received by KXRO, Aberdeen, Washington, during the dedication ceremony of their new transmitting equipment celebrating the station's increase in power from 100 to 250 watts. Apparently the wish is being fulfilled. Recent reports indicate that because of the increased coverage and improved tone quality made possible by the Western Electric 310B transmitter, KXRO is winning hosts of new listeners in Western Washington.

An outstanding feature of the installation is the exceptionally fine ground wave afforded by the location of the transmitter and the 189-foot Blaw-Knox tower situated at Finch Farms. Here salt marsh provides one of the best ground systems in the country. In recent years radio technicians have been stressing the ground wave rather than the sky wave in order to avoid freak and skip distribution of signal. With such a splendid location KXRO's programs are being heard exceedingly well within the city of Tacoma.

Ten remote control points have been provided in Grays Harbor and Pacific counties. The line to the Raymond outlet is said to be the longest west of the Mississippi River. Other regular remote pick-up points are located at the Hoquiam and Aberdeen high school gymnasium and athletic fields, the Trinity Episcopal church in Hoquiam, the Congregational church in Aberdeen, the Elerding chapel and the Warner Brothers theatre.

For the past nine years Harry R. Spence, a pioneer in the broadcasting industry, has directed the activities and formulated the policies of KXRO. Before joining the Grays Harbor organization he was associated with KMO, Tacoma. During 1928 he left Tacoma to reorganize KXRO. In his capable hands the station took on new life. He has consistently aimed for better service to listeners of the Grays Harbor area. "Make 1310 on your dial a habit" has been his motto.

When the new high fidelity transmitter at Finch Farms was placed in operation the latter part of July, one of Mr. Spence's ambitions was realized: for with the increase in power and a modern transmitting plant for KXRO came new standards of transmission and quality and increased listener popularity.

As president and general manager of the station, he heads a competent staff of 23 persons among whom are: Fred G. Goddard, Vice President and Sales Manager; Edwin J. Alexander, Commercial Manager; Ben K. Weatherwax, Program Director; Carlos Pendergraft, Musical Director; W. M. McGoffin, Chief Engineer; R. P. Heatlie, Sam Norin and Kenneth Grinde, engineers.

Harry R. Spence, President

W. M. McGoffin, Chief Engineer

R. P. Heatlie, Engineer

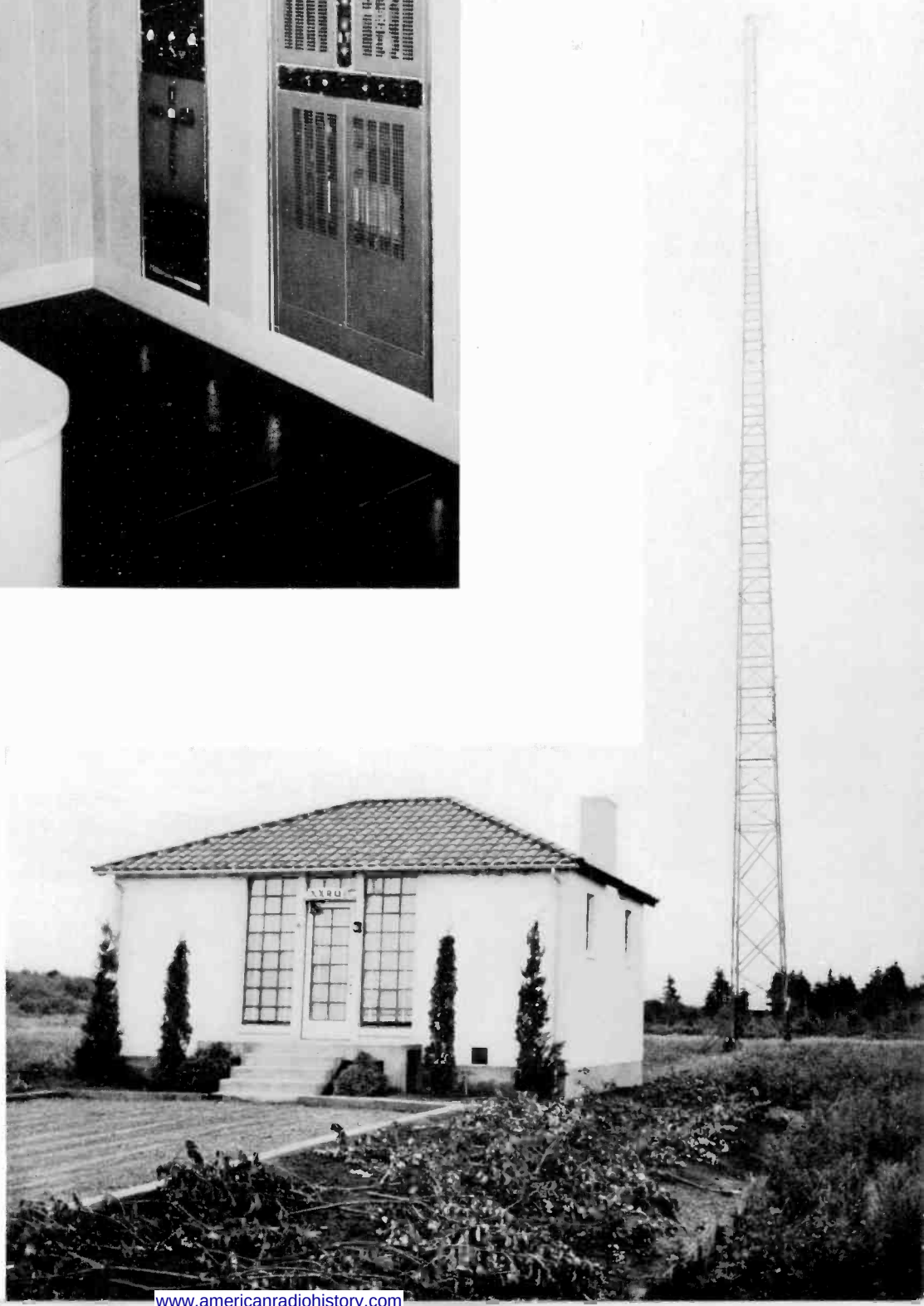
Kenneth Grinde, Engineer

The new Western Electric 310 type transmitter (left) which boosts the station's power from 100 to 250 watts. Dedication programs were heard by New Zealand listeners. The 110A program amplifier is shown at left of transmitter.

Left: Double deck transcription equipment permits use of two vertical cut turn tables in space of one. Compact wall cabinet contains spare tubes.

KXRO's modern transmitter building (right) which is constructed of concrete and stucco. The 189 foot Blaw-Knox radiator in background.

Left: A room with a view to gladden the heart of any engineer who has the good fortune to work in such surroundings — everything at his fingertips.



The latest, and so far the simplest method of carrying a microphone is to wear it. So at least have decided Mathew McEniry of KLZ, Denver, Colorado, and Dave Driscoll of WOR in New York. The breast-plate with its attached eight-ball, worn by announcer McEniry during his "Roving Reporter" broadcasts, is a sure attention-attracter. In this view he looks as if he is eating an apple-on-a-stick. Dave Driscoll of WOR's special features division is particularly fond of his salt-shaker attachment since it also leaves both hands free. Both arrangements, while permitting free movement of hands or body, prevent the fading, or change in voice level that is sometimes noticeable when an announcer accidentally moves away from his mike to catch some spectacular incident.

New Police Transmitter Has Many Features

(*Continued from Page 11*)

Provision is made in this transmitter for allowing the audio amplifier to act as an audio oscillator to transmit a distinctive tone-signal attention call. The circuit switching for this connection is performed by a relay which is operated either by the manual tone-carrier key located on the front of the transmitter or by a semi-remote control switch. When the relay is energized, a series resonant tuned circuit is connected between the cathode circuit of the second amplifier stage and the plate circuit of the fourth or A.F. power amplifier stage.

The radio-frequency amplifier equipment consists of a crystal-controlled oscillator employing a pentode type tube operating at one-fourth the carrier frequency, a doubler stage using a beam type power tube, and a R.F. output stage employing two beam-type tubes connected in parallel. Continuously variable inductances are used for tuning the various radio frequency circuits in order to maintain a high efficiency over the frequency range without the use of plug-in coils. These inductances are adjusted from the front panel by means of a screwdriver. A radio-frequency gain control is provided to compensate for output variations of the oscillator and consists of a potentiometer connected in the screen grid supply circuit of the doubler tube. Of interest, is the use of a center-tapped inductance between the plates of the parallel-connected tubes of the R.F. output stage to prevent parallel singing without introducing appreciable inductance or loss at the operating frequency.

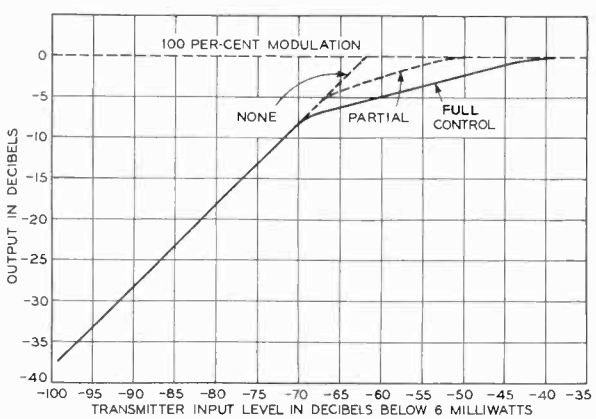


Figure 3

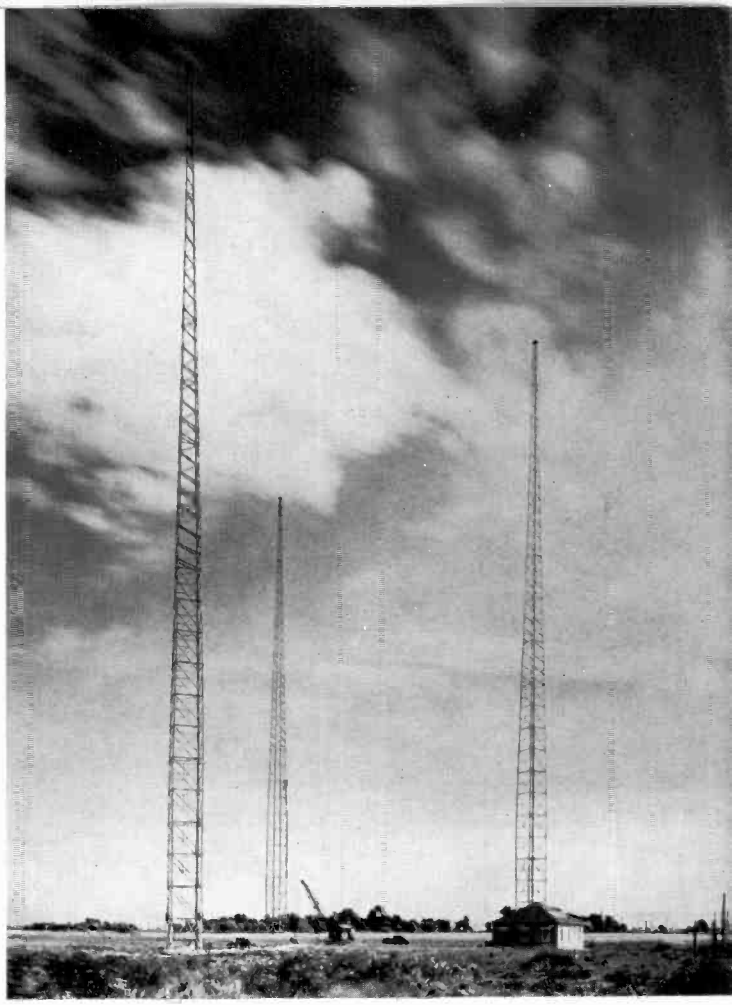
The power supply equipment is of conventional design employing two separate rectifiers, one for the plate supply and the other for the grid bias, microphone and control circuits. The use of the grid bias supply for energizing the control circuit of the plate supply rectifier provides a simple safety method to insure grid bias voltage when the plate supply rectifier is operating.

One of the interesting features is the method of measuring tube currents for tuning the transmitter. Instead of incorporating milliammeters three pairs of pin jacks are mounted in the center compartment which accommodate the test prods of a standard Weston voltohmmeter. The pin jacks are connected to meter resistors in the essential circuits of the transmitter and are of such value that only the zero to three-volt range of the voltohmmeter is used and multiplication factors are employed to obtain actual current measurements. This arrangement provides a definite saving to the customer since a voltohmmeter is always on hand for servicing any type of radio equipment.

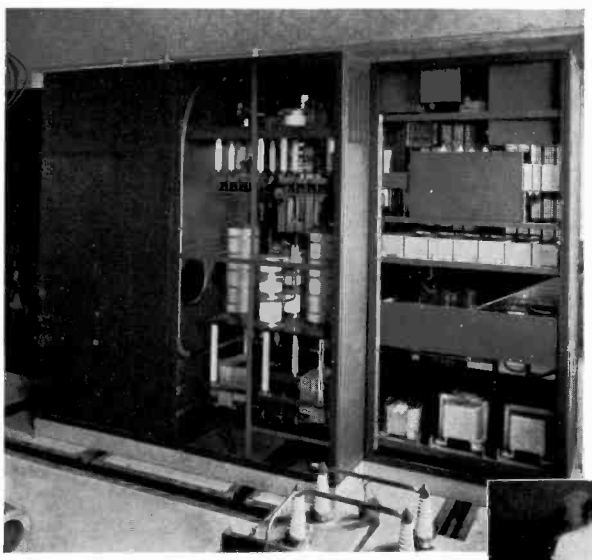
WHIP

Hammond, Ind.

Located in one of the most closely integrated industrial areas in the United States WHIP goes on the air prepared to perform an important job in the realm of broadcasting. The new station is owned and operated by the Hammond-Calumet Broadcasting Corporation. Nearly ten million potential listeners in Illinois, Indiana, Michigan and Wisconsin may now tune in and enjoy the wide variety of programs traveling the air channels via WHIP's transmitter.



Three 350-foot shunt-excited towers give an increase in efficiency of from 15 to 20 per cent. The base spread of each tower is only 12 feet.

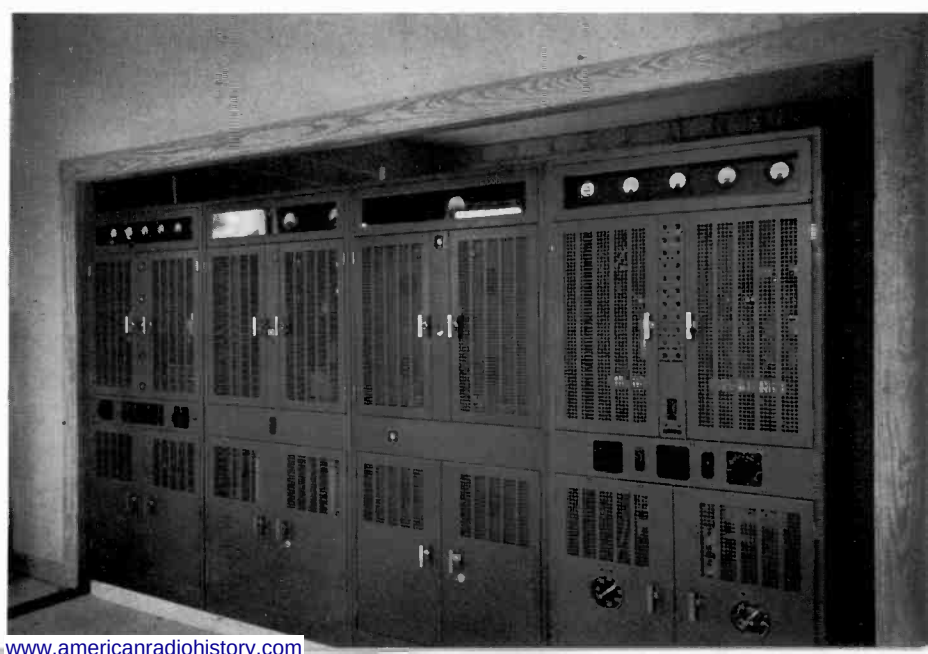


Left: O. E. Richardson, commercial manager and part owner of this new broadcasting station.

Lower left: Decorative stairway which leads to the suite of studios in the Lincoln Building.

Upper left: Rear view of transmitter. Skilled engineers of Bell Telephone Laboratories were employed to plan the installation of this equipment.

Below: The Western Electric 5,000 watt transmitter located within five miles of the southern city limits. It completely covers Chicagoland, recognized as the great mass market of inland America.



New Controls Curb Lightning

Protective Circuits for Antenna Coupling Networks

By F. C. ONG

Commercial Products Development,
Bell Telephone Laboratories

Time off the air during a commercial program is of great concern to owners and operators of radio broadcasting stations, since it detracts from the effectiveness of the programs and may mean a loss of revenue. Although even very short interruptions are objectionable, it is particularly important to avoid the longer shut-downs that become necessary when damaged apparatus has to be repaired or replaced. Under such conditions the loss of revenue may be considerable.

A common cause of program interruptions at the transmitter is a power arc to ground or across some piece of equipment following a transient disturbance induced by lightning. Direct strokes of lightning to the antenna sometimes occur, and in such an event it is impossible to prevent damage, but more commonly the lightning merely induces a high-voltage disturbance that causes a momentary arc. Arcs of this nature may also result from transient disturbances within the transmitter itself. Across the arcs so formed power from the transmitter will flow until the supply has been disconnected, and this radio-power current may do considerable damage. It is very desirable, therefore, to provide some protecting circuit that will disable the transmitter momentarily whenever one of these transient arcs occurs.

With this objective in mind, Bell Telephone Laboratories has recently developed two protective circuits, one or both of which are being incorporated in all Western Electric broadcasting transmitters to assure continuity of service and to minimize damage to the apparatus. Both of the circuits include a relay that operates when a transient arc occurs, and disables the transmitter until the arc is extinguished. Since normal operation of the transmitter is restored in a few thousandths of a second, the interruption is hardly noticeable by the listener. The disabling of the transmitter for this short interval prevents the continuance of the arc, and thus avoids damage to the equipment and the long replacement period that might be required as a result.

(*Continued on Page 29*)

Station Engineers Acclaim New Radio Development

(*Continued from Page 14*)

certain 'dead spots' in the New York metropolitan area have been eliminated. Both quality and volume have improved." "We have noticed a better signal to noise ratio in our regular service area," says T. A. Giles, Chief Engineer of WMBD, Peoria, Illinois. G. F. Ashbacker, Manager of WKBZ in Muskegon, Michigan, notes that the signal in their regular service area has improved so much that it occasioned comment from their listeners. WMBH writes on this subject that "checks have also been made in daytime which show a much stronger signal throughout our trade area but possibly the many unsolicited reports by listeners from localities and distances never or rarely heard from would best prove that the 110A Amplifier is really doing its 'stuff'." WDAY has received some unsolicited reports to the effect that the station is delivering a much stronger signal. "Some of them (listeners) have stated" WDAY writes, "that where before they listened to another station because of better signal they now listen to us."

C. V. Davey, Chief Engineer of KQW writes that "the 110A Amplifier has improved KQW's signal within its service area about one hundred per cent. Much favorable comment has been received from listeners and sponsors alike." Al Leeman, Chief Engineer of WKBH, La Crosse, Wisconsin, says that "the signal at the outer edge of our service area has been noticeably improved." J. J. Long, Technical Supervisor of WHAM, Rochester, New York, reports that "at points near the edge of our daytime signal area we have received reports that the signal is now much more reliable, and rides over the noise level with a very satisfactory signal." "Our average audio signal has been boosted between three and four decibels" says D. A. Weller, Chief Engineer of WISN, Milwaukee, Wisconsin.

W. M. McGoffin, Chief Engineer of KXRO, Aberdeen, Washington, explains that "since this installation was made along with a new 250 watt Western Electric transmitter, a new location and quarter wave radiator, I cannot say exactly what percentage of increase is due to the 110A Amplifier, but altogether our signal strength has been tripled at a distance of forty miles. Where signals were barely audible before I now find splendid reception above noise level." Ivar Nelson, Chief Engineer of KFYR, Bismarck, North Dakota, writes: "Although we have not asked for comment from our listeners since installing the 110A, we have received much favorable comment, especially from listeners near the outer limits of our coverage." I. A. Martino, Chief Engineer of WDRC, Hartford, Connecticut, says that "there has been a decided improvement in the signal delivered in our regular service area and the audibility gain is about doubled. I would safely say that the increase in modulated signal is about 3 db."

To a station seeking higher quality or fidelity in its transmitted signal, any improvement in modulation is of extreme value. So *Pick-Ups* asked—*Has it aided in maintaining a high average modulation level without danger of overmodulation with consequent interruption or deterioration of the program quality?*

WDAE contributed quite a bit on this question: "We find that your claim of a 3 db increase in signal is too conservative. It is quite possible to use 5 db of compression and not be able to detect any particular change in quality of transmission." Lest readers think that WDAE might be a bit careless about overmodulation in order to obtain such a high degree of compression, they go on to say that "one of the greatest advantages we have derived has been the protection of the final amplifier against overmodulation." KFYR notes that "our average modulation percentage is very much higher than formerly, and interruptions due to high audio surges have ceased to exist."

J. E. Peoples, Chief Engineer of WAIM, Anderson, South Carolina, reports that his station is now operating at a modulation level of plus 12 db, where previously a level of 10 db corresponded to 100 per cent modulation. WTAG speaks up to say that "No difficulty has been experienced in normal operation at a level 3 to 4 db higher than previously used, with elimination of trip-outs and bad quality due to accidental overmodulation." H. V. Anderson, Manager of WJBO, Baton Rouge, Louisiana, informs *Pick-Ups* that "tests with and without the 110A Amplifier in our new station show a decided increase in signal strength and approximately a 20 per cent increase in average modulation level." T. E. Atherstone, Chief Engineer of KGVO, Missoula, Montana, says: "The 110A Amplifier has given us a 4 db compression with negligible distortion and has simplified monitoring at the transmitter. We are able to maintain a high level of modulation without danger of overmodulation, and without having to constantly rearrange the program level."

Chief Engineer McGoffin of KXRO writes that it is now possible to modulate as near the 100 per cent mark as desired without overmodulation. To this he adds an interesting bit of information. "In no way does it affect the expression of music, as each instrument maintains its relative volume level, only the undesired composite volume peaks being suppressed. I also find that the spoken word is more clear, as the peak volume of each syllable can be shaded, 'bringing up' the opening and closing syllables, giving clearer articulation, making it possible to broadcast most any voice, ballyhoo or shouting without spoiling the effect, yet maintaining correct modulation."

The last question, *Have listeners com-*

mented on the clearing up of "monkey chatter" on adjacent channels? did not draw many specific answers, probably due to the fact that only a small percentage of stations reporting were bothered with this trouble. Those that were, however, are very enthusiastic about this feature of the 110A Amplifier.

J. R. Poppele, Chief Engineer of WOR in New York, writes that "the areas where WOR's signal has heretofore been hashed with monkey chatter now have cleared considerably, since consistent 3 db audio increase from the 110A Amplifier has definitely aided in clearing this condition. Listeners have commented on this condition being cleared." WTAG relates that "reduction in 'monkey chatter' has been most welcome in our case of operation with an adjacent channel station some 40 miles distant." WKBH chips in with "We receive fewer reports of sky wave interference of stations on the same frequency." At WINS, reports have been received which show that "adjacent channel disturbance has been eliminated."

Pick-Ups closed the questionnaire with a request for any additional information or suggestions engineers might be able to offer. This drew a number of interesting and valuable observations. From WAIM comes a note that "Use of this amplifier will tend to relieve the strain on operators gaining a program, and they are not tempted to cut the level suddenly which always gives a bad effect." Lest anyone receive from this the mistaken impression that the 110A Amplifier might substitute for the monitor man, *Pick-Ups* calls particular attention to the report from KXRO which says, "In no way does the amplifier eliminate the monitor man, it simply adds to his efforts that which no human being can do—instantly suppress undesired peaks and produce an expression-full level that one uninitiated in its performance would call nigh unto impossible." The 110A Amplifier installed at WDAE brought them one improvement that they did not expect. "We find by using the 110A Amplifier," says WDAE, "that our overall distortion, transmitter and amplifier included, has been reduced 1.1 per cent at 400 cycles. This, of course, was a pleasant and unexpected surprise and was undoubtedly due to the incorporation of stabilized feedback in this unit."

One point that is noticeable in the replies to this questionnaire is the variety of stations to which the 110 Amplifier has been of service. From the 100 watters and the 50 kilowatt stations, from the composite jobs and the most up-to-date Western Electric equipped stations, have come these letters telling what the 110A has done for them; letters that prove beyond doubt that it has lived up to its advance promises. These promises were not modest, but *Pick-Ups'* correspondents agree that modesty and the 110A do not go well together.

"If you do not care to throw bouquets at yourselves" says WMBH, "may we have that pleasure?"

Frank D. Binns—WLAC

It's fun to talk to radio men who date back to the early days of broadcasting. Conversation always goes back to those more romantic, more chaotic times when things were on a most informal basis—those good old hay-wire days when a station's call letters had a meaning.

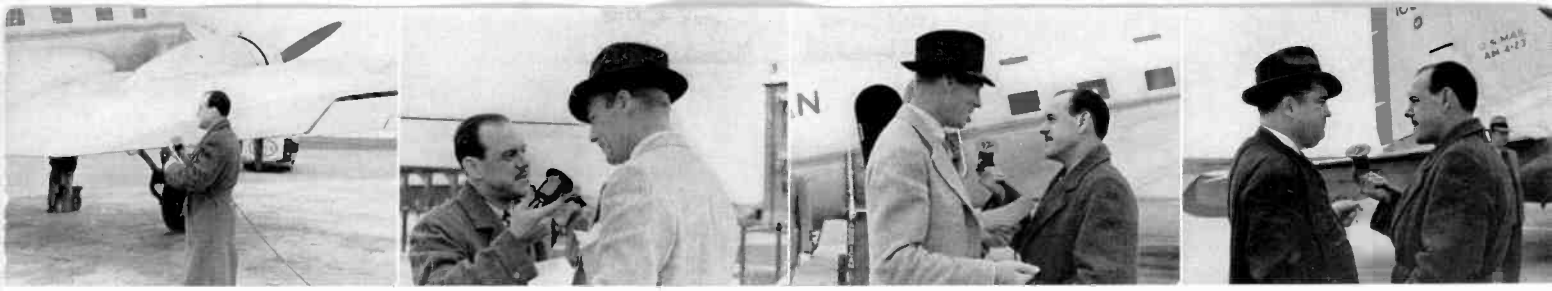
Frank D. Binns

Down in Nashville, Tennessee, in 1924, there was a little 100 watter with call letters of WDAD, and to its listeners it meant "Dad's Auto Accessory and Radio Store." In the organization was a young man who repaired radios, managed the radio stock and spent all of his spare time building sets and broadcasting over his amateur rig with the call letters, 4NN.

He was Frank D. Binns, now chief engineer of WLAC, Nashville. In 1926 the Nashville Life and Casualty Insurance Company bought an interest in the station. Power was increased to 1,000 watts and Binns was made chief engineer. Two years later power was increased to 5,000 watts, and the old transmitter was sold to an organization in Bay City, Michigan. Binns was given the job of moving the old transmitter and installing it in the new location. "I learned a lot on that job," he says.

From talking with him you get an idea that he's happiest when he has a tough job on his hands. He should be a very happy man, indeed, next year. Complete new studios are to be installed in a new location. A new transmitter site is planned, and if the license is granted, there will be a new 50 KW transmitter to install.

WLAC engineers. Frank Binns, Chief Engineer; G. Miller Watkins, Felix R. Riley, station engineers; Raymond Lowry, studio engineer; Charles S. Dorris and Allen Dunkerly, engineers, do not appear in picture.



Tim Sanders Interviews Transcontinental Air Passengers—A WLAC Feature

Tim Sanders, WLAC Production Manager, waits for the passengers to alight. Ah, the first man off is a movie star, Randolph Scott. "Won't you say a few words, Randolph?" Scott gives a good interview, and next comes an Atlanta business man. Sanders never fails to get the interview, and he meets the planes three times a week, rain or shine.

Public Is Broadcaster's Governor, Says Ward

(*Continued from Page 7*)

tively uses such programs as just described to give local color, interest and balance to other programs fed to it by Columbia. Six times a week Sanders conducts a "Man on the Street" broadcast from a downtown street corner. It is a particularly popular program, and Sanders has acquired an amazing fund of random facts. He should. He spends two hours nightly in research work compiling questions and answers to pop to Nashville's secretaries, bankers, and laborers as they pass before his microphone.

Early risers who like friendly philosophy interspersed with transcribed music swear by Charles S. Roberts and his "Favorites of the Air," which he gives them from 7:15 to 8:25 six times a week. A WLAC statistician has figured that his fan mail would cover a goodly portion of Nashville's streets. Broadcast from the municipal traffic court is another popular feature, and you can be sure that there is a WLAC microphone present at most civic enterprises which may be of interest to the public.

There are 23 men and women in the WLAC organization. They are a hard hitting, hard working, fast moving crew. They tell you with pride that they do more work per man than people in any other station in the country. For instance, there's Edwin S. Glease, merchandise-publicity director, who knows each of the 90 druggists in the city by his first name, and can call on every one of them in three days in the interest of a sponsor's product. He doubles in brass by going on the air several times a day with newscasts.

Then there is Herman Grizzard who last year was rated by a national sponsor of baseball broadcasts as one of the five top baseball announcers in the country. Herman has been associated with the station since 1926, first as entertainer, charming the audience with his fine tenor voice. For a short period he worked in the bookkeeping department, but he soon returned to the microphone winning acclaim as the station's ace sports announcer.

The WLAC studios are located about two miles from downtown Nashville in an old Southern residence. It is a friendly, informal, energetic atmosphere in which this broadcasting crew operates. No one is hampered by the red tape which so often clutters and impedes the operations of larger organizations. "If you want to do something, if you have an idea for a new program, you simply take it to the Boss and get a quick decision," they tell you.

Perhaps this accounts for the small turnover at WLAC. Most of the personnel has been with the station for years. Each has contributed to the success of the station and each is proud of his part. When you talk to these men, you often hear them mention the Boss. He is J. Truman Ward, owner and President of WLAC, Inc.

Radio has grown so fast it has almost hoisted itself by its own bootstraps. Developing from nothing to a leading industry in a few years, it has carried men along with it; made them big, important. It has also attracted men who would have grown important and influential in any industry. Ward is distinctly of the latter type.

After graduating from David Lipscomb school and with one year at Vanderbilt, Ward became a life insurance agent for the Nashville Life and Casualty

F. C. Sowell, Vice-President, and General Manager, WLAC.

Edwin S. Gleose, merchandise-publicity director, and Helen Whitmore discuss promotion plans for a sponsor.

Insurance Company in 1921. Promotions came fast. Before the end of the first year he was made manager of a district office. After six months he was put in charge of sales promotion in the field, covering 13 states and the District of Columbia. In 1924 he was brought back to the home office and made assistant secretary of the company working in the Industrial Division. Two years later he became a vice president in charge of the Ordinary Life Department.

By 1926 radio had boomed ahead and was ringing up sales for many firms. The company bought a half interest in a little 100 watt local station, and before the end of the year installed a new 1,000 watt transmitter. Ward was placed in charge of all radio activities. Power was increased again in 1928, the new transmitter being a Western Electric 5 KW.

By 1934 Ward had seen radio grow to amazing proportions. He realized the opportunities it offered, and so, forsaking the insurance business, bought the station, taking over the ownership and full operation on January 1, 1935. That he had become an influence in broadcasting was shown by the fact that the National Association of Broadcasters made him its president for 1934 and 1935.

It is a refreshing experience to talk to him. He is a business man and a realist. He is as aware and conscious of the "public interest" clause in his license as any broadcaster, yet he says: "Let's not kid ourselves. I am in business to make money and so is every other commercial broadcaster. That does not mean, however, that any of us disregards the public interest.

"It happens that by serving ourselves best we also serve our listeners best. We must strive constantly to develop interesting, worthwhile programs to hold our listeners, and as long as we are successful in doing this stations will be successful financially. Sponsors have come to realize this rather elementary fact of broadcasting and the very evident improvement in commercial programs is a direct result.

"One of the easiest things in the world to do is to tune out a station, and the public will do just that to any station or any program which does not fulfill the requirements of 'public interest.' This check that the public has over broadcasting is the industry's greatest governor. As long as it operates, no one should have much fear of the control of broadcasting passing into other hands.

"It is this check of public approval or disapproval which has accounted for the vast improvement in programs and station personnel. The men who did not have the vision to give the public what it wanted and needed have passed out of the picture. Today most announcers are college graduates, and the entire personnels of broadcasting stations are of the same calibre that you find in any industry."

Ward, a successful business man, a successful broadcaster, and a keen student of the industry, sees no menacing clouds on radio's horizon. Through the natural business law of the survival of the fittest those men who had no place in broadcasting have dropped out, and the industry is in the hands of men who have the vision, ability, resources and courage to continue the rapid development of broadcasting in the "public interest."

Although he looks upon television and facsimile broadcasting as tremendous future factors in the business, he sees no threat in them. "They will never replace sound broadcasting," he says. And Ward is backing his optimistic view of broadcasting by a large expansion program for WLAC. Early in 1938 he is taking over an entire floor of a large downtown office building for new studios. An application is now on file for a 50 KW license, and tests are under way for a new transmitter location.

Radio's Proving Grounds

(*Continued from Page 6*)

may transmit the same amount of power as that of 1927 but, like today's car, for that same amount of output power an enormously decreased amount of input energy is required. The 1937 transmitter has advanced in outward appearance as much as this year's streamlined car has advanced over its predecessors. And in its interior, as in the modern car, is incorporated every improvement that research engineers have developed in the past ten years.

To the proving grounds of the automobile manufacturer, with its trials and tests under all possible conditions, is attributed much of the efficiency of the modern car. The Laboratories, too, has its proving grounds—Whippany. Here must be tested every radio development of Bell Telephone Laboratories. Here must every sample of equipment prove its worth. Every engineer in the radio industry knows that after the words, "Developed by Bell Telephone Laboratories," there follows the unwritten assurance, "Tested and approved at Whippany." Whippany, the proving grounds of radio!

New Controls Curb Lightning

(*Continued from Page 24*)

One of the circuits is shown in heavy lines connected to the output of a transmitter in Figure 1. Under normal operating conditions the radio-frequency plate voltage of a power amplifier is opposite in phase to the grid voltage, and proportional to it in magnitude. The current to ground through a high impedance network connected to the plate circuit can thus be made equal to that through a similar network connected to the grid circuit by making the impedances of the networks proportional to the voltage of the circuit to which they are connected. Since the currents through these two networks are of opposite phase, no current will flow in the common ground connection.

In Figure 1, these two networks, which are designed not to pass direct current, are Σ_1 and Σ_2, and the common ground connection passes through the rectifier with the winding of a relay bridged across it. The currents through Σ_1 and Σ_2 being equal and of opposite phase, no current flows through the relay winding under normal conditions. If the output circuit becomes untuned, however, due to an arc, short circuit, or the failure of one of the tuning elements, the impedance of the plate circuit will change, causing the radio-frequency plate voltage to change in phase or amplitude or both. Under this condition the currents through Σ_1 and Σ_2 no longer balance each other, and a current will flow in the ground circuit and operate the relay, which in turn will remove the carrier power. As soon as current ceases to flow through the relay winding, the relay will release, and power will be restored.

The second circuit is shown in Figure 2, and differs from the first in requiring an arc to ground for its operation. In this case one side of the relay is connected to ground and the other side to the outgoing transmission line through a potential source and a high impedance. Normally the circuit through the relay winding is open by the high impedance between line and ground, illustrated in the diagram by the air gap between the central conductor and sheath of a coaxial line. If an arc should form to ground,

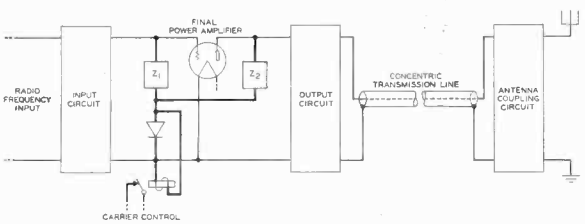


Fig. 1—Schematic of protective circuit that disables transmitter on any disturbance of the output tuning

however, current from the potential source in the relay circuit would flow through it and operate the relay. Here again, the circuit would be restored to normal as soon as current ceased to flow through the arc. In the diagram the relay potential is shown as a battery, but provision is made for using a 60 cycle source if more convenient.

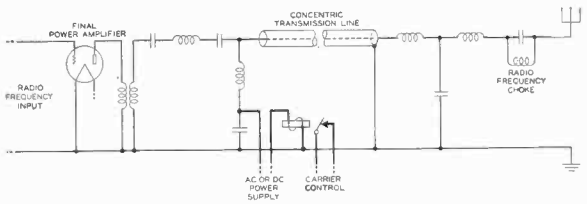
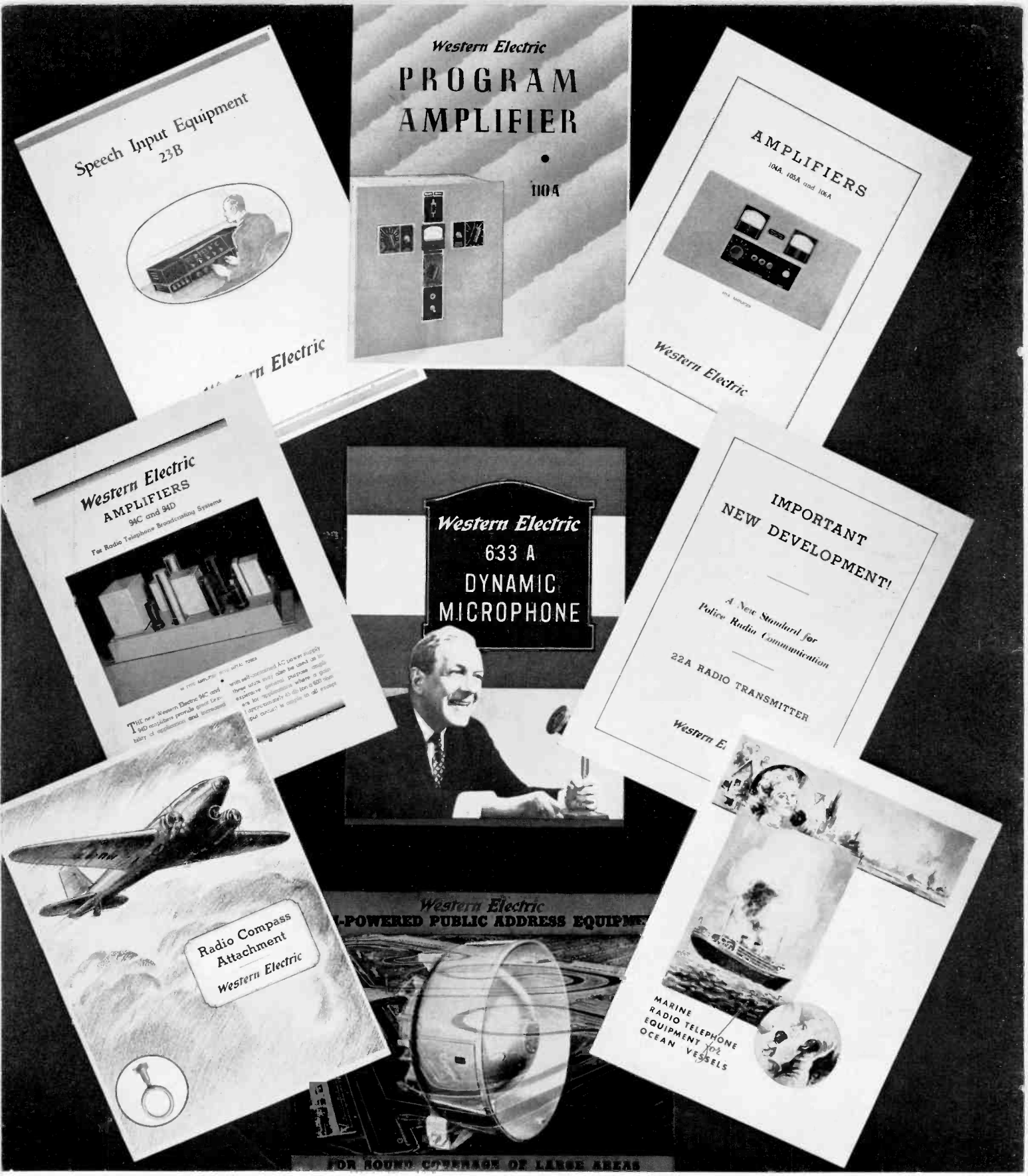


Fig. 2—Another form of protective circuit acts only on an arc to ground.

For the operation of this latter circuit, the DC or 60-cycle current must flow across the arc to ground, and so if there were a series condenser between the arc and the relay, the circuit would be inoperative. To avoid this condition, any series condenser in the circuit—as shown at the right of Figure 2—is bridged by a choke coil that has a very high impedance to radio frequencies but a low impedance to 60 cycles. The minor change in the tuning of the output circuit caused by the shunting effect of this coil is easily compensated by a slight retuning of the circuit.

These two circuits perform essentially the same function, but that shown in Figure 1 has the advantage of operating under any abnormal condition that disturbs the tuning of the output circuits, while that of Figure 2, operates only on an arc to ground. On the other hand, the first circuit requires somewhat more equipment. The second circuit is particularly suitable for protecting a coaxial-conductor transmission line, which might require a long replacement time if a protracted power arc occurred. These various factors are considered in selecting the particular circuit to be installed. In general local conditions will determine which is the most suitable, and in some cases both may be installed to provide double insurance against shutdowns.

Numerous tests in the laboratory on both circuits have shown that very reliable protection is obtained. Arcs, produced artificially in the transmitter by severe over-modulation or by shorting a part of the output circuit, have been so quickly extinguished that no damage resulted even when the power of the transmitter was several hundred kilowatts. Experience with several field installations of each type of circuit has further demonstrated this reliability of operation. In some instances where lightning disturbances had previously been responsible for considerable "time off the air" because of apparatus being damaged by "follow-up" arcs, the use of one of these circuits has practically eliminated such shutdowns.



Western Electric Bulletins Issued Recently

Speech Input Equipment 23B
Program Amplifier 110A
Amplifiers 104A, 105A and 106A
Amplifiers 94C and 94D
633A Dynamic Microphone
Important New Development — 22A Radio Transmitter
Radio Compass Attachment
High Powered Public Address Equipment
Marine Radio Telephone Equipment for Ocean Vessels

(These bulletins will be furnished upon request)

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Western Electric

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- Private Flyers Two-Way Radio Telephone
- Ground Station Two-Way Radio Telephone

Police
- One-Way Medium-Frequency Transmitters
- Two-Way Ultra-High-Frequency Mobile and Headquarters Radio Telephone

Marine
- Two-Way Boat Radio Telephone with Radio Compass and Direction Finder
- Two-Way Shore Radio Telephone

VACUUM TUBES

Amplifiers
Oscillators
Modulators
Detectors
Rectifiers — High Vacuum
Rectifiers — Mercury Vapor
Rectifiers — Grid Controlled
Ionization Manometer
Thermocouples
Vacuum Switches
Photoelectric Cells
Ballast Lamps
Cathode Ray Oscillographs

PUBLIC ADDRESS EQUIPMENT

Paging Systems
Announcing Systems
Program Distribution Systems — Records, Radio
Portable Public Address Systems

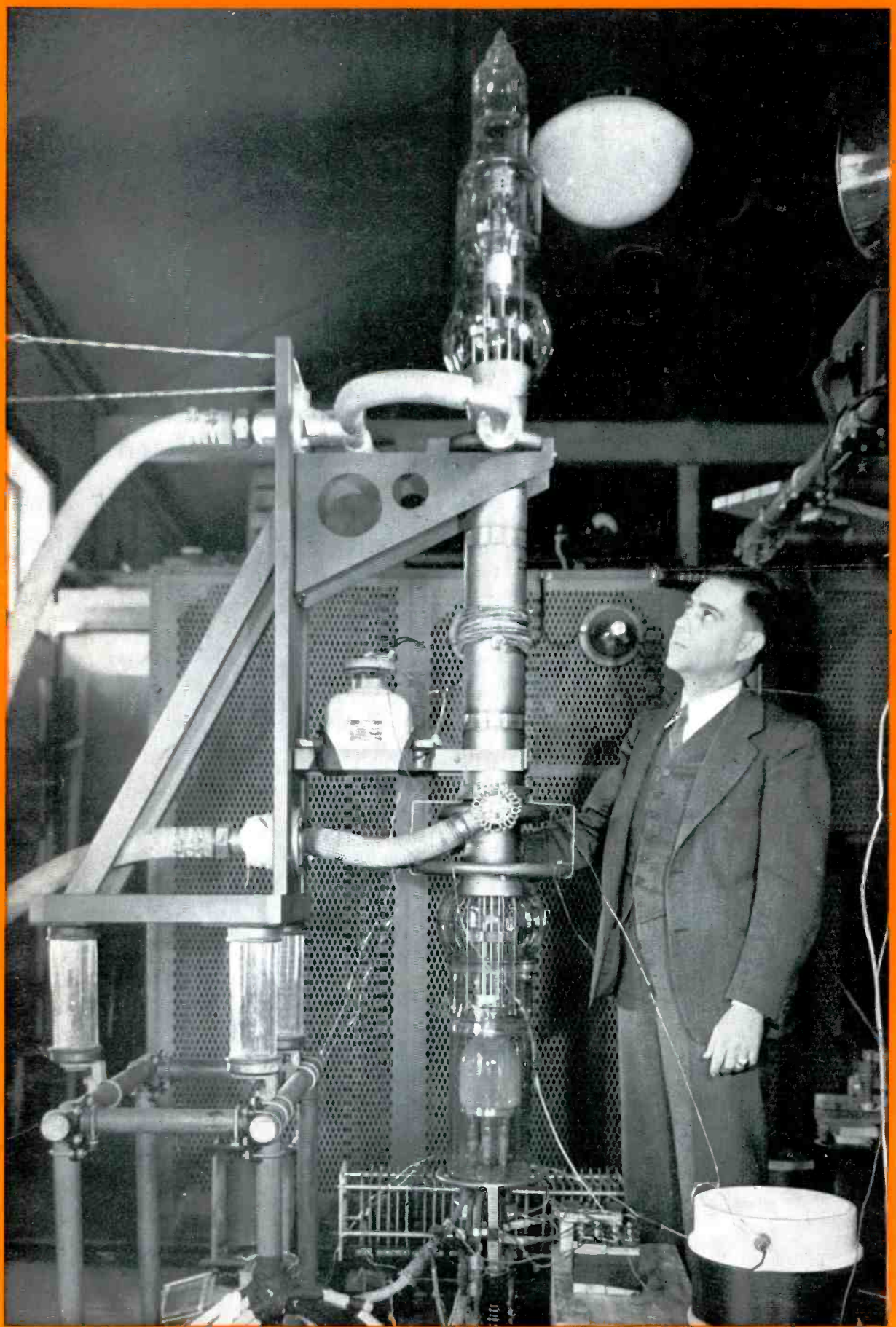
HEARING AIDS

Individual Audiphones — Bone and Air Conduction Types
Group Audiphones
Audiometers

CABLE

Lead Covered (Quadded and non-quadded)
Tape Armored
Submarine
Textile Insulated
Switchboard

RAILWAY TRAIN DISPATCHING TELEPHONE SYSTEMS



Western Electric's Giant 250,000-watt vacuum tube being put through its paces in a test circuit at Bell Telephone Laboratories' Radio Proving Grounds, Whippany, N. J.