PICK-UPS

NOVEMBER · 1936

6 WWJ (P)
KWK 21 (P)
6-23 WCLO (D)

GIANT LOUD SPEAKERS—See Page 26

In This Issue

PUBLISHED BY
Western Electric

— PICK-UPS —

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

Western Electric Company

EDGAR S. BLOOM . . . . . . *President*
H. B. GILMORE . . . . . . *Secretary*
F. H. LEGGETT . . . . . . *Treasurer*
195 Broadway, New York, N. Y.

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

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Oil companies for years have transported their commodities through pipes. Now broadcasters are using pipes to transport their commodity, radio frequency currents, from transmitter to antenna. P. H. Smith of Bell Telephone Laboratories provides a technical discussion on RF piping in PICK-UPS.

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It's easy for most of us to remember back 16 years, but it's difficult to realize just how far broadcasting has gone in that time. In the layout of pictures of WWJ, Detroit, there's one picture which will give you a laugh. It's WWJ's first transmitter. Today WWJ is one of the finest stations in the country—a good example of the progress of radio.

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The Lone Star State got out its chaps, sombreros, and spurs, put on its friendliest smile, and welcomed the nation to come and see its wonders. One wonder that visitors both saw and heard was a historical pageant in which Western Electric sound played a big part, did much to make it a hit. Pictures and story tell you about it.

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For engineers only, but applicable to broadcasting in general is the information J. F. Morrison of Bell Telephone Laboratories gives readers. It's all about shunt-excited antennas.

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Vacuum tubes—they give wings to words and music. PICK-UPS takes you into the Western Electric tube shops and shows you how tubes are made, and tells you, too, in the accompanying article.

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And incidentally, PICK-UPS with this issue begins its second year. We hope you have had half as much fun reading it as we have had preparing it. And not so incidentally, PICK-UPS is on speaking terms with quite a few engineers who know this and that about radio. They will be glad to present their knowledge during PICK-UPS' second year, if you let us know what particular things you're interested in. Any suggestions?

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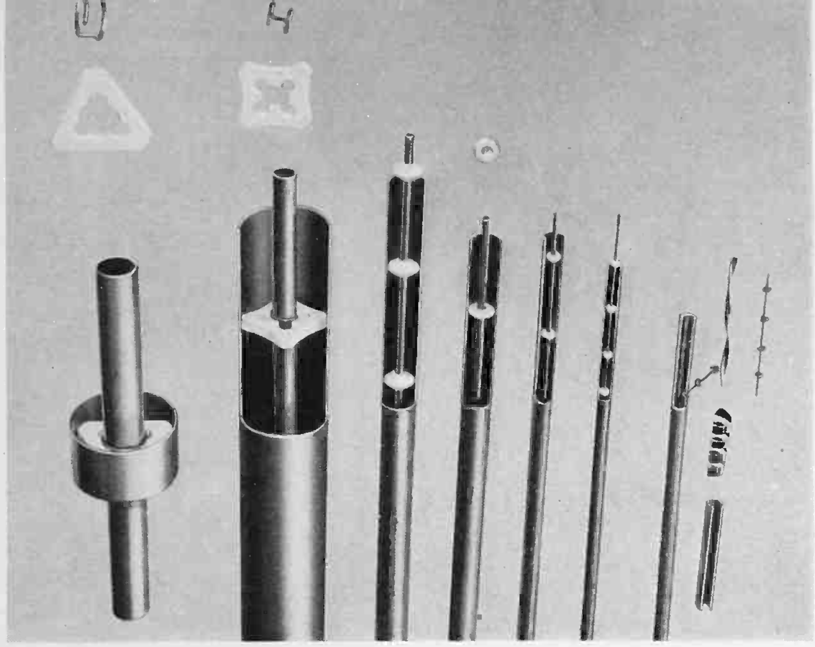
This Issue



Piping RF

From Transmitter to Antenna with Concentric Lines

By P. H. SMITH
Member, Technical Staff, Bell Telephone Laboratories

Radio frequency transmission lines in the more general sense include all conductors of radio frequency currents from the shortest interconnection between radio circuit elements to the longest carrier frequency telephone line. In the broadcast field interconnections between circuit elements are invariably very short electrically so that considerations of their electrical behavior from the standpoint of transmission line theory is generally unnecessary. However, at higher frequencies, due to their greater electrical length, short connections often exhibit marked transmission line characteristics which may at times become detrimental to the successful operation of a circuit. A consideration of the behavior of these connections as radio frequency transmission lines will often indicate the trouble and may even suggest ways of taking advantage of some of their desirable characteristics.

In the usual sense, the radio frequency transmission line comprises the connection between the antenna and radio equipment. At broadcasting stations the many advantages afforded by locating the antenna a few hundred feet away from the transmitter have encouraged this practice generally. These advantages include among others greater freedom from spurious coupling effects in the transmitter which are produced by the strong electric fields immediately beneath the antenna structure, and a greater degree of flexibility in the overall design. Under these conditions, however, the radio frequency connection to an antenna required is generally of sufficient electrical length to warrant careful consideration of its electrical properties from the standpoint of transmission line theory if an efficient, trouble-free connection is to be provided.

Within the past few years the concentric type of transmission line has been gaining in favor over the open-wire type. In addition to providing far more constant electrical characteristics, this type of line offers many other attractive advantages. Concentric transmission lines may be buried in the ground since all of the radio energy is totally enclosed by the outer conductor. Thus the hazard of unsightly exposed wires carrying high voltages is eliminated and the possibility of spurious couplings between the antenna and line are prevented. Furthermore, the concentric line will not be a source of harmonic radiation and is not affected by weather conditions.

The outward appearance of these lines is simply that of a metal tube or pipe. A cross sectional view, however, reveals an inner coaxial conductor which for the sake of economy is frequently made hollow. This inner conductor is generally supported by toroidal shaped, ceramic insulators spaced so that by far the greater part of the medium between the inner and outer conductors is air or gas. Calculations and experimental verifications have shown that a most desirable ratio of diameters* of these conductors exists and that this ratio is ordinarily between 2.7 and 3.6 to 1. While the ratio is not very critical, there is considerable justification for employing lines having a ratio of diameters within this range. The

* The ratio of inner diameter of the outer conductor to the outer diameter of the inner conductor.

ratio 2.7 to 1 represents the optimum ratio from the standpoint of corona formation and voltage flashover, while the 3.6 to 1 ratio corresponds to the minimum radio frequency loss conditions, both for a given size outer conductor. Also, these ratios present no particular mechanical problems.

Typical concentric radio frequency transmission lines cut away to show the insulators and inner conductors are shown at top of page 3. These lines are manufactured in sizes ranging from a fraction of an inch to several inches in diameter. The fourth line from the right is used to transmit radio frequency powers up to 15 kilowatts and the second line from the right will handle up to 100 kilowatts. The line at the extreme right is used to conduct tower lighting current and will be discussed later.

In contrast to the complex nature of the electro-magnetic field about open-wire transmission lines, concentric lines present well defined field patterns. Figure 3 depicts such a pattern. The electromagnetic field, as in any conductor of electric currents, radiates outward from the conductor in a series of concentric rings; whereas the electrostatic field extends radially outward from the inner conductor cutting the magnetic field at right angles similar to the spokes of a wheel. The fields, as may be seen from the diagram, are entirely confined to the medium between the internal surface of the outer conductor and the external surface of the inner conductor. It is for this reason that no radiation takes place from the line, permitting it to be buried in the ground if desired.

The flow of electric current becomes more confined to the surface of the conductors as the frequency is increased, thereby increasing the current density for a given current and in turn increasing the conductor losses. At broadcasting frequencies, the current may be considered as confined to very thin conducting surfaces. It is interesting to note in this connection that at ultra high frequencies a tarnished wire exhibits a measurably higher resistance than a polished one. Neglecting dielectric losses, which can be made small in well constructed concentric transmission lines, the losses are proportional to the square root of the frequency.

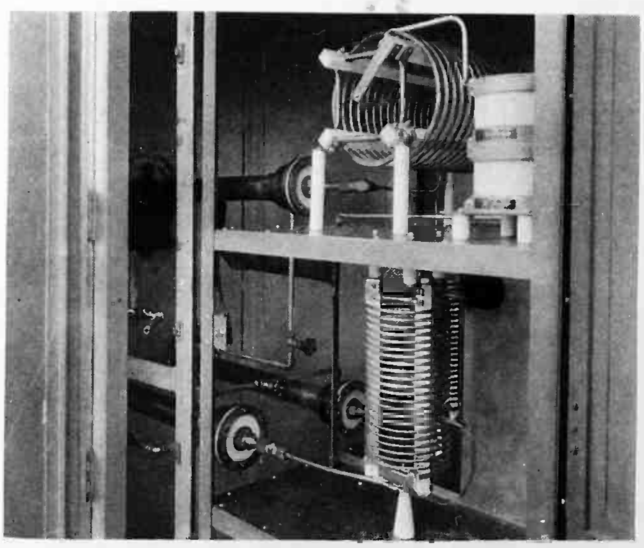


Fig. 1

Fig. 2

The conductor losses are also inversely proportional to the diameters (with fixed diameter ratio) and proportional to the square root of the resistivity of the conductors.** At broadcasting frequencies, the losses in copper transmission lines with air or gas dielectric are for most practical purposes negligible and, in general, less than the losses in the associated circuits.

One of the most fundamental parameters of a transmission line is its characteristic impedance. This is a function of its several distributed electrical constants but may be easily computed, however, from its physical dimensions***. It is desirable,

(Continued on Page Twenty-four)

** The radio frequency resistance is given by the following equation for lines in which the inner and outer conductors have the same resistivity:

$$R = .024 \sqrt{\rho f} \left(\frac{1}{d} + \frac{1}{D}\right) \text{ ohms/1000 ft.}$$

where ρ is the resistivity in microhms per cm cube (for copper ρ is 1.72.)
f is the frequency in kilocycles.
d is the outer diameter of the inner conductor in inches.
D is the inner diameter of the outer conductor in inches.

*** The characteristic impedance of a concentric transmission line is practically equivalent to a pure resistance at radio frequencies and may be computed from the following:

$$Z_0 = \frac{138}{\sqrt{K}} \log_{10} \frac{D}{d}$$

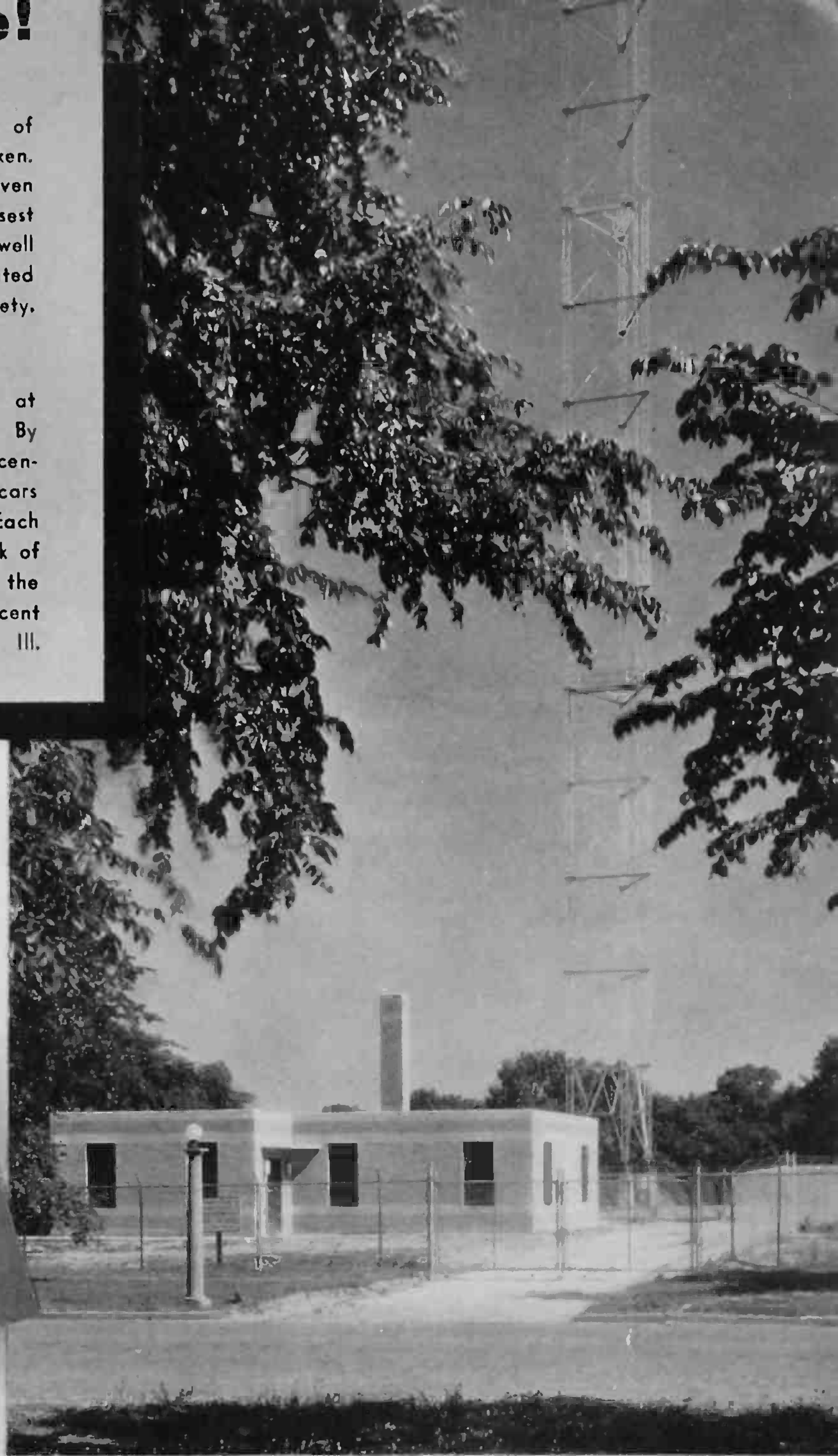
where D/d is the ratio of the inner diameter of the outer conductor to the outer diameter of the inner conductor.
K is the dielectric constant which for air or gas is very nearly unity.

Illinois Criminals Beware!

For the arm of the law grows longer and stronger with the installation of the most comprehensive state-wide police radio system ever undertaken. There is little chance of escape from town to town, from city to city or even across the border, for the whole plan has been worked out to effect the closest cooperation with municipal and county police departments in Illinois as well as those of neighboring states. Thus an interlocking network has been created which will cover an extensive area and provide a maximum of public safety.

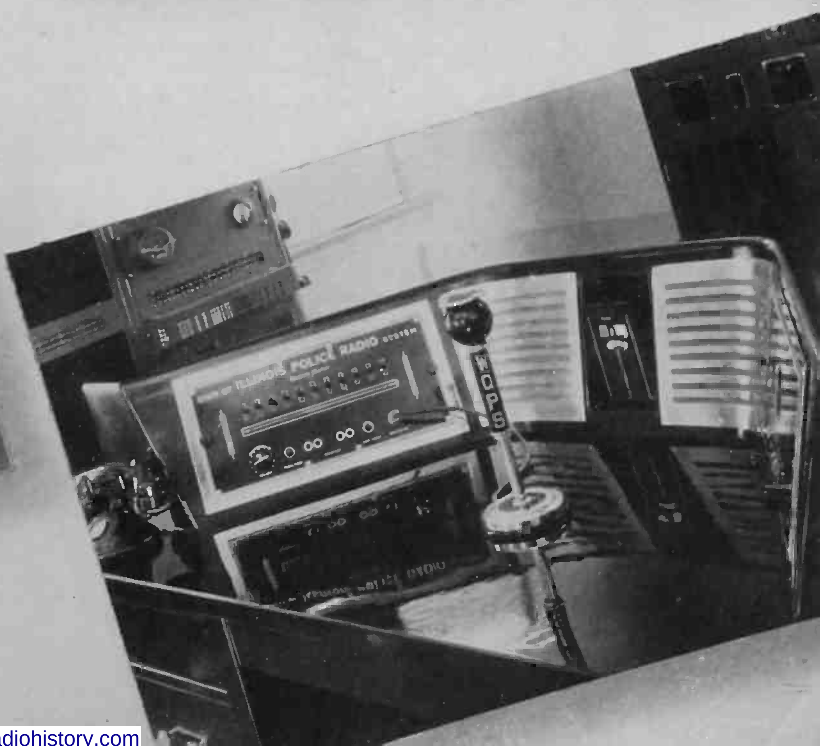
Seven control points, Western Electric equipped, are being established at Chicago, Springfield, Pontiac, Duquoin, Effingham, Sterling and Macomb. By inter-communicating radio, telephone and telegraph systems, these radio centrals will keep in continuous touch with each other and with police radio cars and radio motorcycles cruising throughout their respective territories. Each control point will be equipped with a one-kilowatt transmitter and a bank of receivers. One receiver is to be tuned to the standard frequency of the Illinois State system; the others to the various frequencies used by adjacent police radio systems. Photographs are of station WQPS, Springfield, Ill.

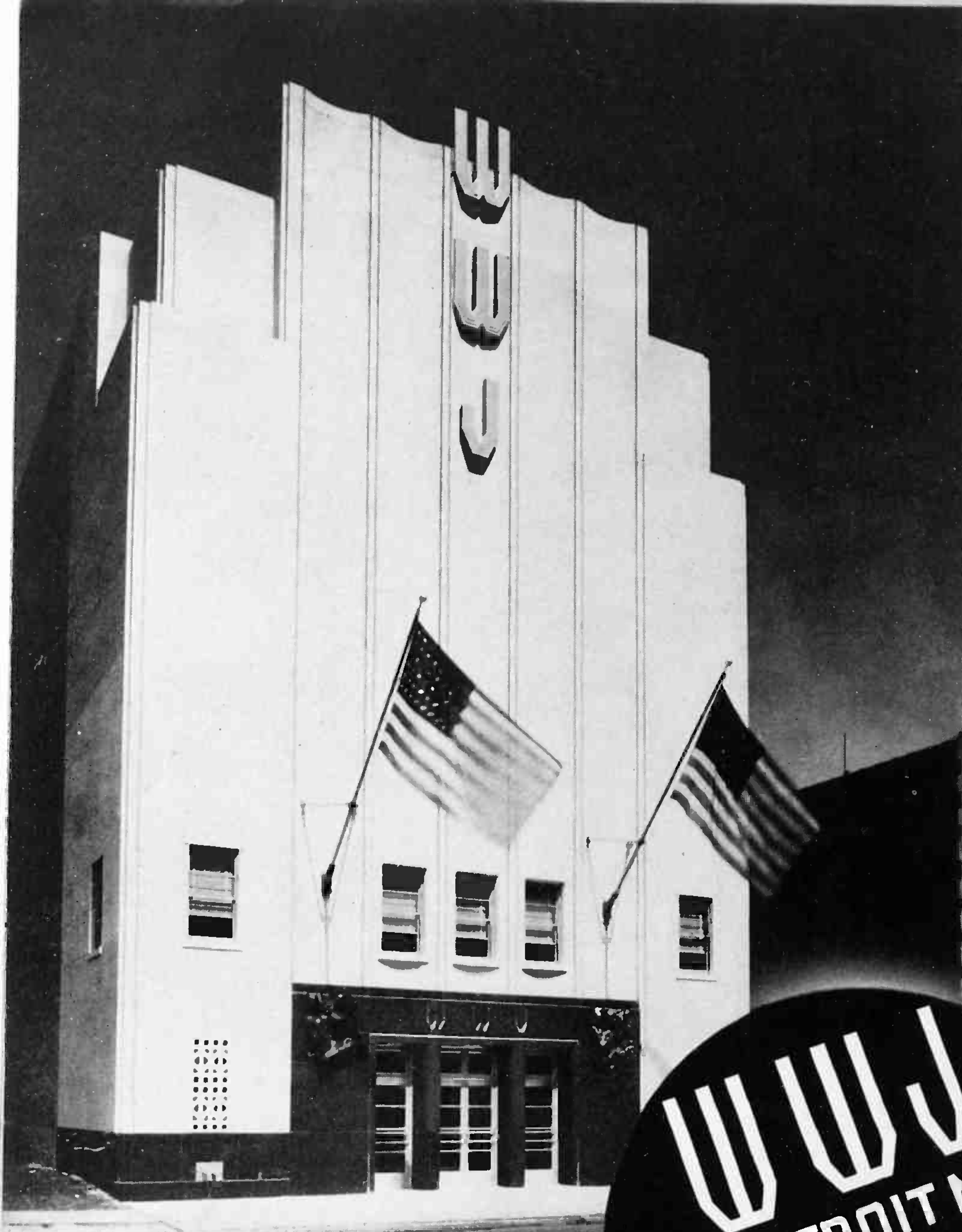
R. H. Lindsay, Bell Telephone Laboratories, inspecting the one-kilowatt transmitter. Six more are to be installed in Illinois.



A place of beauty pledged to the grim task of crime prevention—the transmitter building and 329 foot steel antenna.

Control console with transmitter in background. At right: Close-up view of console which is of modernistic design.





AUGUST 20, 1920, the Detroit News began its commercial broadcasting career and it is on that date that WWJ lays claim to the title of America's oldest broadcasting station. Sixteen years later WWJ celebrates that historic date with the completion of one of the finest studios and stations in the country. During its steady strides forward men and women prominent in practically every field have broadcast over its microphones. The station was the first to broadcast a symphony orchestra, participated in the first national broadcasts of football and baseball games and was among the first to bring news bulletins to its listeners.

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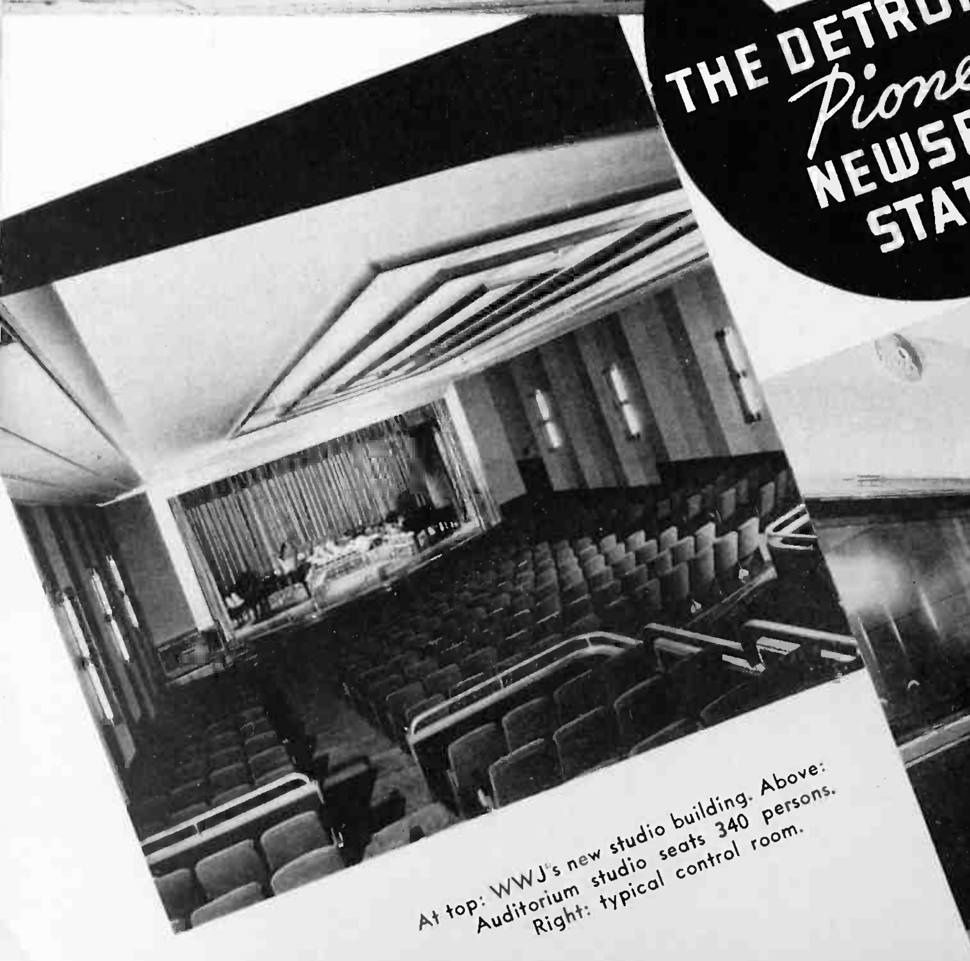
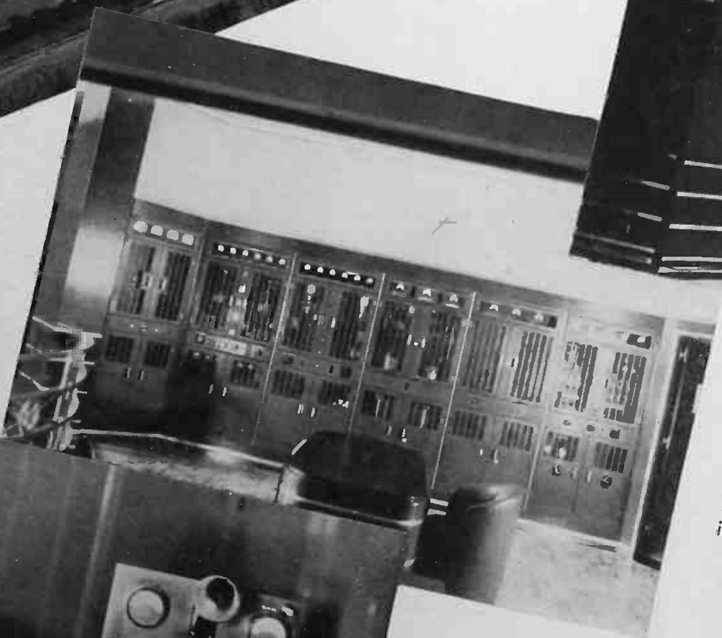
JANUARY 28, 1922, WWJ installed the first commercial transmitter sold by the Western Electric Company. Since that day WWJ and Western Electric have traveled along hand in hand. WWJ has been 100 per cent Western Electric in broadcast station and studio equipment. Progress in the art of broadcasting for one has meant progress for the other. WWJ and Western Electric are proud of this record.

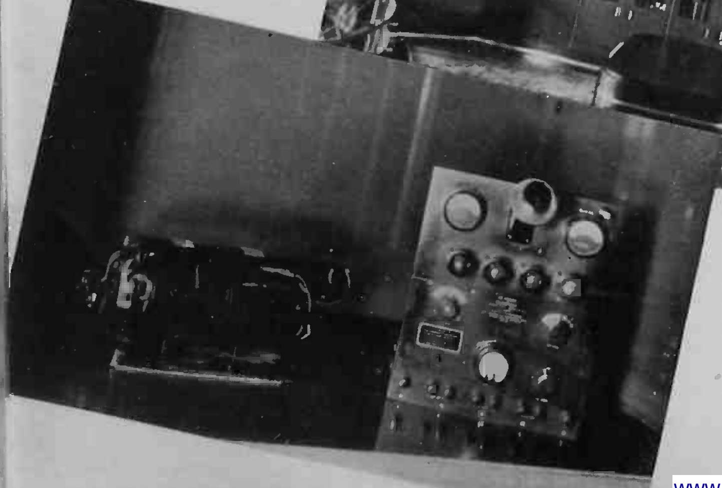
WWJ
THE DETROIT NEWS
Pioneer
NEWSPAPER
STATION



At top: WWJ's new studio building. Above: Auditorium studio seats 340 persons. Right: typical control room.



At top: WWJ's new transmitter station and 400 foot vertical radiator. Above and at left: Two views of Western Electric five KW High Fidelity transmitter. Striking murals and modern decorations make this one of the most beautiful stations in the country. While making a perfect setting for the present equipment, the station is spacious enough to permit future expansion.



Left: Historic first transmitter of WWJ which operated under the call letters of 8MK. It was a marvel in 1920.

The Shunt-Excited Antenna

A New Development in Which the Base of the Radiator is Grounded; Simplicity and Economy Accrue

By J. F. MORRISON

Member, Technical Staff, Bell Telephone Laboratories

Antennas such as are used for broadcasting are connected at the base through the generator or coupling impedance to ground, and it is generally understood that the coupling impedance as viewed from the antenna in no way affects the radiation characteristics of the antenna. In fact, as far as the radiation characteristics are concerned, the antenna may be connected directly to ground without affecting its performance. It might at first appear difficult to couple power efficiently into a vertical antenna grounded at its base, particularly at frequencies other than the resonant frequency of the antenna. An arrangement developed by Bell Telephone Laboratories, however, accomplishes this objective in a very effective manner and in doing so attains a number of worth-while improvements. The new method is called shunt excitation.

The ordinary base-insulated antenna is energized by a transmission line running from the radio transmitter, and between the end of this line and the antenna, some form of coupling circuit must be provided to match the impedance of the antenna to the characteristic impedance of the transmission line. For any one type and size of transmission line, the characteristic impedance is more or less fixed, but the impedances of antennas vary widely, depending on height, configuration, and the operating frequency of the station. The coupling network, therefore, must either be especially designed for each installation, or a standardized coupling circuit must be provided, which has sufficient flexibility to allow it to be adjusted to meet the wide range of antenna characteristics. One of the advantages of the new "shunt-excited" antenna arrangement is that the coupling circuit has been reduced to a single condenser and a connecting wire that becomes essentially an element

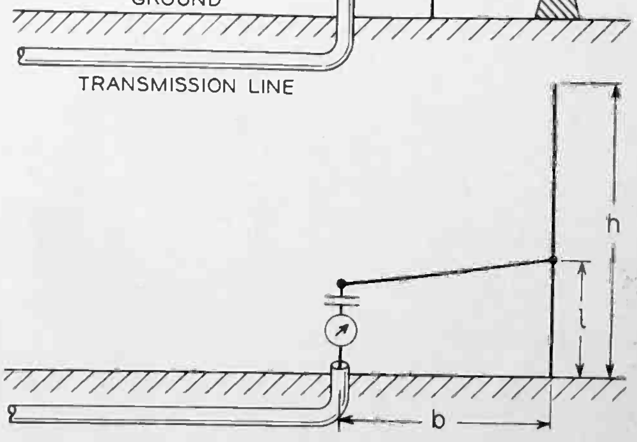


Fig. 1.

of the antenna, and the normal adjustment of impedance involves only an adjustment of this condenser.

This simplification is brought out by Figure 1, where the upper sketch represents the usual arrangement of the insulated antenna, and the lower one, the new shunt-excited antenna. A simplified schematic arrangement of the electrical elements comprising the insulated antenna and connecting circuit could be represented as shown in Figure 2. The radio transmitter, designated T, operates between the transmission line and ground. Zo represents the characteristic impedance of the transmission line, and Za, the impedance of the antenna; the insulator at the base of the antenna is indicated for contrast with the grounded antenna. The function of the coupling impedance, Zc, is to make the combination of Za and Zc equal to Zo.

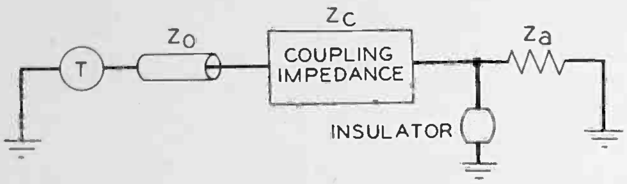


Fig. 2.

Contrasting with this, the arrangement of the shunt-excited antenna circuit is shown in Figure 3, where the base insulator of Figure 2 is replaced by a solid connection to ground. This arrangement divides the total antenna impedance into two parallel impedances, with the result that the antenna impedance may be varied within limits by changing the point of connection of the coupling wire. Still further adjustment is possible by varying the distance "b" of Figure 1, which also modifies the impedance which must be matched with that of the transmission line. With the former method the entire antenna impedance was in series with the coupling circuit, while with the new method it is split into two parallel branches, and for this reason the new method is described as shunt excitation.

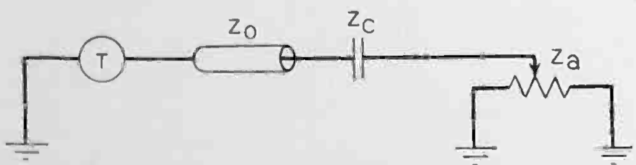


Fig. 3.

The simplification wrought by the shunt-excited antenna would be largely vitiated if the radiation from the antenna were adversely affected. Although mathematical analysis could give an approximate answer to this problem, there are always assumptions underlying such computations which may be open to question. It seemed desirable, therefore, to make field studies on an actual, full-size antenna.

Such a study became possible through the courtesy of the Detroit Daily News, which made available its 400 foot vertical radiator at Station WWJ. This antenna is of uniform cross-section, 6½ feet square, throughout its entire height except for the bottom 22 feet, which tapers to the dimensions of a single porcelain insulator. The base of this antenna is shown in Figure 4. It offered the advantage of permitting comparative tests on grounded and ungrounded antennas, since the base insulator could be short-circuited for the grounded tests.

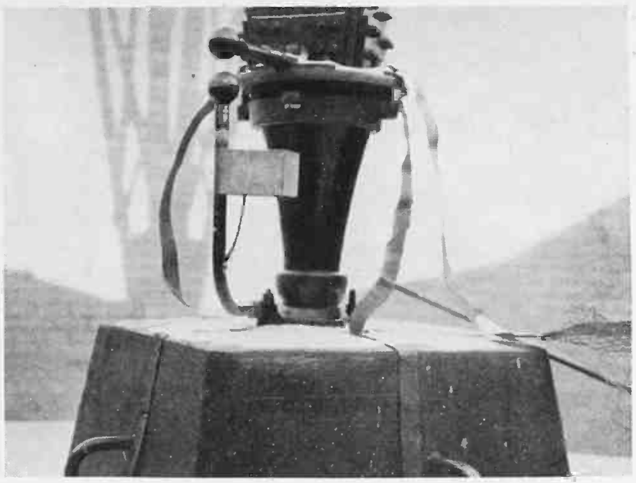


Fig. 4.

Although the current distribution in an antenna is commonly referred to as sinusoidal, such a distribution is only approximated in practice. To determine the actual current distribution, studies were made under both grounded and ungrounded conditions. A loop antenna from a Western Electric 44A Field Intensity Measuring Set was arranged so that it could be carried by a rope suspension up or down the full height of the tower. It was maintained firmly against one corner of the structure so as to be predominantly affected only by the current in the antenna at its own level. Current distributions for the series and shunt-excited antennas are shown in Figure 6.

In neither case is the current strictly sinusoidal, but it is essentially alike for the two conditions except for that section of the antenna below

Fig. 5.

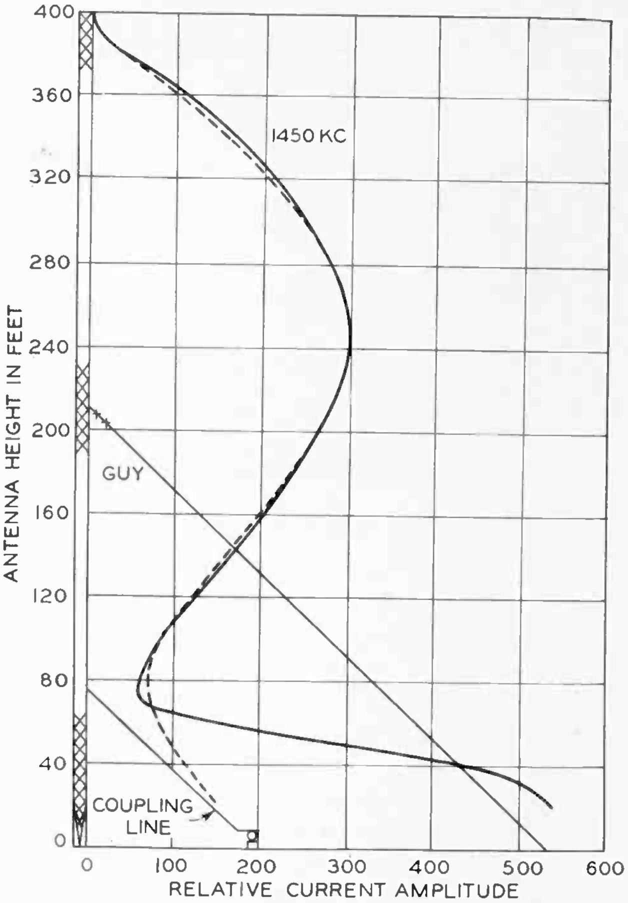


Fig. 6.

the point where the coupling wire is connected. The measurements were taken on the side of the antenna opposite to the coupling point so as to eliminate the field from the coupling connection itself. See Figure 5. Calculations indicated that for other positions around the antenna, the field caused by the current in the coupling wire would partially neutralize that due to the vertical radiator — making the distribution of the grounded antenna more closely approach that of the ungrounded antenna.

As a further check on the comparative effectiveness of the series and shunt methods of excitation, the ground-plane field intensity was investigated. A low-power oscillator was used to excite the antenna, but the data were corrected to correspond to a power level of 1000 watts and a distance of one mile. As shown in Figure 7 the two field intensity curves are substantially alike.

These field intensity measurements plotted against the height of the antenna in wavelengths are shown in Figure 8 for both the series and shunt-excited antennas. Here again, it will be observed, the two methods of excitation give very similar results. The slightly lower value of field strength in the vicinity of an antenna height of .3 wavelength for the shunt-excited condition was caused by known deficiencies in the ground system near the base of the antenna. These curves illustrate in addition the fact that with either series or shunt-excited antennas there is very little justification for increasing the antenna height above about ¼ wavelength unless it is increased to between .5 and .6 wavelength. The curves are fairly flat up to about .4 wavelength, and then begin to rise more rapidly, reaching a maximum value in the neighborhood of .6 wavelength.

These various curves show that the ground wave radiation is not appreciably affected by the new method of excitation. To determine the effect on radiation at higher angles, field intensity measurements were made, through the courtesy of the National Life and Accident Insurance Company, at distances ranging from 35 to 110 miles in several directions from the 0.58 wavelength vertical radiator of Station WSM in Nashville. Automatic recording equipment was used, and the antenna was excited by the series and shunt methods alternately every hour from midnight to 8:00 A.M. over a period of three weeks. A typical chart is shown in Figure 9. No discernible difference in the fading characteristics for the two methods of excitation was noticeable.

In so far as radiation characteristics are concerned, therefore, there is no important difference between the series and shunt-excited antennas. In respect to the cost and operation of the system, however, the shunt-excited antenna has a number of distinct advantages. The gain in the simplification of the coupling equipment has already been mentioned. With the shunt-excited antenna the required weatherproof housing for the coupling equipment becomes smaller and less expensive, since the only equipment required is a series capacitance and a meter.

The circuit supplying antenna lighting is simplified to an even greater extent. Since the antenna is at ground potential at its base, filter circuits or coupling transformers are not required. The lighting circuit may be run directly to the base of the antenna and thence vertically up the structure. All

(Continued on Page Twenty-six)

MILLIVOLTS PER METER

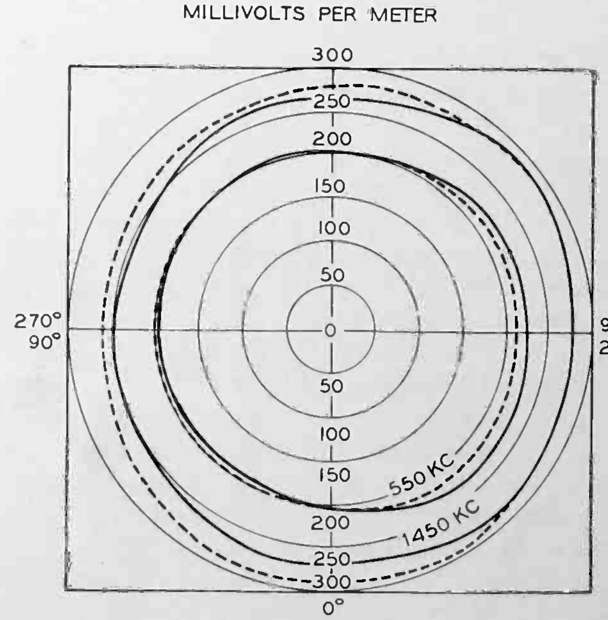
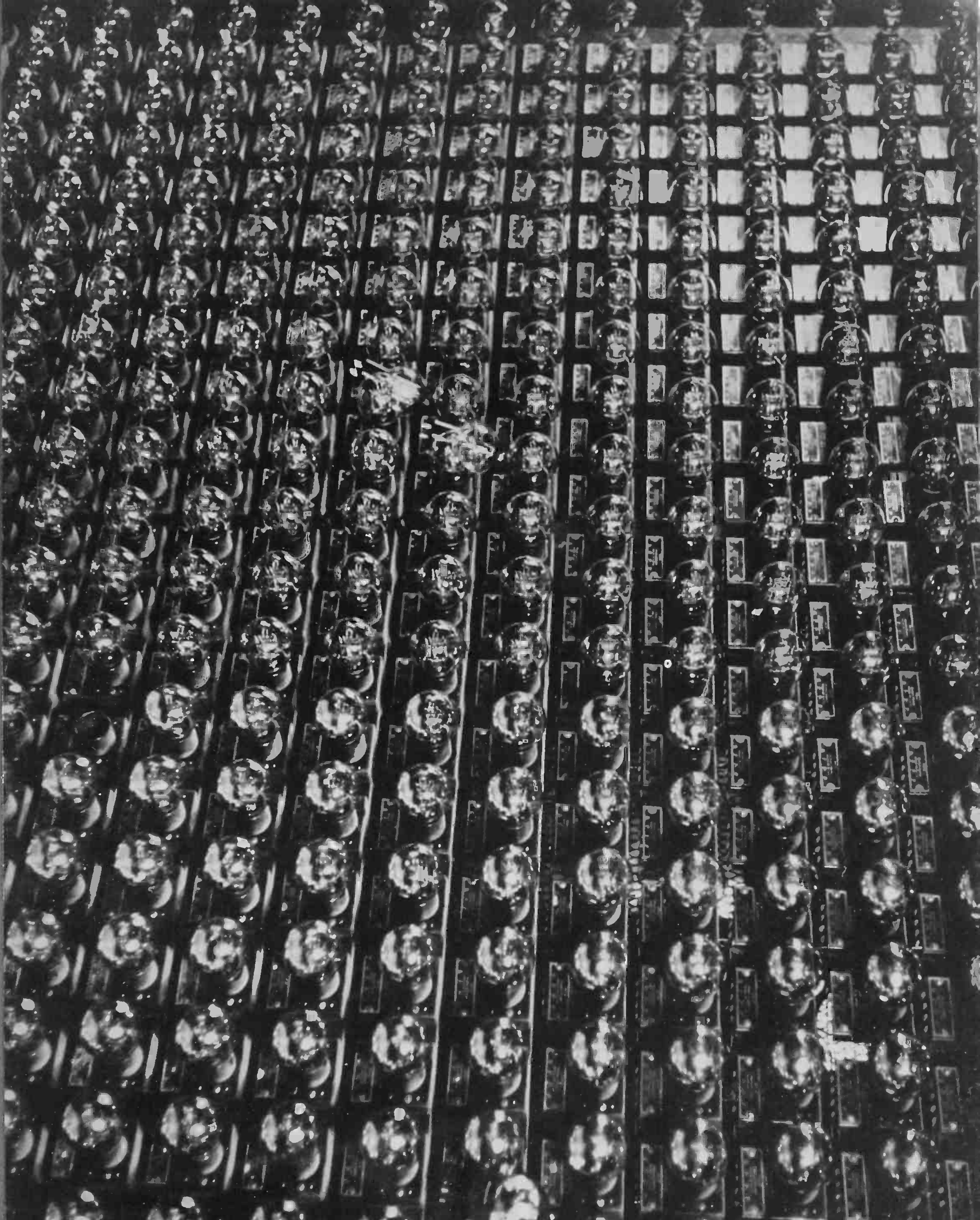


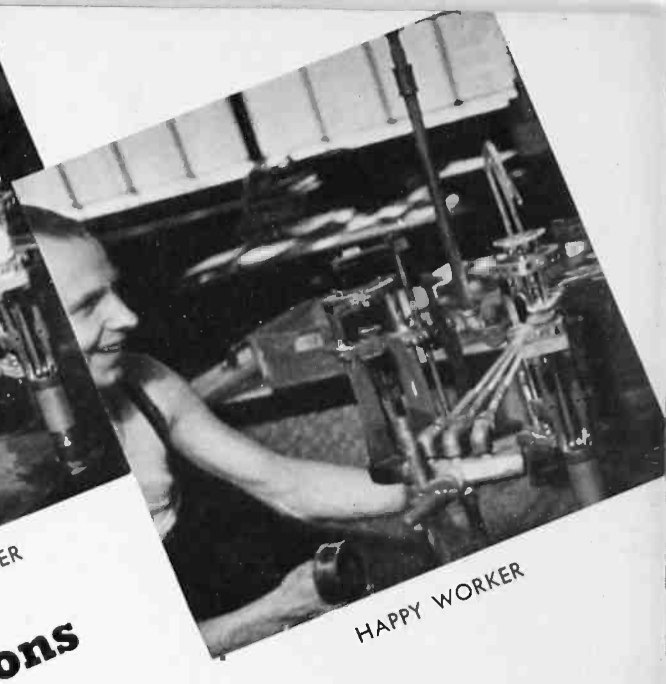
Fig. 7.



VACUUM TUBES

CAREFUL WORKER

CAUTIOUS WORKER



HAPPY WORKER

Here's Where They Bottle Electrons

By MADELEINE MOSCHENROSS

After you have tried to pick up a piece of wire 12 times finer than the finest hair, watched jets of flame many times hotter than the hottest ordinary heat taper off a bulb, heard a shop girl speak in terms of ohms, decibels and millimeters, learned how air was pumped out of a giant tube, and marveled as a single platinum wire moved slowly across a great, ponderous black coating machine, you become aware somehow that this unit of the Western Electric Company is "different."

By the time you end your tour of the vacuum tube shop at 395 Hudson Street in New York City, you are firmly convinced vacuum tube making is more than a manufacturing process . . . that it's an art, and the people engaged therein are artisans—from the girl who polishes the silvery bulbs to the shop's physicist.

Boxes and racks and rows of bulbs glitter like iridescent soap bubbles, or gleam like silver Christmas balls. These are the tubes which give voice to radio and talking pictures, enable the public address system to speak like a giant, and the telephone user to talk across the continent.

Here is a rack of photoelectric cells. That innocuous-looking bulb with a whitish-silver patch, which turns light into sound, causes doors to swing open mysteriously, and performs other practical feats of magic.

The shrill note of bustle and hum ordinarily identified with busy workshops seems strangely lacking. With quiet concentration, white-gloved girls, protected by slabs of glass, lean over small assembly blocks. So fine is the work, some must peer through microscopes. Laid out in neat piles before them are bits of mica and metal, delicate spirals, short lengths of fuzz-thin wire. An attractive miss picks up a wire with a tweezer. Sometimes, for the sake of accuracy, the tip of a razor blade is resorted to, the point of a needle, or a miniature awl.

Watch this girl spot-weld. Without a tremor she joins two almost invisible wires. The weld is a mere speck. A clear eye, a steady hand, long practice and intelligent application, these seem to be the requisites for tube shop workers.

There is a girl wearing asbestos "finger-tips." Everywhere you look, you see brilliant jets of flame playing on spheres of glass. On one type of machine, a girl joins a small glass tube to a bulb. The tip of the bulb is heated to a fiery consistency which melts a hole in it, and the tube is added thereon—"tubulating," it is called. A man threads a long glass bead upon a wire, and flames melt this into a small globule—"beading." A girl with opera-length white gloves sits intently watching while the tubes on her machine cool and harden—"annealing."

White gloves, you learn, are to protect the hands from burns and slivers, or "spits," of glass.

From a giant tube measuring four feet or more, for use in a famous broadcasting station, all the way down to tiny vacuum fuses less than an inch in length . . . from a crisp, cool, air-conditioned room

All photographs on pages 11, 12, 13, 14, 15 were taken at the Vacuum Tube Development Laboratory of Bell Telephone Laboratories and the Vacuum Tube Shop of the Western Electric Company, New York, N. Y.

The process of making a grid for an ultra-short wave vacuum tube is so delicate that it must be carried on with the aid of binoculars.

with an all-year-round even temperature to a glass-walled air-tight place where the thermometer sometimes reaches dizzy heights . . . from a girl who assembles 280 tubes a day to a man who works on a single job for two days . . . from cement so hot that it freezes, to liquid air so cold that it burns . . . tubes costing a dollar to tubes costing several hundreds . . . individual electric fans to cool the operators, and areas where no breeze is allowed . . . truly this is a place of contrasts!

In the air-conditioned room, where the filament work is done, humidity ratings are taken four times a day. Peeling and cracking of filament is fatal to the life of a tube; thus, every precaution is taken to prevent such a calamity.

All bulbs, or "glass envelopes"—as some call them here, are made to order by an outside manufacturer. They are carefully inspected upon reaching the shop. Before they are sent to the assembly room, they must go through a series of baths. Subsequently, the tubes are tested for "strain."

A strain means a weakness in the glass; a weakness means a probable crack; and a crack means that a tube must be replaced. Great caution is exercised to prevent "susceptible" material from being sent out.

Tests are conducted in an odd-looking contraption called the "polariscope." It looks like a small doll-house with one wall knocked out, and is lined with a deep velvety black. Peering through a lens you see a square of lavender light, like a screen in a darkened theatre. You hold a tube before this screen. If a greenish streak appears anywhere in this bulb, explained an engineer, that's a strain. If the color is yellow, that's a very bad strain indeed.

Voluminous test data are taken daily. Terms like resistivity, megacycles, capacitances, harmonics, reactances are bandied about.

"Aging" is important to the quality of a vacuum tube. Tubes stay in aging racks from eight to sixteen hours before a final test is made.

In a corner on the fourth floor, life studies of new tubes are conducted regularly. The tubes remain in test racks about 2,000 hours and any oddity, change in characteristics or variation in action, is observed and recorded.

In the glass-blowing room, artisans are doing amazing things with lengths of glass tubing, twisting, turning and manipulating while glass assumes a jelly-like consistency under a powerful heat.

"KEEP OUT" signs are much in evidence on another floor. The signs, augmented by heavy iron chains, warn you that this is the high-voltage area—and here the all-important process of pumping out air and gases is carried on. Apparatus is covered with thickly latticed guards.

Much of the vacuum tube work consists of making repeater tubes for the telephone companies, those tubes which reinforce the voice currents flowing over the wires of the nation. A great many "peanut" tubes, the smallest made here, are used by the Government. They really are no bigger than a peanut.

However, the job which fascinated this reporter most, was not the evolution of a giant or peanut tube. It was the intricacies of what is called a "thermocouple." A thermocouple is a tiny current or heat measuring device. Slightly larger than a vacuum fuse, its inner construction transcends by far the minuteness of a Swiss watch. Girls are hand-picked for this work. Six to twelve months are required to train one.

Truly, this is a major operation performed with Lilliputian tools. For example, the wire used measures only .0003 of an inch in diameter and is reduced to this size electrolytically. "Electrolytically" means an etching or acid bath, plus electric current, which reduces the wire from a diameter of .0005 of an inch to approximately .0003 of an inch in diameter, with a resistance of 300 ohms per inch. Wires have been reduced to as small a diameter as .0001, practically invisible.

The wire which goes into the thermocouple gets a mercury bath,

(Continued on Page Twenty-three)

Electrical spot welding operation in the assembly of the filament to stem leads in a ballast lamp—performed in an atmosphere of hydrogen.

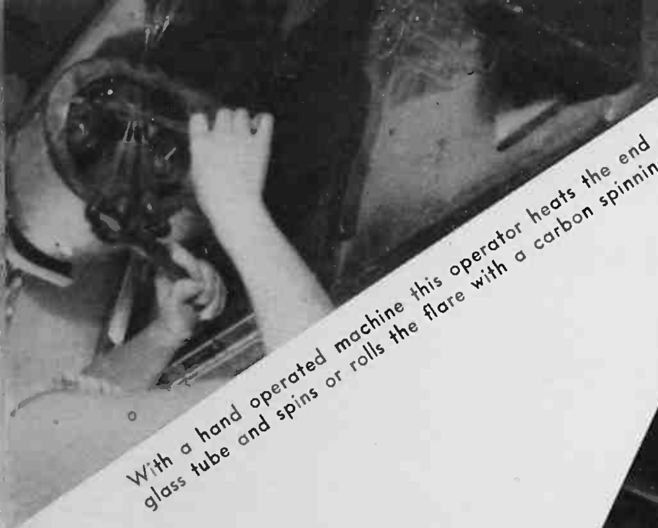
Copper-to-glass seal being made on the 298A vacuum tube

Full automatic grid making machine capable of producing 4500 grids in eight hours

Routine inspection of tube stem assemblies for alignment, appearance and quality of wells

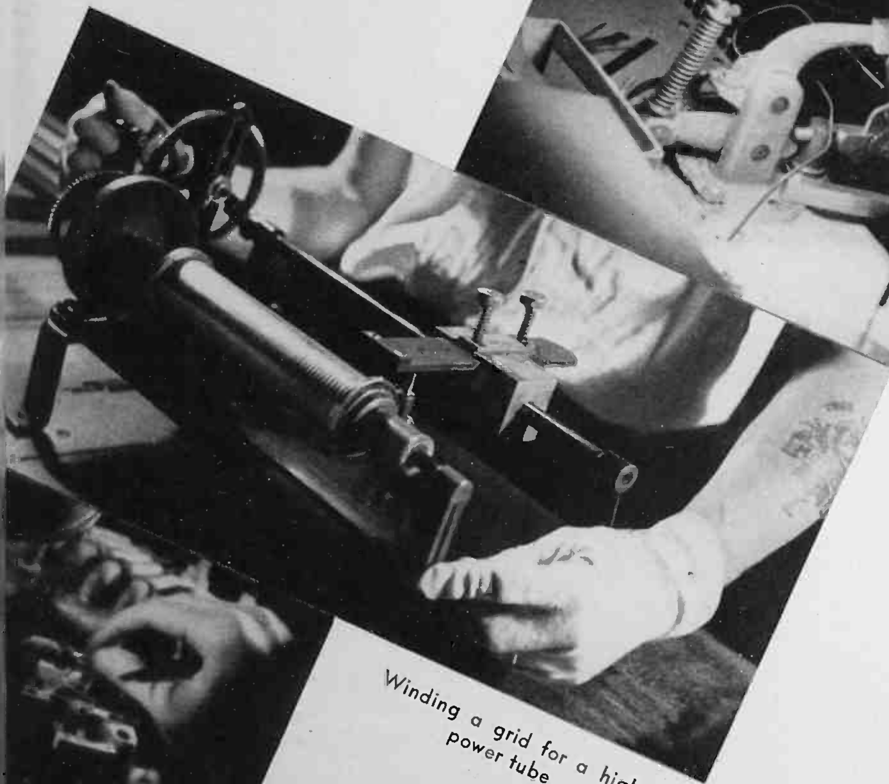
Apparatus for preparing and bottling pure carbon monoxide used in special processes

Assembling
and glass prep
making tube



With a hand operated machine this operator heats the end of a glass tube and spins or rolls the flare with a carbon spinning tool

Assembling a 316A ultra-short wave vacuum tube



Winding a grid for a high power tube

Upper right: making final seal on a 232 B vacuum tube

ires
to

Below: inserting lead-wire to side wall of glass stem

Left: joining a tube extension to a bulb

WCLO Introduces

the First 23 A Transmitter to Go on the Air

By SIDNEY H. BLISS
Station Manager

A full, rich chord from the organ—a majestic call to attention—swells out over the studio. The music fades.

"H-e-r-e we go," says the announcer. Backstage a switch clicks into place. Five seconds later station WCLO starts operating a complete new broadcasting system from microphones to antenna. Again the same full chord resounds through the studio — but now it wings over the air with such power, clarity and purity of tone that the comparison is startling.

Sidney H. Bliss

Telephone calls and telegrams pour in from WCLO's enthusiastic audience. "Program coming in clear as a bell"—"Change from old to new a great improvement"—"Increased volume marvelous"—"WCLO comes to us clearer than any station"—"Getting our signals from new transmitter wonderfully clear"—"Reception splendid"—"Congratulations"—"Success." And so they come by the hundreds.

This was the reception accorded the initial performance of the 310 B Transmitter introduced recently by the Western Electric Company. The Janesville Daily Gazette, owner of WCLO at Janesville, Wis., was the first organization to purchase and to put into operation this new high fidelity equipment.

Prior to the dedication, the Gazette carried a full page announcement advising listeners that at 11:45 A.M., August 16, a 15-minute musical program, using the facilities of the old station, would be presented and promptly at 12 noon, a switch would be thrown putting all the new equipment into operation. Immediately following the transition the identical program would be repeated. These plans were carried out to the letter and the results were overwhelmingly gratifying.

WCLO's history as a newspaper-owned station dates back seven years when it was purchased by the Janesville Daily Gazette from a realtor in Kenosha, Wisconsin. For the following two years the station hobbled along with ever-increasing bills for burned out parts and tubes. The equipment was of a composite variety which gave more grief than service.

In 1932 the newspaper, exasperated with the way things were going, decided to replace the transmitter with the then new Western Electric 301 type. Although the change solved the transmitter troubles the speech input equipment was still composite and a constant source of trouble. The quality of programs proved far from satisfactory, particularly when compared with those emanating from metropolitan centers.

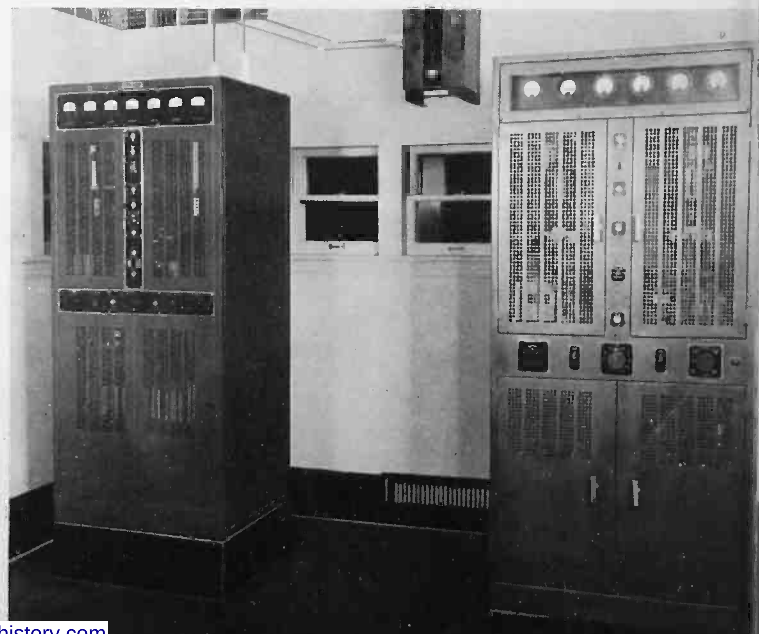
Early this year the owners determined once and for all to throw out the whole layout and replace it with the most modern equipment of recognized quality, from microphones to antenna. So it was that WCLO took delivery on the first Western Electric 310 B 250/100 watt high fidelity transmitter. According to station manager S. H. Bliss the new equipment has far fewer parts than other transmitters which were considered, is simple to operate and up to the present time does everything the manufacturers claim for it.

In March a site, located between Janesville and Beloit, was selected, a five-acre plot purchased and work begun on an attractive modernistic transmitter plant. A three-eighths wave 260 foot vertical Truscon-tower radiator with a capacity top was erected just north of the plant, using the shortest transmission line possible.

The single story house represents the last word in modern transmitter plants. It is con-

(*Continued on Page Twenty-three*)

WCLO's new 23A Transmitter (left) which replaces the 301A (right) now used for county police service and operated by the station's technical staff.



Texas Tells the World About Texas

and Western Electric Radio and Public Address Play a Big Part in the Telling

Cowboys, Indians, fan dancers, million dollar buildings and exhibits, lakes, lagoons, longhorn steers, Texas rangers, historical pageants, Shakespeare, a hot sun and fleecy clouds by day, fireworks, gorgeous light displays by night, awe-struck, laughing crowds, music and sound! Such is the Texas Centennial Exposition at Dallas, commemorating the 100th anniversary of Texas Independence.

1936—Texas played host to the Nation at large.

It is an exposition in every sense of the word. A fairyland which is completely eye-filling, combining and mixing past with present. It is a glowing, proud and dramatically living history of Texas' past, and a dynamic demonstration of its present and promised future. It is an exposition of and by Texans as only Texans could conceive and achieve it.

No less dramatic and outstanding than any other feature is the use of sound; sound as recorded, reproduced and broadcast by Western Electric equipment. Sound at the Exposition actually becomes one of its high spots. Great sound pylons erected at strategic points throughout the spacious area of the exposition grounds direct sounds to every avenue, nook and corner. So well are the grounds covered with sound that it is impossible to find even one dead spot.

To some, whose nerves revolt at the harsh, blatant sounds which often characterize reproduced music, it might seem that such a blanket of sound would prove offensive, but the reverse is the case at the Texas Centennial. The music as it is reproduced from vertical cut recordings or coming from live talent has the same soft, appealing quality as original music. At the fair it proves a balm to tired, weary sightseers who sit under the shade of trees, and listen to the strains of southern melodies, or the broadcast of a famous orchestra imported from the East for the duration of the fair.

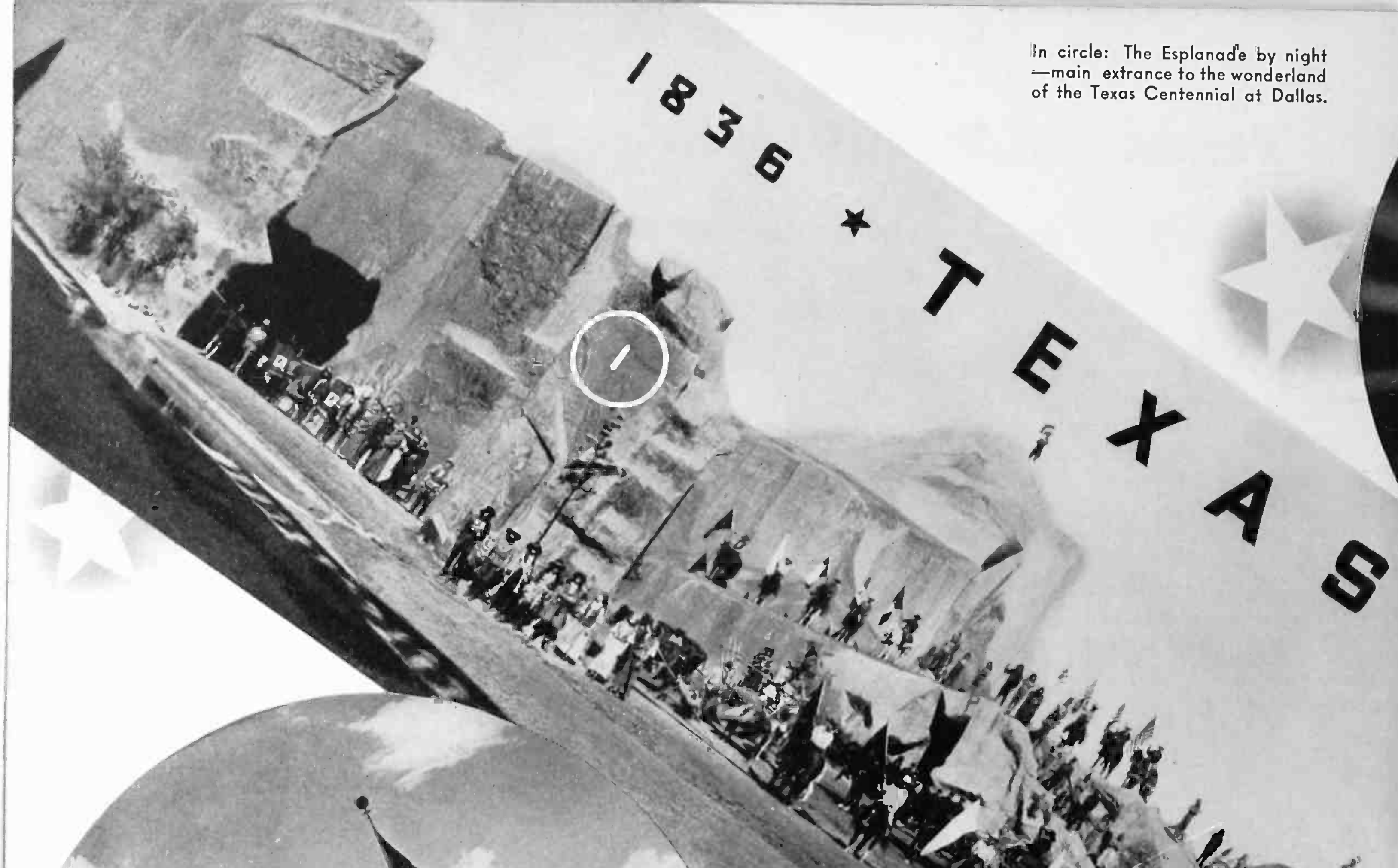
Probably the most unique use of reproduced sound ever achieved is found in the great historical pageant, "The Cavalcade of Texas." This spectacular show paints with bold, fast moving tableaus the high points of Texas history. The action takes place before an enormous stage setting of mountains, rivers and cattle trails. It is the largest set of its kind ever constructed—300 by 100 feet. Huge sets roll in from either side on railroad tracks. Across the panorama of Texas scenes ride cowboys, Indians, cattle. Covered wagons appear. The battle of the Alamo is staged. There are passages showing Sam Houston visiting Andrew Jackson at the Hermitage, and many other intimate scenes where dialogue is an essential.

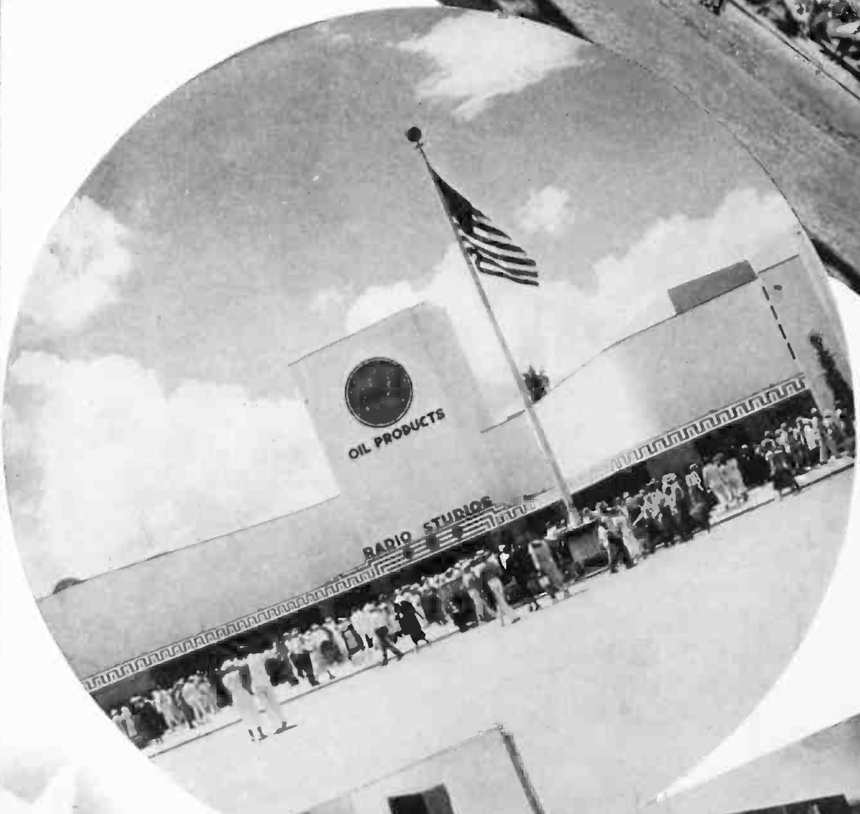
And it is the use of dialogue which makes the spectacle the success it is. It would have been impossible to have the actors speak their lines, for their voices would not have carried to the front row of the 3,500 spectators who jam the amphitheatre at each performance. Nor would it have been feasible to pick up their voices and amplify satisfactorily, for the action is spread across too vast a stage. The answer was to record the dialogue and have the actors time their pantomime to the reproduced dialogue. So splendidly has this been done, there are few who realize that the actors do not speak their lines. Music is blended with the dialogue throughout, and this combination of music and dialogue makes "The Cavalcade of Texas" a living pageant, thrilling, dramatic and moving. As far as it is known, this is the first use of pre-recorded dialogue for a pageant.

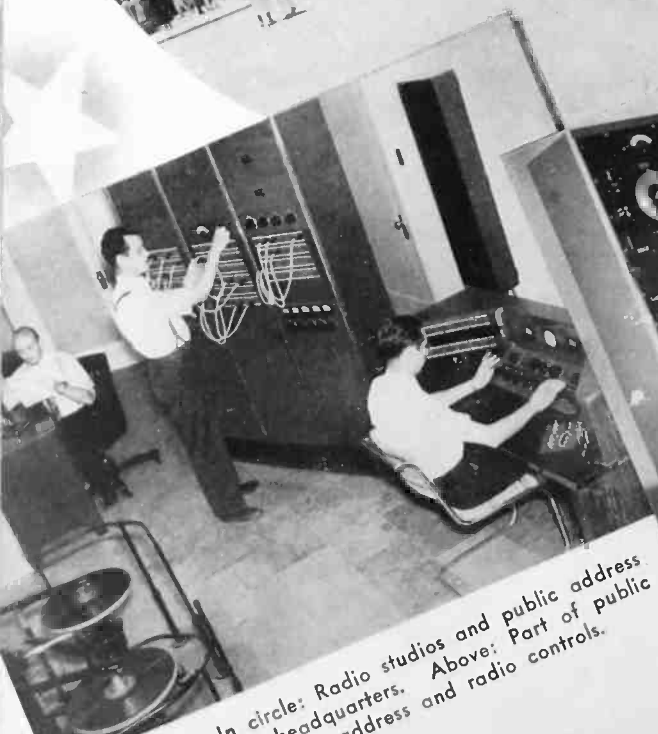
Sound comes from three sources, one on either side of the great setting and the third in the center. The loud speakers are cleverly camouflaged in the set. As the action moves from one part of the stage to another the sound moves with it, so that at all times the dialogue appears to emanate from the mouths of the actors. This is accomplished by skillfully fading and switching the sound from one sound source to the other.

The complete radio and public address system at the fair is controlled by the Gulf Oil Corporation. Radio plays a great part at the fair for programs emanating from the grounds are broadcast over local and national hook-ups many hours of the day. The $50,000 radio studios erected on the grounds are completely Western Electric equipped. There are remote pick-ups at many points on the grounds and all of this equipment is likewise Western Electric as are the two sound trucks which are in constant use. There are two complete Western Electric Public Address Systems in the Chrysler Building, one in the General Motors Auditorium and another giant system in the Cotton Bowl which seats 50,000. Radio and Public Address play a tremendous role in the Exposition, and it's all Western Electric.

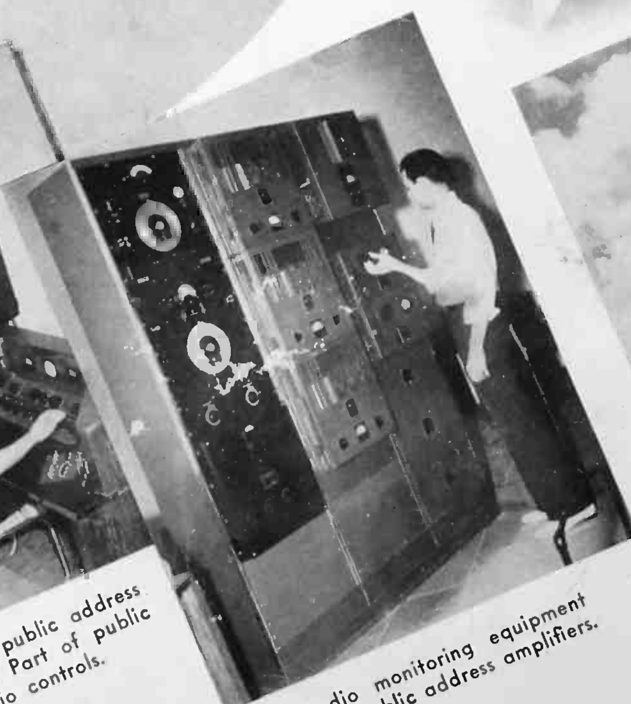
In circle: The Esplanade by night —main extrance to the wonderland of the Texas Centennial at Dallas.







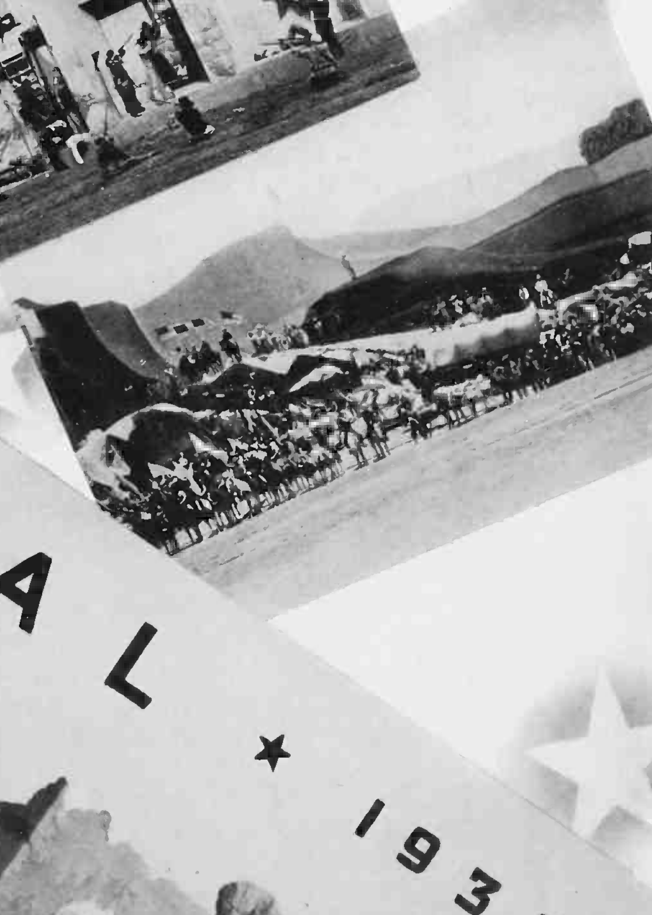
In circle: Radio studios and public address headquarters. Above: Part of public address and radio controls.



Radio monitoring equipment and public address amplifiers.

One of the 19 sound pylons which distributed sound over the entire grounds.

CENTENNIAL ★ 1936



Individual scenes from "Cavalcade of Texas."

Tremendous setting for "Cavalcade of Texas," thrilling pageant depicting Texas history. All music and dialogue is reproduced from vertical cut records on Western Electric high fidelity public address equipment. Sound emanated from three sources indicated by white circles.

KWK Tops Eleven Years' Progress With Installation of New 5 KW

Baseball Reports and Constant Improvement Helped to Win Early Recognition for Station

To keep pace with the rapid progress of broadcasting—to fulfill the demands of a widespread radio audience for high fidelity and greater signal strength, Station KWK in St. Louis, has installed a new Western Electric high fidelity, all-AC-operated 5 KW transmitter. The new station is situated on Riverview Drive in the Baden section of northern St. Louis. This is an ideal transmission site for city coverage as well as for numerous small towns to the north and east in Missouri and Illinois.

KWK has traveled a long and sometimes tedious road in its climb to prominence and popularity. Eleven years ago on St. Patrick's Day the station, owned and operated by Thomas Patrick, Inc., went on the air. Although located in the Hotel Chase, one of the finest hotels in the city, KWK was provided with meagre space—one small office, a transmitter room, and a studio. The staff numbered three—an engineer, an announcer, and a stenographer who also acted as program director and pianist. Thomas Patrick Convey, head of the organization, carried on all other duties from those of office boy to those of president.

With every conceivable obstacle impeding KWK's progress, but with its play-by-play baseball reports carrying it into popular favor, the first real break came with an offer from the National Broadcasting Company to join its network. Needless to say the offer was accepted and on December 1, 1927, KWK became an associate station of NBC for programs originating from WJZ. The network affiliation brought the station immediate recognition, and month by month it gained in popularity.

Early in the fall of 1930 Thomas Patrick, Inc., purchased from "The Voice of St. Louis, Inc.," their Western Electric transmitter which was located at Kirkwood, a suburb of St. Louis. These added facilities enabled KWK to give constant day and night service not only to the metropolitan audience but to rural districts throughout Southern Illinois, Missouri, Tennessee and reaching north to the Iowa line in the area commonly termed the "billion area."

This step forward placed KWK among the leading stations in handling both sustaining and commercial programs originating on the Blue Network out of Chicago and New York studios, as well as a number of other pick-up points of the NBC System.

All through the hectic days of KWK's early development Thomas Patrick Convey looked to the time when his son Robert Thomas would take his place at the helm of his rapidly growing business. He continually trained the boy in the fundamentals of good broadcasting supervision. After assigning young Convey to a broadcast of a ball game, a post mortem would be held for frank criticism. Soon "Bob Thomas" became a by-word to baseball listeners. As the years rolled by the father's vision became a reality. Young Bob was managing the junior executive departments with the ability of his dad.

Thomas Patrick Convey's patience and perseverance meant much to the organization. When he passed away recently his talented son was well equipped to take complete charge of KWK. His handling of executive duties has placed him 'way ahead of the average young man, for R. T. Convey, president, is yet only in his early twenties. Ably assisting Mr. Convey are Clarence G. Cosby, general manager of the organization; James P. Burke, chief engineer, and an excellent staff of employees.

Mr. Burke with his keen knowledge of transmitting equipment, has done an outstanding job in the organization. While still at high school he began experimenting with amateur wireless telegraphy. Shortly after graduating from the Rankin school in St. Louis he entered the service of the Southwestern Bell Telephone Company where he spent three years. He holds a commercial wireless operator's license and sailed on merchant vessels for the old Marconi Company and later for RCA when that company took control of wireless communications.

Today as in earlier days the Thomas Patrick corporation continues to plough its revenue back into expansion, development and programs. The studios occupy two-thirds of an entire floor of the Hotel Chase—the personnel has grown from 3 to 43 members and the installation of the new 5 KW transmitter places KWK among the best equipped stations in the country.

KWK's new Western Electric transmitter is similar to the 5 KW equipment at WSAI of the Crosby Radio Corporation, described in the May 1936 issue of PICK-UPS.

KWK

ST. LOUIS

Eleven years ago KWK began a hectic rise to fame and power in the middle west. It was founded by Thomas Patrick Convey. Today his son, Robert Thomas, carries on.

•

Above: The Western Electric 5 KW transmitter. Nick Zehn, plant engineer, records as James Burke, chief engineer, takes readings.

•

Left: William Ludgate, operator, before the Western Electric speech input and monitoring equipment.

•

Below: KWK's modern station and half-wave vertical radiator.

Phillip H. Smith

Back in 1924 a model "T" Ford jogged along a highway that led to one of Florida's ideal camping sites. Model "T" Fords were as common as the dandelions which grew along the roadside yet this particular car drew the attention of every passing motorist, for from its cramped interior came the sweet strains of an orchestra playing "The World is Waiting for the Sunrise." The young man at the wheel was 19-year old P. H. Smith, of Lexington, Mass. He was getting a big kick out of the sensation being created by his home-made loudspeaking radio set.

P. H. Smith

Smith had just finished high school and was on a vacation trip before entering Tufts College. Radio caught his fancy at an early age. While still in high school he took evening courses at the Cambridge YMCA and the Eastern Radio Institute to further his knowledge of the subject. During this period he contributed several briefs to the radio section of the Boston Traveler.

In 1928 Smith received his BS degree in EE (majoring in communications) and in August of that year joined the Radio Research Department of Bell Telephone Laboratories. Smith's first assignment took him to the Laboratories' experimental station at Deal Beach, N. J., where he worked principally on short wave directional transmitting antenna problems. Later he aided in testing and developing directional antennas for the American Telephone and Telegraph Company's short-wave transatlantic telephone terminal at Lawrenceville, N. J. Here he also assisted with the installation and tests of this extensive array of antennas.

In 1933 Smith transferred to the Radio Development Department of the Laboratories where he has since been engaged with antenna and transmission line problems as they are related to broadcasting. He was responsible for the electrical design of the coupling circuits for the new WOR and WJAR directional broadcast antennas. He is the author of the article on Concentric Radio Frequency Transmission Lines and their Application to Broadcasting, which appears on page 3 in this issue of PICK-UPS. He is also the co-author, with J. F. Morrison, of a paper on the shunt-excited antenna which was presented at the last convention of the IRE in Cleveland.

Smith holds a first class radio telephone operator's license and is an associate member of the Institute of Radio Engineers. During his spare time his interests lie in motor-boating. He is married and has two small children.

John F. Morrison

John F. Morrison, of Bell Telephone Laboratories, had hardly donned his first pair of long trousers when he decided that radio was just about the most interesting career a chap could follow. This was in 1921 and young Morrison had reached the advanced age of 15 years. Two years spent at the Buffalo Electrical Vocational School gave him the background he desired.

J. F. Morrison

His first job came in 1923 when he joined the engineering department of the Federal Telephone and Telegraph Company. Here he devoted his time to the development and manufacture of the earlier types of broadcast receivers and transmitters. He left the Federal Company in 1926 to join forces with the Long Lines Department of the American Telephone and Telegraph Company. Perhaps the desire to do a little roaming and see new lands took possession of the young engineer at this time for he switched over to the Radio Corporation of America as radio operator on Standard Oil Company ships plying their trade between New York and South American ports.

A year later an unusual opportunity came along that made operator Morrison say goodbye to life on board ship and hurry back to Buffalo, his home town. A new $1,000,000 concern known as the Buffalo Broadcasting Corporation, which would direct the activities of Stations WKBK, WGR, WMAK and WKEN, was being organized and Mr. Morrison was offered the position of vice president and technical adviser. He was 22 at the time. The youthful executive soon became a well known figure in broadcasting circles.

In spite of the success and prestige of this new venture Mr. Morrison felt he wanted to devote more time to research in broadcasting equipment and its design. Therefore in 1929 he returned to New York and joined the radio development department of Bell Telephone Laboratories. His work there has included the supervision of radio broadcast transmitter installations, radio transmission studies and broadcast antenna design. One of his outstanding achievements was the design of the antenna system for WOR's 50,000 watt transmitter at Carteret, N. J.

When asked if he had a hobby, Morrison answered, "yes, radio."

He is married and the father of a son and a daughter. His wife was the former Susan Burlock of Buffalo. His article "The Shunt-Excited Antenna," appears on page 8 in this issue of PICK-UPS.

WCLO Introduces First 23A

(*Continued from Page Sixteen*)

structed of Haydite and glass block and is one of the first structures of its kind in the country. There are four different roof levels, the entrance being a tower about 23 feet high. A glass block section running to the top of the building becomes a part of the front wall directly above the entrance door. Into the back wall of the tower facing the transmitter room a large monitor unit has been constructed which utilizes the wall as a part of the baffle. The house is heated by oil, humidified and completely air-conditioned, and provides living quarters for the chief engineer, his wife and two operators. It consists of a transmitter room, two bedrooms, bath and combination living and dining room and kitchenette.

The lighting effect at night is most unusual and colorful. A glass block section 2 feet wide running completely around the transmitter room gives the effect of a white lighted strip.

WCLO's four studios occupy the third floor of the newspaper plant in Janesville. This floor also accommodates a large reception room, four offices, sheet music and transcription libraries, control room and kitchen. All equipment is modern and efficiently cared for by a staff that takes genuine pride in the station.

The Janesville Daily Gazette, a progressive newspaper which has served southern Wisconsin for over 90 years, is guided by an organization which thoroughly understands the needs, and desires of WCLO's listeners. The station caters to a combination urban and rural audience, with a large variety of programs with local interest, though a comparatively small amount of local talent is used. It is a member of the Affiliated Broadcasting Company and uses the NBC Thesaurus program service.

WCLO accommodates scheduled programs of such organizations as Milton College; the State Normal School, Whitewater, Wisconsin; Parent-Teachers Association; the Medical Association; 4-H Clubs; and Civic Organizations requesting time for specific purposes.

A very complete news schedule is carried each day consisting of four 15-minute broadcasts at 8:00 A.M., 12:00 noon, 6:00 and 10:15 P.M., with news bulletins on the hour throughout the day and evening. Street broadcasts, a large number of remotes in Janesville and Beloit; organ programs with soloists; cooking schools; religious periods; news of social, church and club activities throughout the area; sports broadcasts; and dance programs make up the majority of the programs of a well-balanced schedule of local interest. The network programs provide another type of entertainment and add to the completeness of WCLO's service to the listener.

The station has an enviable following throughout southern Wisconsin and northern Illinois.

Control desk showing control assembly, rack, frequency monitor, turntable and temporarily installed microphone. Western Electric Non-directional microphones are used in WCLO's new studios.

It has fostered many unusual and interesting types of services, such as giving life-saving and swimming instructions over the air and feeding to a Wisconsin network of radio stations a unique series of safety programs for the Pure Oil Company.

Where Electrons Are Bottled

(*Continued from Page Thirteen*)

an acid one, an ammonia-water mixture, and finally a drop of pure distilled water, and still it looks like a baby's hair, only more so. It's twelve times finer than the finest hair, and the slightest movement of the table, or a sudden gust of air can break it, and the process must be repeated.

The tinkling of breaking glass is pleasant to the ears as you pass by the rotating sealing machines (the glass is knocked off as a tube is sealed in)—and you learn that 300 bulbs an hour are tubulated here.

Fleeting impressions can scarcely do justice to a shop of this type. One is too apt to leave out some vital and important point. A day in the tube shop is not enough. Nor a week. Said an attractive miss who has spent all her working years here, "It's a great place, and it still has a fascinating hold on me." No wonder a visitor is spellbound.

You are ready to leave. You thank D. H[illegible]er, who heads this interesting workshop, for a new experience. As you are ushered out, something is ushered in—something so big, so *colossal* you stand back in awe and ask:

"What is it?"

"Oh, that's just the biggest broadcasting tube in the world," is the casual reply.

Piping RF

(Continued from Page Four)

for several reasons, to terminate a transmission line in a pure resistance load equivalent in value to the characteristic impedance. By so doing, standing waves are avoided which if present may cause corona discharges or flashover within the line at nodal points. Also, the input impedance is then equal to the load impedance irrespective of the length of the transmission line, so that the transmitter output circuit can be designed to work into a predetermined transmission line impedance.

The design of lines suitable for transmitting a specified amount of radio frequency power safely must also involve a consideration of the voltages which are to be imposed on the line. This voltage in the case of a line terminated in its characteristic impedance (Z_0) remains constant throughout its length and is simply:

$$E = \sqrt{P Z_0}$$

where P is the radio frequency power at the carrier in watts.
E is the radio frequency r.m.s. voltage at the carrier.

This must be multiplied by 1.414 to obtain the radio frequency peak voltage at the carrier and again by 2 to obtain the radio frequency peak voltage at 100% modulation.

In a concentric transmission line the maximum voltage gradient occurs at the surface of the inner conductor. A smooth line free from insulators and perfectly concentric flashes over at radio frequencies when this gradient exceeds about 20 kv/cm. The presence of insulators, slight irregularities in the surface of the conductors, etc., often produces this gradient at localized points on the inner conductor long before the same gradient on a smooth part of the surface is reached; consequently the breakdown voltage is not readily calculated from standard formulas with any great degree of accuracy.

Theoretically for two lines of similar construction but of different cross sectional dimensions, the ratio of their breakdown voltages is proportional to the ratio of their characteristic impedances times the ratio of their inner conductor diameters. However,

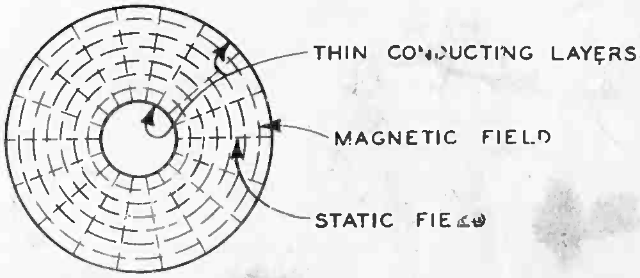


Fig. 3

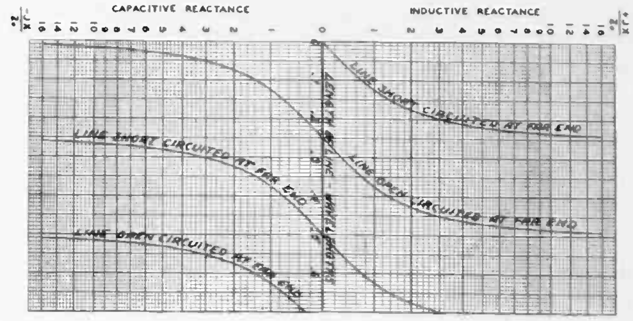


Fig. 4

experiments have shown that due to the large number of other variable factors involved, it is advisable to measure the actual breakdown voltage in each case to obtain definite information.

A notable example of the use of concentric transmission lines is at the new 50 kilowatt station WOR in Carteret, N. J., in connection with a three-element, directive antenna system designed by Bell Telephone Laboratories. In this installation a 2⅝″ O.D. copper line is employed. The line is filled with nitrogen gas under pressure which serves to exclude the possible entrance of moisture and to provide an additional factor of safety by more than doubling the normal breakdown voltage. Figure 1 and Figure 2 show close-up views of details of this line. Gas valves and connections are partially visible in Figure 1.

Concentric lines have been found to exhibit certain electrical properties which render them useful in performing special duties as circuit elements. Sections of line which are either short-circuited or open-circuited at the far end are equivalent at the near end to substantially pure inductances and capacitances varying cyclically between zero and infinity as the length of the section is varied. This property is indicated quantitatively in Figure 4.

In the significant case of a quarter-wave line which is short circuited at the far end, the input impedance approaches infinity at the operating frequency while at even harmonics of this frequency the input impedance is but a fraction of an ohm. This property makes the quarter-wave line valuable as a shunt for suppression of the even harmonic frequencies flowing in the main transmission line connecting the transmitter to the antenna. A similar shunt for the third harmonic and its multiplier is obtained in a line which is short-circuited at a distance equal to one-sixth of the operating wavelength.

The one-sixth wave line exhibits a positive input reactance at the operating frequency. While this property makes it impossible to bridge it across the main line as in the case of the quarter-wave line without proper coupling means, the positive reactance can be anti-resonated with a line, in parallel at the coupling point, which is equal to one-twelfth of the operating wavelength and open-circuited at the far end. The latter line will offer further attenuation to the odd harmonics.

The attenuation offered to the harmonics by these shunts depends upon the ratio of the harmonic impedance of the main line to that of the shunt, since the output of the transmitter may be considered as a source of constant harmonic current. Expressed in decibels, this attenuation is:

$$\mathrm{db} = 20 \log_{10} \frac{Z_1}{Z_s}$$

where Z_1 is the harmonic impedance of main line.
Z_s is the harmonic impedance of shunt line.

When the shunt is connected across the sending end of the main transmission line of a given length, it is necessary to consider the impedance of the load at the harmonic frequency. The most desirable load impedance at the harmonic frequency will depend entirely upon the particular length of transmission line which is used. Thus, for example, a line which is approximately a quarter wavelength long at the harmonic frequency should be terminated in a low harmonic impedance in order to produce a desirable high impedance at the sending end.

On the other hand, a line which is approximately a half wavelength long should be terminated in a relatively high harmonic impedance. Under favorable conditions, harmonics delivered to the antenna may be suppressed 50 db or more by the application of such a shunt. The new 50 kilowatt station WJR at Detroit makes use of a quarter wavelength concentric transmission line harmonic shunt to suppress the second harmonic radiation which, in this case, is the exact operating frequency of another Detroit station.

With the advent of tall radiating structures, the problem of suitable tower lighting circuits has become of some importance. In many cases large electric signs displaying the station's call letters, etc., have imposed unusually heavy requirements upon these circuits which must be designed to prevent the flow of radio frequency energy from the antenna structure to ground and at the same time allow the free passage of low frequency power to the lights.

At station WWJ in Detroit a quarter-wave concentric transmission line serves in the above capacity. The inner conductor of the line is the conduit which carries the lighting wires from the source to the lights. The outer conductor extends from the antenna base back towards the transmitter for a quarter wavelength and is then short-circuited to the inner conductor. This quarter wavelength section of concentric line, as well as the remaining length of conduit, is buried except for a short vertical section at the antenna where the connections emerge from the ground. Large amounts of low frequency power can in this way be economically and efficiently fed to the lights. In addition, this tower lighting connection serves to suppress even order harmonic radiations and provides a static drain for the antenna.

Walter R. Hoffman—WWJ

Few radio engineers have a longer record of commercial broadcasting experience than Walter Robert Hoffman, chief engineer of the Detroit News' station WWJ, and it is doubtful if any radio man has served one station longer than has Hoffman. He went to work for the News station in December, 1921. He has been there ever since.

W. R. Hoffman

How Hoffman became interested in radio and how he followed up that interest is surprisingly similar to that of many another old-time radio man. As a boy in Ann Arbor, Michigan, where he was born, he read in a magazine how to build a wireless receiving set. Perhaps he didn't realize it then, but reading that article set the pattern of his life. He was in radio for better or for worse. When the set was built, using a broom handle and an oatmeal container for parts, nothing happened for several days. Then finally he heard dots and dashes. He had actually heard a wireless station! It is not at all unlikely that he broke all speed records running from the barn where he had set up the receiver to the house to break the great news to his family. It was not until some time later that he learned the transmitter was just a few miles away, 8XA at the University of Michigan.

By 1917 he had become a full-fledged amateur; yet this was not enough for him, so down to Baltimore he went to take and pass the examination for a commercial license. His first commercial berth was on a coastal boat plowing (and Walter insists plowing is the right word) between Norfolk and Baton Rouge.

Evidently the young operator must have known how to pound the brass because his next trip took him all the way to Archangel, Russia, and he followed the sea until the summer of 1921. A few months later he joined the News where he has been ever since.

Hoffman has seen WWJ through all its stages of development from the time it was still operating under the amateur call letters of 8MK until today when it puts out a beautiful, high fidelity signal from a new Western Electric 5 KW. During that time there have been four transmitters, each of which was a Western Electric. Walter Hoffman is proud of that fact. Today with 24 technical men on his staff, radio is just fascinating to him as it was when he sawed off the end of his mother's broomstick to make his first receiver. He is married, has two boys: one, four; the other, nine.

The Shunt-Excited Antenna

(*Continued from Page Ten*)

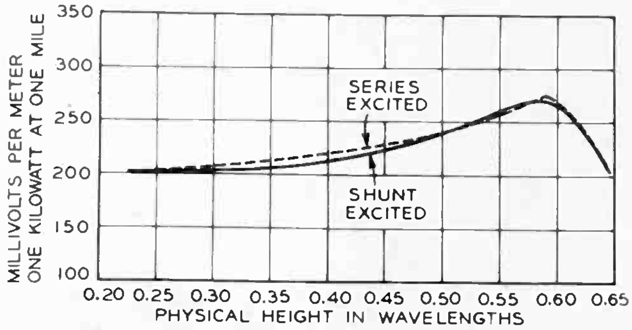


Fig. 8.

forms of protection from lightning or other high voltages on the antenna structure also become unnecessary. With the base of the antenna at ground potential no precautionary measures need be taken either to eliminate high potentials or to keep people from coming in contact with the structure.

The shunt-excited antenna also has the advantage of greatly reducing the interruptions of

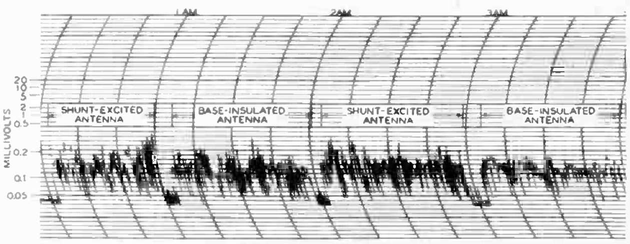


Fig. 9.

programs caused by lightning or static discharges. Although such interruptions are of short duration, they are annoying to the listeners, and their radical reduction will be welcome to broadcasters. Over and above these many advantages, the cost of the antenna itself is decreased, since no base insulators are required and the more rigid support made possible by a direct steel connection to the foundation permits the use of smaller cross-sectional dimensions.

Pick-Ups Presents on the Cover

The photograph on the cover shows the 100-foot sound projection tower—a part of the most powerful public address system ever constructed. The first of these giant systems, developed by Bell Telephone Laboratories and manufactured by Western Electric, was installed at Roosevelt Raceway, Mineola, Long Island, to carry announcements and entertainment to the 50,000 spectators who witnessed the Vanderbilt Cup Race on Columbus Day.

The new super-power sound projector makes it possible literally to "spray" sound out over the entire area of the track from a single source. Nineteen mammoth projectors are located at the top of the tower.

William J. Scripps—WWJ

When other boys were getting bicycles for birthday presents, he wanted a radio transmitter. He got the equipment, and today he is still in charge of a radio station. He is William J. Scripps, Radio Director of WWJ, owned and operated by the Detroit News.

William J. Scripps

Bill Scripps today, in his early thirties, is an outstanding figure in broadcasting. His energy, enthusiasm, and ideas for broadcasting are limitless. WWJ is one of the most modern, aggressive, and progressive stations in the country. As supplements to the regular broadcast transmitter, WWJ operates an ultra-high frequency transmitter, a radio-equipped airplane, and a mobile truck transmitter. With these facilities, Bill Scripps and WWJ are doing a fine broadcasting job today, and, what is perhaps more important, they are blazing new trails into the wilderness of what will become the broadcasting of tomorrow.

Scripps background has given him the training and the approach for his job. His amateur radio experience gave him a good technical background. He is a graduate of the University of Michigan. He worked in a bank for about a year gaining business experience. Then he went into the Detroit News, and for two years worked in every department of that great paper. He likes to think of the fun he had as a reporter.

From the newspaper he went into the paper's radio activities and became assistant sales manager. He took over the direction of the station in November, 1935.

Bill Scripps considers a radio station as an instrument of public service more than simply that of a business for money making. WWJ has broad plans for bettering the lives of the citizens of Detroit. Plans are now under way to rid the city of tuberculosis in the next ten years. Radio will play a great part in the campaign.

Providing perfect radio reception for every listener in the WWJ territory is another ambition. Two engineers on the WWJ staff provide engineering service to citizens free of charge. Man made interference is tracked down and eliminated wherever it occurs.

Finding time to carry out all of his activities seems to be Scripps' most difficult problem. He goes in a stride like that of an Olympic runner, and when his legs are not fast enough he takes to the air.

Radio — then and now

The history of WHAM, Rochester, N. Y., dates back to a day in 1922 when the station made its bow on the air. Milestones along the 14-year journey loom up in the form of four Western Electric transmitters which have relayed WHAM'S programs to its radio audience since the first broadcast.

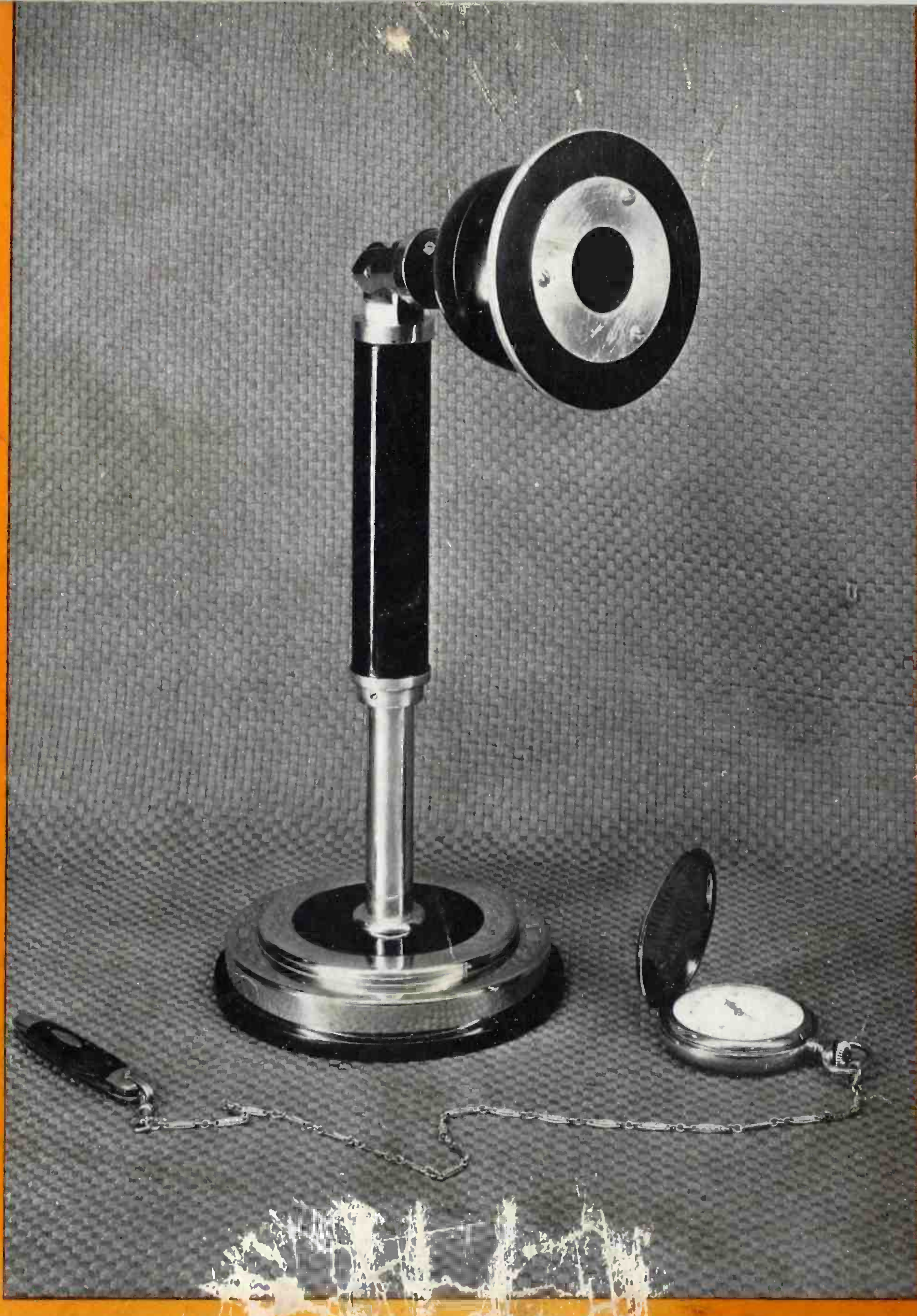
The station is owned by the Stromberg Carlson Telephone Manufacturing Company and was originally located in the Eastman School of Music. It started operating with a Western Electric 100 watt transmitter. In 1927 a 5 KW transmitter was installed in a special building near Victor, N. Y. This equipment, served western New York listeners until 1933 when the 50 KW 306A Transmitter operated at 25 kilowatts took its place. Later the same year the power was increased to the present 50 kilowatt assignment. Today the old 5 KW has been modernized and converted for wide range transmission and is used as auxiliary broadcasting equipment.

WHAM

Rochester, N. Y.

William Fay,
General Manager

Yesterday's and today's transmitters. Above—the Western Electric 50 KW used today at WHAM. At right of top picture the 100 watt of 1922.



When is a ro[illegible] [illegible]na[illegible] microphone [illegible]tional? When it is fitted with a s[illegible]ifically [illegible]signed aco[illegible]ic baffle. With it, a screwdriver and a few minu[illegible] [illegible]e, the non-directional 630 A microphone is converted into a semi-di[illegible]tional microphone having essentially the same response as the 61[illegible]