PICK-UPS

SEPTEMBER 1938

CBS – Hollywood Studios – KNX

New Antenna Increases Signal up to 8 db.

KSL, Salt Lake City

New Ideas in Program Control at WJR

PUBLISHED BY · · · *Western Electric* · · · NEW YORK, N.Y.

— 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*
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Assistant Editors

SEPTEMBER, 1938

The new radio receivers for the 1938-39 season are marvels of mechanical ingenuity. We've about come to the point where all one need do to tune a radio set is to think about it, and, presto, wheels begin to turn, colored lights flash and your radio brings in another station. Being lazy, we are much in favor of it all. And broadcasters might note that these new gadgets make it all the easier for the public to tune out stations with a poor signal and tune in good ones.

Another excellent development is the introduction of more high fidelity receivers. We would rather have a receiver that gives us good quality than one with a combination of all the tuning gadgets now on the market. And we'll use monkey-wrenches and screw-drivers, if necessary, to tune in on a station that's putting out a good signal.

Pick-Ups fires both barrels this month with two articles on studio speech input equipment. The lead article, written by Robert A. Bradley of Columbia, gives a complete picture of the audio facilities at Columbia Square, Hollywood. In the other, A. Friedenthal points out all of the novel features of the new studio facilities at WJR, Detroit.

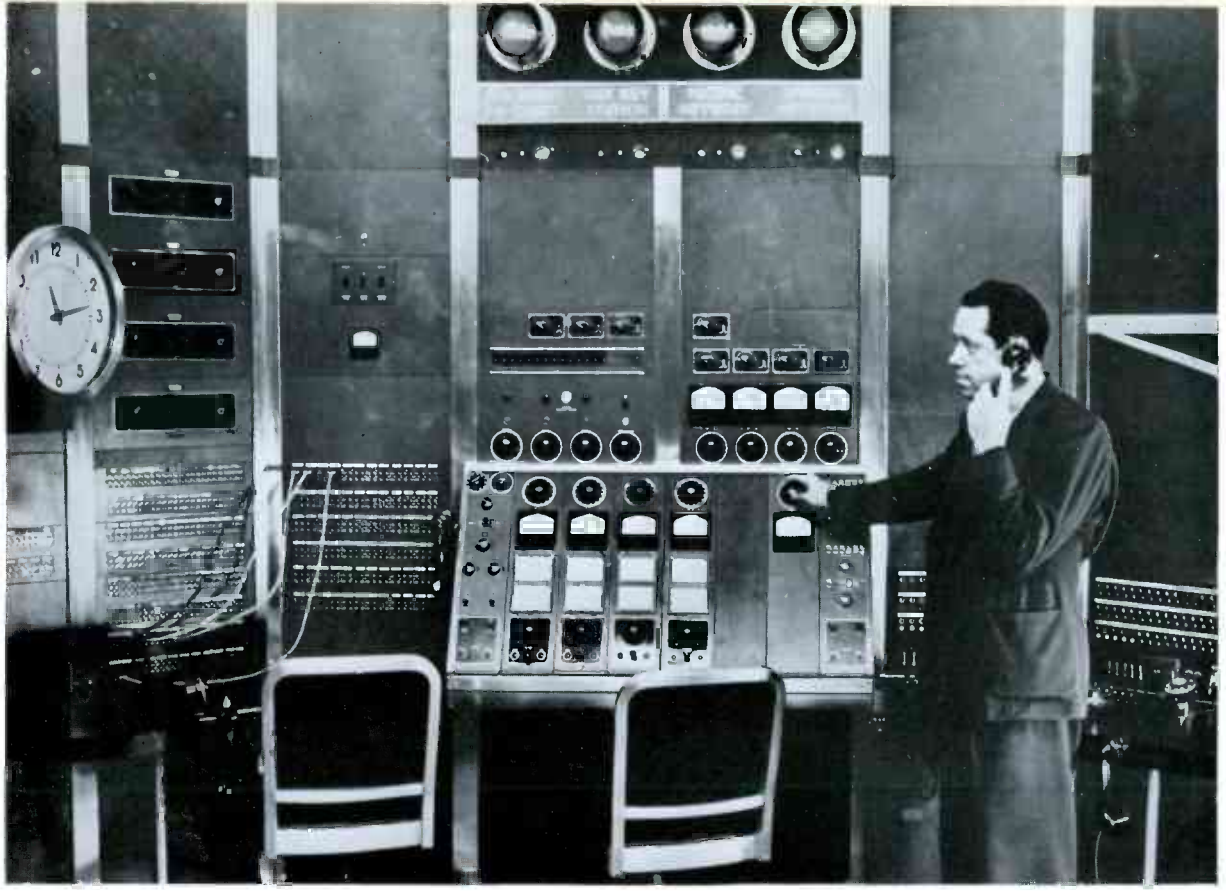
We hopped out to Salt Lake City to do a yarn about KSL, and came back, according to the boss, with a travelogue. Station story or travelogue, it's in this issue, and we hope you enjoy reading it as much as we did doing it.

And out in Minneapolis, we spent an exciting night in a police car getting a first hand demonstration that "crime doesn't pay," particularly in communities protected by Western Electric two-way police radio. Minneapolis has one of the finest police radio systems in the country. *Pick-Ups* tells about it.

Looking back on the many developments in radio since man first sent his voice out over the air, we wonder how those first crude sets worked at all. No industry or art can show more rapid technical development. *Pick-Ups* describes a new antenna which promises up to an eight db increase in signal strength for ultra-high transmitters.

There's just a hint of fall in the air today which makes us think how much radio will add to our enjoyment during the long winter nights to come.

This Issue



CBS HOLLYWOOD STUDIOS KNX

By R. A. BRADLEY
Columbia Broadcasting System, Inc.

A new five-story concrete structure rising from the tract of ground which marked the pioneer efforts of the motion picture industry, is now the west-coast headquarters of the Columbia Broadcasting System.

Designed expressly for broadcasting, it includes the most modern audio facilities built by Western Electric and the most advanced design features of studio construction. Eight studios are built into the structure at Columbia Square, ranging in size from the 8 by 10 feet announce studio to the auditorium studio—one of the largest units ever built exclusively for broadcasting.

The main building contains seven studios, two audition rooms, a master control room, two reverberation rooms, a recording studio, engineering laboratory and 70 offices. A two-story structure, separated from the main building by a patio and driveway, houses a restaurant, bank, three stores and associated business offices. Access to the auditorium is had from the driveway and patio as well as from the main lobby. Both buildings are of reinforced concrete construction and are acoustically treated and air-conditioned, following best authoritative design.

Above, master control board, the nerve center of Columbia Square, the Hollywood studios of KNX and the West Coast outlet for the Columbia Broadcasting System.

The auditorium studio has a seating capacity of 1,050. The mammoth stage is 50 feet wide and 38 feet deep with an arch 27 feet high. The effective area of the stage is controlled for orchestral and performer groups of varying size by the use of movable flats.

The stage proper is equipped with 12 microphone outlets and 16 utility outlets distributed in hidden floor pockets. In the ceiling of the auditorium are additional outlets for microphones suspended over the audience. The utility outlets provide a multitude of spare facilities including extensions of telephone and cue circuits, headphone monitoring and volume level indicator instruments.

The control room and observation room

(*Continued on Page 22*)

COAXIAL ANTENNA

Tests Indicate New Radiator Increases Signal up to 8 db.

By ARNOLD B. BAILEY
Commercial Products Development,
Bell Telephone Laboratories

An idealized radio antenna for ultra-high frequency broadcast and police radio applications may be defined as one which uniformly radiates the strongest possible signal along the surface of the earth. To attain this objective, it must be mechanically designed for easy mounting at the top of a high pole to take full advantage of height, and further it must be electrically designed to radiate most efficiently in horizontal directions for the greatest utilization of the radio power.

The coaxial antenna shown in the panel represents a practical form of this idealized antenna utilizing certain new principles that attain the desired objective. Its slender proportions, short length, light weight and coaxial symmetry enable it to be applied easily to high steel poles of standard construction. Its superior radiating capabilities resulting from electrical design features described in subsequent paragraphs make it the most modern approach to the idealized radio antenna.

Before describing the coaxial antenna in detail and how it attains these desirable features a few observations on the real advantage of high antennas are given below to stress the quantitative importance and economic necessity in utilizing height to maximize the coverage of an ultra-high frequency station. The electrical handicaps of feeding a high antenna at the top of a metal pole are discussed, and the means employed to overcome these adverse effects are described.

A radio antenna may be compared with a beacon light which spreads its light over the surface of the earth. If the beacon light is close to the ground it cannot be seen at even comparatively short distances

The inventor, Arnold Bailey, and an early, experimental model of the coaxial antenna.

by observers located on the surface of the earth because of local obstructions and the curvature of the earth. Some radiated light from the beacon will be scattered in the atmosphere, however, and this indirect weak light may be observable at considerably greater distances. Now as the beacon is raised to a point 100 feet above the ground, it becomes easily visible over much greater distances and the scattered light in the atmosphere is perceptible still further.

The ultra-high frequency radio antenna may be considered as somewhat similar to a beacon light except that it emits polarized radiations of a longer wavelength. It, too, must be placed high above the earth if it is to be effective in transmitting over long distances.

Figure 1 shows the quantitative importance of the antenna height. In the three cases, the transmitter power is adjusted to give equal signals at a fixed distance for three heights of 100 feet, 320 feet and 1,000 feet. The respective transmitter powers required are 500 watts, 50 watts and 5 watts. In so far as the listener is concerned, the effectiveness of the three stations is the same although there is a great difference in the power supplied to the antenna for the three cases. It can be shown that the effective power is proportional to the square of the altitude or height, caution being taken to properly select the datum level above which the height is measured.

In most practical cases the radio equipment is located at ground level in a building and is connected to the high antenna by means of a transmission line. In this discussion a low loss concentric type transmission line will be assumed since most commercial installations employ this type of line because of its desirable mechanical and electrical characteristics. In this line the useful current at ultra-high frequencies is carried by two paper-thin metallic conducting surfaces; first, the skin surface of the

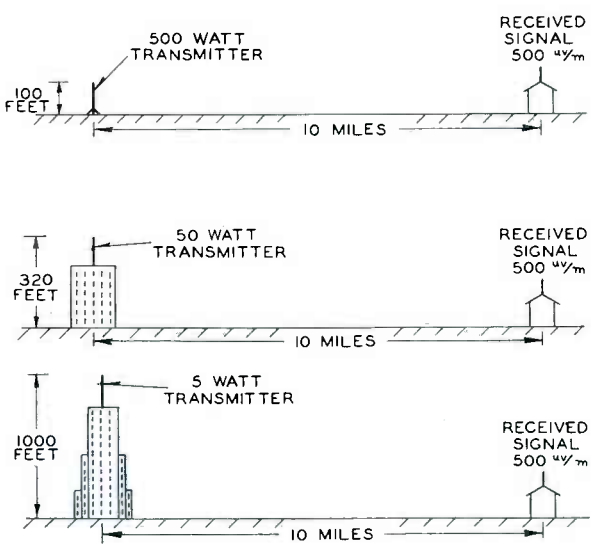


Fig. 1—Illustrating the importance of height.

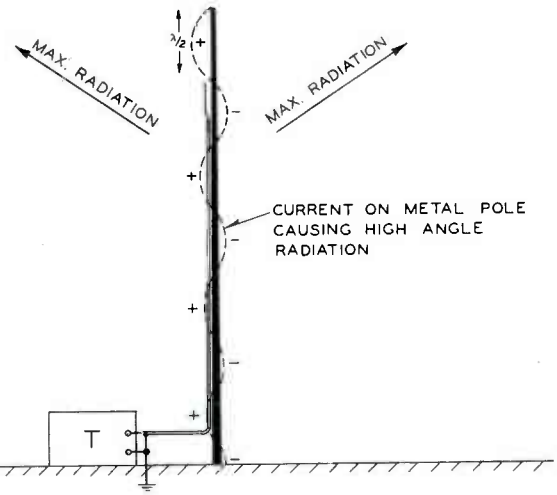


Fig. 2—Effect of adverse radiation from metal supporting pole.

quarter-inch copper inner conductor which may be considered as the outgoing conductor and secondly, the inside skin surface of the seven-eighths inch copper sheath which may be considered as the return conductor. The penetration of the current in these surfaces is extremely small at ultra-high frequencies.

A third conducting surface, namely the outer surface of the seven-eighths inch copper sheath is present but plays no part in this transfer of useful energy in the idealized case.

Troubles immediately arise, however, as soon as the concentric line is placed in a vertical position, i.e., when it is installed alongside the steel supporting pole and terminated at the top of the pole by the antenna. Under this condition the vertical run including both pole and outside surface of the transmission line acting together as one conductor may be considered as a long antenna grounded at the base of the pole and excited at the top by the presence of the supported antenna. This effect is graphically illustrated by Figure 2 which shows a "J" type antenna excited by the internal useful current in the concentric line and, in turn, the antenna exciting the supporting pole and outside surface of the transmission line. The degree to which this effect occurs will depend, among other factors, on the dimension of the pole but in no practical case will this alone be sufficient remedy to materially reduce the effect.

Such a condition will seriously distort the vertical directivity of the antenna itself. The resultant radiation from antenna, transmission line and pole may be considered as somewhat analogous to radiation from a long antenna. In Figure 3 the vertical directivity diagrams are given for three antenna lengths showing that as the antenna length exceeds one-half wave, the maximum signal is radiated at high angles and the useful signal along the ground diminishes to a much reduced value. The case shown is for

(*Continued on Page 24*)

Two-Way Police Radio Brings New Era of Protection to Minneapolis

City Has One of Finest Systems in Country; KGPB Serves Area of More Than 300 Square Miles

In the city of Minneapolis there is a small, square building sitting on the brow of a bluff overlooking the Mississippi River. Although insignificant in appearance, it plays one of the most important roles of any building in the city. Its value to the citizens is inestimable. The things which transpire in this stucco hut are cutting down most forms of city insurance rates, reducing traffic accidents, bringing a new era of safety and protection to the public, and above all, they are demonstrating in new and dramatic fashion the hard and shining truth of the old saying that "crime doesn't pay."

This little building is the very nerve center of the Minneapolis Police Department. It is known as Radio Station KGPB and is the police two-way dispatching headquarters from which go instructions to radio police cars in every part of the city and surrounding territory. It controls the movements of all police cars patrolling the avenues, alleys and streets interlacing the 72 square miles of the city and it ties together the entire police work of the city and of five outlying communities covering a total area of more than 300 square miles.

Police radio in Minneapolis began in 1929 but it was not until April of this year that the two-way system was added making it one of the finest in the country. During those nine years the radio system had its ups and downs. It is due mainly to the herculean efforts of Howard Kelly, superintendent of communications, that the system has reached its present level of efficiency. Carrying on through changing administrations where police chiefs were appointed and dismissed with alarming rapidity (in one year there were seven chiefs), he nevertheless managed to sell the city government and the public on the value of police radio. Eventually he suceeded in building up a radio system which is now a model from which others are patterned.

KGPB is a municipal transmitter for Minneapolis and for parts of three counties. All of this traffic is handled through radio telephone contact. Actually the service area of KGPB extends about 35 miles in each direction from the transmitter.

Each of the five communities, Columbia Heights to the north, Robbinsdale to the northwest, St. Louis Park to the west, Edina to the southwest and Richfield to the south, has one radio police car on 24-hour service operating entirely from instructions furnished through KGPB. These communities are from 13 to 16 miles from the city. Four additional cars of the Hennepin County police also operate through the station as do the 10 park police cars

(*Continued on Page 9*)

Radio on wheels — a line-up of police and fire department cars, each equipped with Western Electric two-way police radio equipment. This group is just a portion of the entire motorized force.

Western Electric radio equipment in the DC-4.

AIR GIANT, DC-4

When the giant new Douglas airliner DC-4, now undergoing tests at Santa Monica, California, roars into the sky with 42 passengers and three tons of air express, she will carry the most powerful and comprehensive radio telephone system yet developed for commercial air transport service. The complete system is of Western Electric manufacture.

The 250 watt Western Electric transmitter installed aboard the DC-4 is five times more powerful than conventional airplane equipment and includes many unique features. For the first time, a flight crew is equipped to make simultaneous observations of the beacon, weather and marker signals while holding two-way communication with the landing field. During flight the pilot may talk over any one of ten different frequency bands, and a special direction finding loop enables him instantly to check the ship's position with respect to ground stations.

All major components of the system are assembled to form a panel installed on the "bridge" immediately behind the co-pilot's position. This unit, operated remotely from a master control column which rises between the pilot and co-pilot, is entirely self-contained and is comprised of the transmitter; communication, beacon, auxiliary and marker receivers; and the intercommunicating system amplifier.

As the ship passes from one radio zone into the next, the transmitter and communications receiver to which it is geared are shifted progressively through five pairs of "day" and "night" frequencies by means of a rotary dial on the transmitter panel. Instantaneous shift from day to night frequency is effected by a push-pull lever located on the master control column. Quartz-plate oscillators of new and improved design hold the several frequencies within required limits and a forced draft ventilation system cools the transmitter with filtered air.

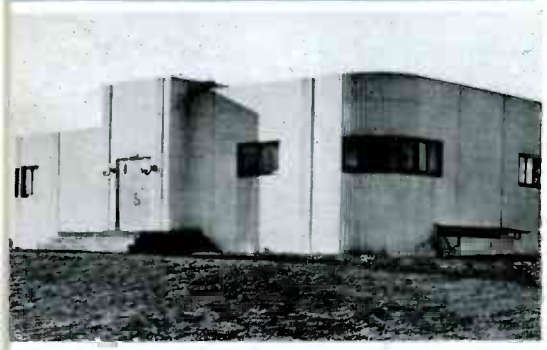
The communications receiver, too, is crystal controlled and is of the superheterodyne type. It is adjusted to maximum sensitivity from the master control column and thereafter is regulated automatically by a special vacuum tube circuit.

The beacon receiver is basically similar to the communications receiver but differs in its purpose and in several minor features of mechanical design. Provision is made for reception on either a conventional single wire antenna located beneath the ship's fusilage, or from the shielded direction finding loop enclosed within the ship's plastic nose. The receiver can be tuned to any frequency between the limits of 195 and 415 kilocycles by means of an illuminated dial on the control column, on which is also mounted the sensitivity control knob and an indexed dial showing the loop position.

An auxiliary receiver, which may be operated from battery supply in event of power failure, covers all of the frequencies to which the pilot would normally have occasion to listen. It is tuned remotely from the control column by flexible shafting.

Marker zones are indicated by a series of colored signal lights which appear in the cockpit and which may be augmented by an audio signal to the headset. The crystal controlled superheterodyne receiver operating these devices requires no operating attention during flight.

Performance specifications for the new equipment were compiled by four leading airlines: United Airlines Transport Corporation; Transcontinental and Western Air, Inc.; American Airlines, Inc., and Eastern Airlines, Inc. The system was designed by Bell Telephone Laboratories, and more than two years were required to perfect and complete the initial model. It is the first complete commercial aviation radio system ever built for operation from 800 cycle power supply.



KHQ

Spokane, Wash.

A feeble ten watt signal sputtering through the earphones of patient Seattle listeners back in 1920 marked the beginning of a broadcasting station which today serves the "Inland Empire of the Northwest"—that vast fertile valley between the Cascade and Rocky Mountains in northern Washington, Idaho and Montana.

Those old-time cats whisker enthusiasts had Louis Wasmer, designer and builder of transmitting and receiving sets, to thank for the ten watt venture. Under the call letters KHQ he had set up his own broadcasting station. And it is Mr. Wasmer who still guides the destiny of KHQ, now a 5,000 watter reaching a potential audience of over 800,000 listeners, scattered throughout 54 counties in the three states.

Even in those pioneer days Mr. Wasmer brought to broadcasting a fund of technical knowledge, having spent years in building and developing both transmitting and receiving sets. Early he envisioned broadcasting as opening a great new field of service, a medium which would catch the fancy and intrigue the imagination of the public.

His determination to provide listeners with the best possible service and to increase coverage, led him from time to time to seek and acquire greater signal power, first from 10 to 50 watts—then to 100. In the fall of 1925, what may be considered the second era in the development of KHQ took place when Mr. Wasmer moved the station to Spokane and increased the power to 500 watts. This move was made after a delegation of Spokane men had pointed out the need for a superior type of radio station in the capital of the Inland Empire.

Two small rooms in the Davenport

(*Continued on Page 17*)

1920-1938 styles in transmitters (above and below). The gentleman broadcasting is Louis Wasmer, president, and designer of the early equipment. Western Electric is responsible for the 5,000 watter and associate equipment which is housed in the modernistic building above. Studios are located in the Radio Central building topping the page. Towering skywards is the 826 foot antenna structure, said to be one of the tallest self-supported towers in the world.

Minneapolis Police Radio

(*Continued from Page 6*)

which patrol the city parks on a 16-hour daily schedule and another police car operated by the Chicago, Milwaukee, St. Paul and Pacific railroad which patrols 13 miles of right-of-way on a 24-hour schedule.

In addition to the above, all emergency calls transmitted by the St. Paul station are repeated over KGPB. These calls include those concerning hit and run accidents, stolen cars, missing persons, descriptions, and drunken drivers. All St. Paul calls to cars in Dakota and Ramsaye counties, West and South St. Paul, and White Bear Lake are also repeated because the St. Paul coverage is not too efficient in these areas.

Radio service for 16 cars operated by the State Police covering 11 counties is just one more job handled by KGPB as a part of its regular duties. All of this work is done free of charge, according to Kelly, because the additional cooperation of these forces resulting from the service is worth far more than any fee which could be charged. As an example, the State Police recovered nine stolen cars for Minneapolis last year.

The primary function of KGPB, however, is to control the radio police cars of Minneapolis proper, and what a job it does! At present there are 36 two-way radio cars in service in the city. Twenty-five of these are patrol cars, three are detective cars, one is operated by an accident squad, one is a radio service truck, and the remaining six are operated by deputy fire chiefs. There are also a number of police cars operating with one-way equipment and the ambulances of the two general hospitals are one-way equipped.

That the two-way system is far superior to one-way is a self-evident fact in Minneapolis. Ask any member of the police force about the relative effectiveness of the two systems and the result is a smile which says all too plainly: "Don't ask foolish questions."

When two-way was first installed there was some trouble among members of the patrol cars who saw in the system a too-easy method for checking their whereabouts and attention to duty. Once the system was in use, however, the objection was soon forgot. Now any car patrolman who is forced to operate a car without two-way equipment feels that he is the victim of discrimination.

First-hand evidence as to two-way efficiency may be had by anyone who rides in a police car for a night. Here are a couple of instances this writer saw in a few hours:

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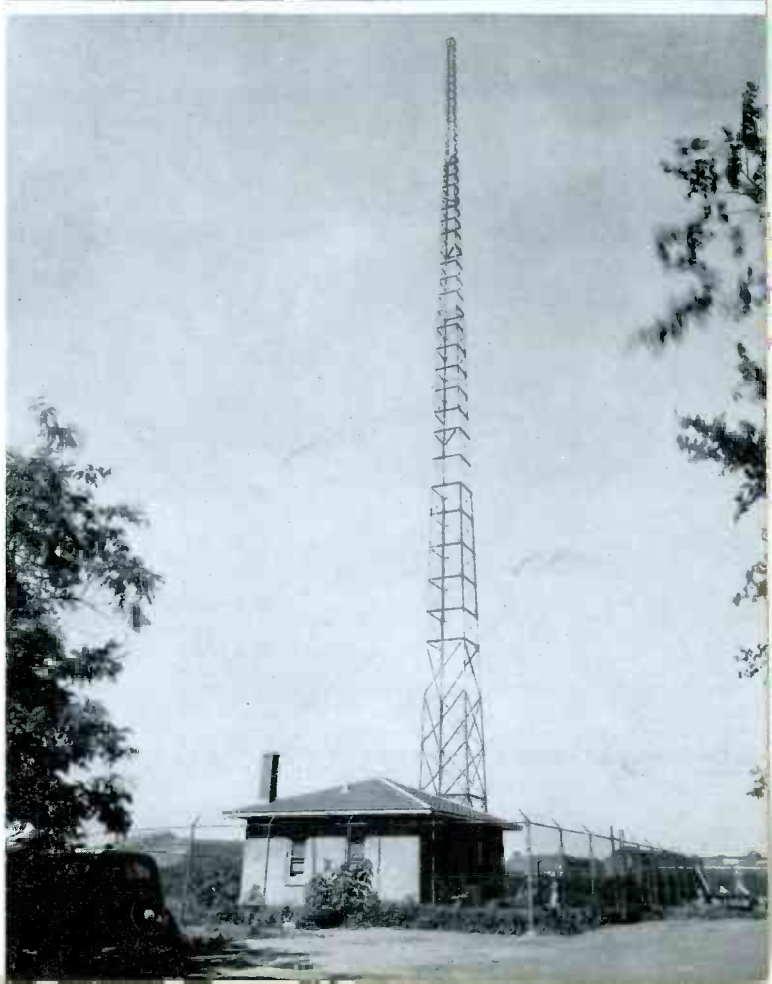
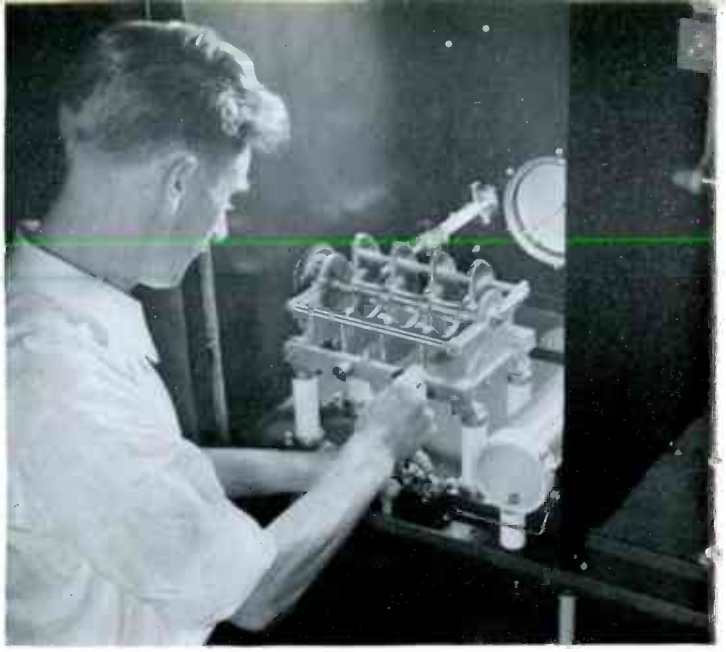
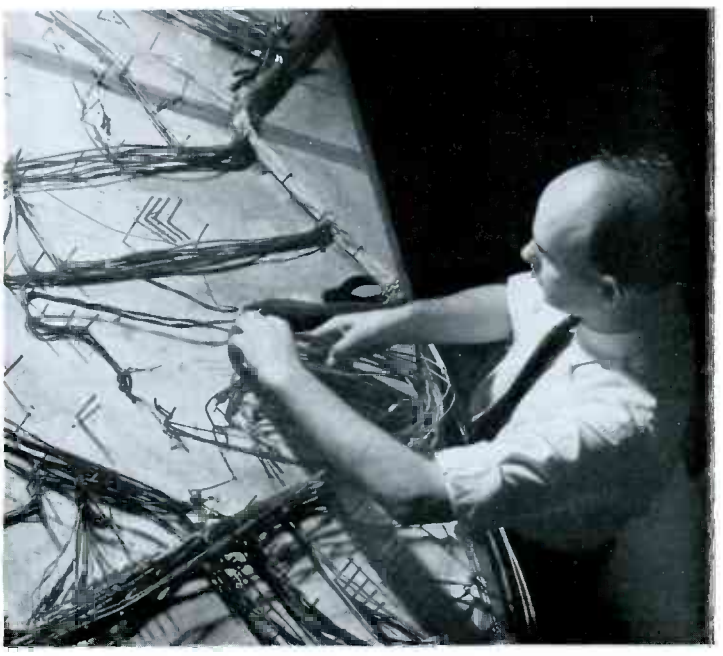


Top: Western Electric 14 type 10 frequency 400 watt transmitter handles all traffic at KGPB. Center: Western Electric speech input equipment and at right another Western Electric transmitter used as standby. Below: KGPB antenna and transmitter house.

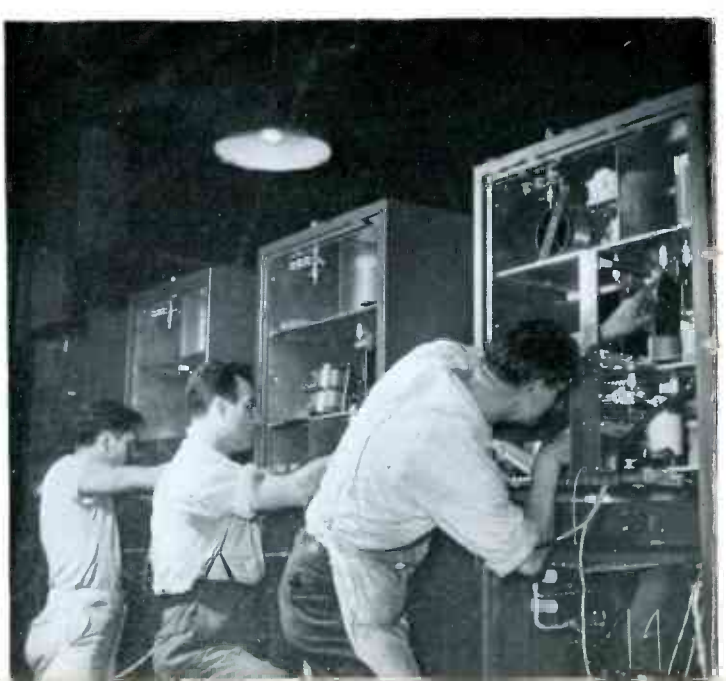
Above: Assembly work in a long row of five kw. power amplifier units.
Below: Utmost care goes into the assembly of a 100-250 watt transmitter.



Precision-machined parts assembled by craftsmen eliminate future troubles for the engineer faced with keeping the station on the air.



Above: Cable forming like this makes Western Electric transmitters famous for neatness. Below: Assembling 100-250 watt transmitters.



VOICES ARE BORN

Out at Kearny (N. J.) Works of Western Electric new voices are born every day . . . transmitters, large and small for the nation's stations. *Pick-Ups* shows you here how these units are assembled by master craftsmen, each skilled in his particular job, and trained in the Western Electric tradition of doing every detail of work in only one way — the best possible way.

When a unit is completed, it is placed on a test rack and put through its paces. If there's a bug in the unit, it will be found and corrected before shipment.

One badly soldered connection may throw a transmitter off the air some day. Soldering is a fine art at the Kearny Works.

Above: A row of five kw. power amplifier units near completion. Below: Before long, the high fidelity voices of these five kw. units will be entertaining millions.

Western Electric Master Control Desk at WJR.

New Ideas in Program Control at WJR

By A. FRIEDENTHAL

Technical Supervisor, WJR

At 9:45 P. M., June 5th, 1938, WJR's new $30,000 speech input installation was placed in service. The cutover was made in the middle of a program, and to the writer's knowledge this is the first time a new speech input equipment installation was put in operation without testing or trouble shooting. The equipment functioned perfectly from the start and at this writing, not one case of trouble has occurred.

A. Friedenthal

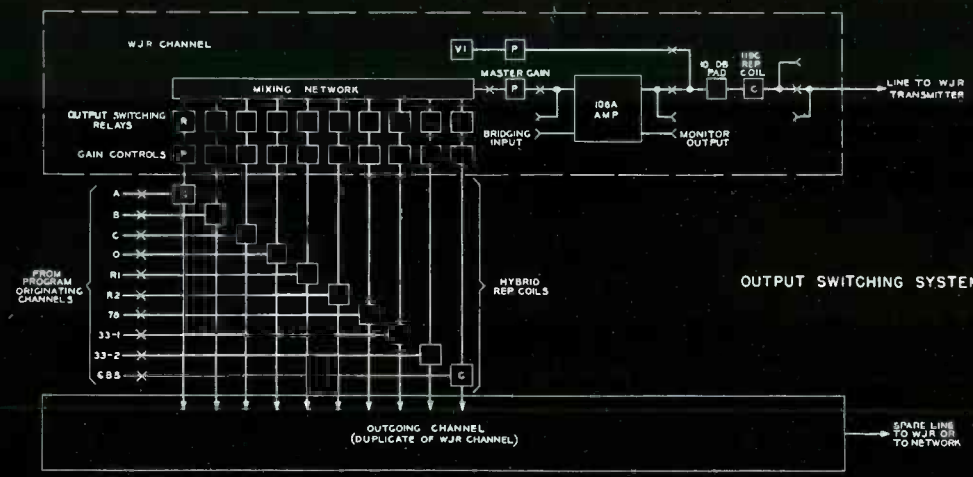
The entire assembly was manufactured in the Kearny, New Jersey, shops of the Western Electric Company, following rigid specifications submitted by the writer. The equipment was designed and engineered by Messrs. James Tarr and W. W. Griese and his crew of Bell Telephone Laboratories engineers, and H. F. Scarr of Western Electric. Contrary to the general trend, simplicity was the keynote in this installation. The specifications called for a master control desk (headpiece) which would permit pushbutton control of any 10 programs to either of one or two outgoing channels. One channel is reserved for feeding WJR's 50,000 watt Western Electric transmitter, while the second outgoing channel is used to feed whatever circuits are patched up.

With this arrangement it is possible to feed any combination of the 10 channels to either of the two outgoing line setups. An indication of whatever positions are in use is given on the master desk lamps as well as in all of the studios. The studios are equipped with multiple switching cabinets and complete control of the programs is also available at these points.

Mixing and blending of the program is handled by the individual channel faders on the master desk. One feature, which to the writer's knowledge is entirely original, is that all mixing and program switching in the master control room is done at a plus 10 db level. The two larger Studios, A and B, are equipped with Western Electric 23B consoles, which handle a total of 8 low level microphones, the

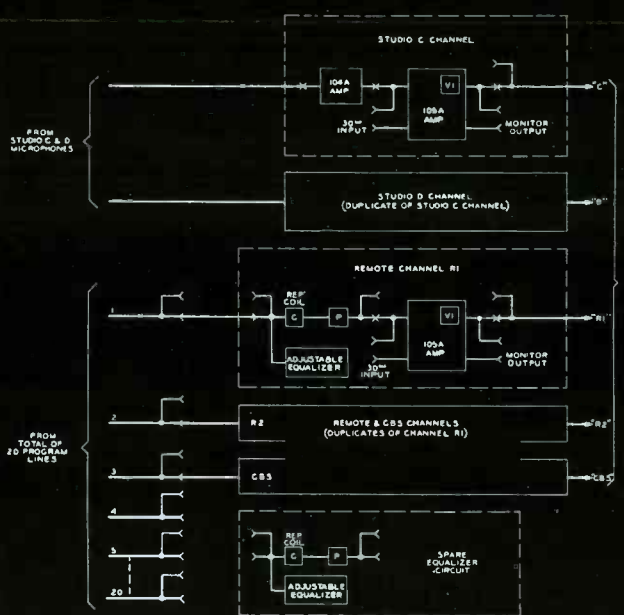
(*Continued on Page 16*)

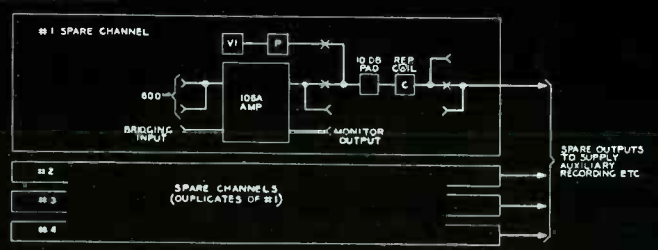
STUDIO SPEECH INPUT EQUIPMENT AT WJR, DETROIT



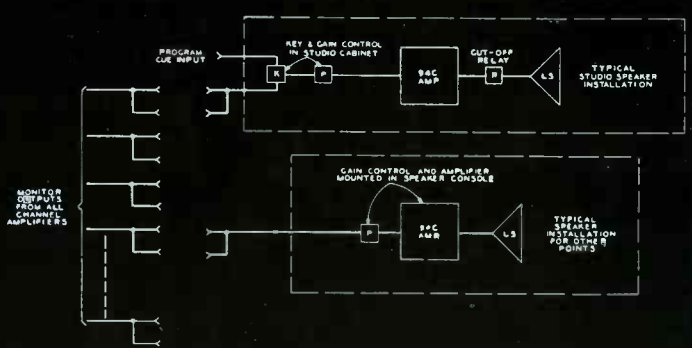
OUTPUT SWITCHING SYSTEM AND OUTGOING CHANNELS

PROGRAM CHANNELS FOR STUDIOS C AND D, REMOTE AND CBS PROGRAMS

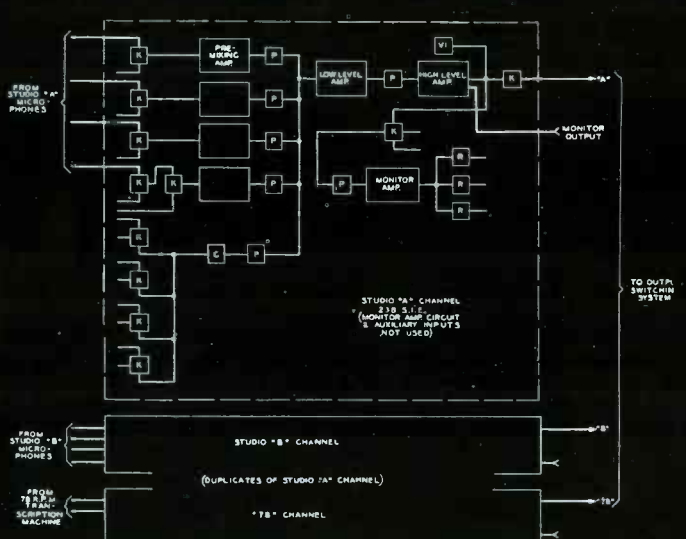




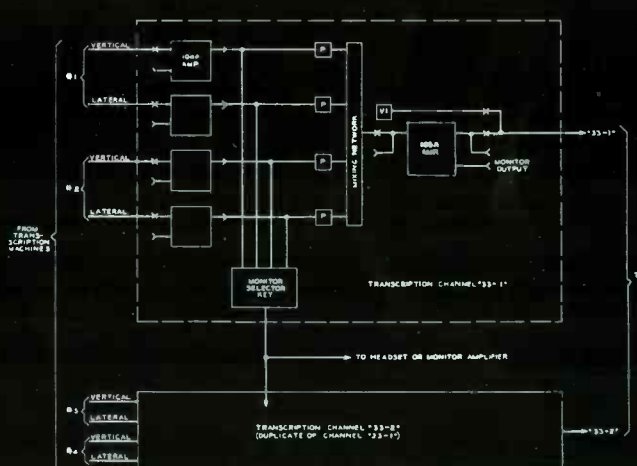
MONITOR SYSTEM

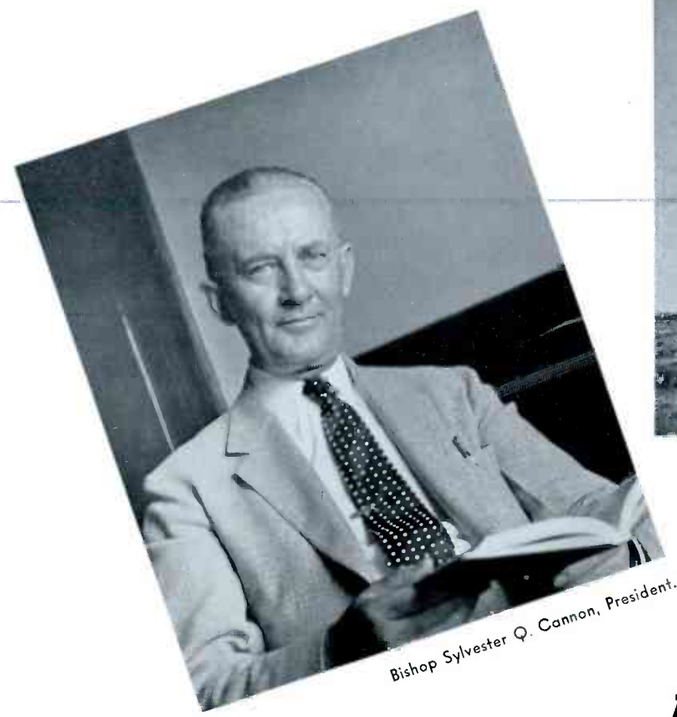


PROGRAM CHANNELS FOR STUDIOS A AND B, AND 78 TRANSCRIPTION

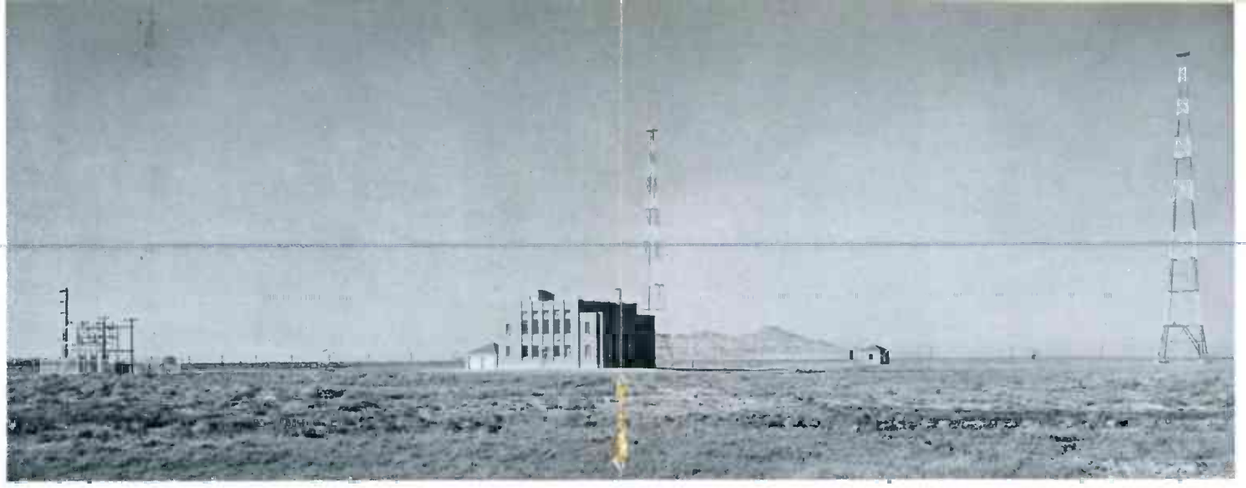


TRANSCRIPTION CHANNELS





Bishop Sylvester Q. Cannon, President.



On the salt flats of Great Salt Lake stands KSL's 50 kw. Transmitter System.

SALT LAKE CITY **KSL** UTAH

Earl J. Glade, Managing Director.

A Station which Serves a Great Intermountain Empire

By WILL WHITMORE

"Don't picture KSL as a radio station owned and operated by a Church," Earl Glade, managing director, told us. "This radio station is just like any other. It is operated as a commercial enterprise, and tries to show a profit at the end of the year. The Mormon church owns only fifty and five one hundredths per cent of the stock, and other stockholders include a wide variety of representative non-Mormon interests. That should convince anyone that the station is not an instrument of propaganda for the church."

Yes, that should convince anyone, but it doesn't, and happily so. No one can listen to the inspiring choir recitals broadcast from the mighty tabernacle and the Sunday evening broadcasts from Temple Square which Glade himself has directed for the past nine years without having a feeling of respect and admiration for the Church of Jesus Christ and Latter Day Saints, the official title of the Mormon Church.

No, you can no more escape the Church in Utah, than you can escape its majestic mountains. Salt Lake is a city anchored to its foundations and its foundations, past and present, are the Church. That fact alone accounts for everything that is Salt Lake. It accounts for the fact that Utah has more college graduates per capita than any other state. It accounts for the high calibre of radio programs which emanate from KSL.

From the day of its inception the Church has stood for and fostered education and intellectual and cultural attainments. From the first, it has sent missionaries throughout the world. Today, as in the past, practically every Mormon youth at about the age of 18 goes out to some foreign country or some distant part of this country to spend two years in learning the language and customs of the country, to mix with the people and do evangelical work. At least 2,000 young men and women are in the field all the time.

When they return to their homes in Salt Lake City, in the state or in the great Western Intermountain Empire served by KSL, you can be sure that they bring back new ideas, new thoughts, and new ambitions. They are people of the world who know and ask for the finer things of life. Is it any wonder then that they ask for and get something better than hillbilly music for radio programs?

Salt Lake is as modern as any city in the country. Its mind is on the present and future and yet it looks back on its past and takes guidance and spirit from it as it marches forward into the future. The studios of KSL, in the Union Pacific building, are in the very center of the city. You can look out Earl Glade's office windows, directly across the street and see the first house ever built in Salt Lake City. It is now on exhibition on Temple Square. It was similar to the first Utah home of Brigham Young, a one-room hut constructed of logs upon the treeless desert in 1847, out of which the city grew. Salt Lake is a city less than three generations old. Grand children of the men who built an empire out of a desert are its present leaders.

Following the settlement of Salt Lake City, the stream of colonization spread out in all directions so that today there are hundreds of rich and fertile valleys scattered throughout many western states, populated by an energetic and enterprising people who have their roots in the civilization which started with Brigham Young and his followers.

What a sight it is today to fly over this vast territory. Your plane strains to rise above lofty mountain ranges, and then, as the crest of the mountains passes underneath, the mountains fall rapidly away and below you lies a flat and fertile valley, green and golden with growing crops of vegetables, wheat and corn, all getting their sustenance from water brought to the land by great irrigation systems. In these valleys lie modern, prosperous towns and villages, whose inhabitants buy automobiles and radios and vacuum cleaners, just as people do in any other place.

The signal of KSL reaches out to all these communities with a mighty voice. Even the sheep herders today demand a radio before they accept a job. According to the station, primary voice of KSL is heard and listened to by 2,000,000 people in 140 counties of Idaho, Montana, Utah, Washington, California, Oregon, Nevada, Colorado and Wyoming.

Its secondary voice spreads out to encompass the entire western and southwestern territory with a total population of almost 12,000,000, and in addition, there's an occasional coverage of almost another million. In all, KSL claims to reach the lives of practically 15,000,000 people within the boundaries of the 17 states and Canadian provinces in which its signal is heard. Perhaps the far flung signal of KSL can be credited in part to its antenna designed for secondary coverage and to the ground system which lies in the saturated salt solution which is Great Salt Lake.

The above is ample proof that KSL broadcasts to something more than rattlesnakes and coyotes as some might think. The voice of KSL is particularly important to its listeners because its territory is a vast one where communities are isolated by many miles, great mountains and arid deserts. To them the station is a link with the outside world. To them KSL has a meaning not enjoyed by other stations whose listeners have newspapers delivered to their doors. Yes, when you fly over this tremendous Western Empire, you begin to realize just what radio has done and is doing for the people of this country. You realize, too, the tremendous responsibility a radio station owes its listeners in living up to its license requirements: Serving the interest, convenience and necessity of the people who have given it the franchise to broadcast.

KSL realizes the implications of that franchise to the fullest. Because it forms such an integral part of the lives of the people it serves, you are not so much surprised when Earl Glade, KSL director, tells you, "We want our listeners to LOVE our station as their own institution, and our constant effort is to make them do so."

How? Here's a typical instance. When an agricultural delegation from the town of Moapa, Nevada, comes all the way to Salt Lake to request the station to broadcast more agricultural news and help,

(*Continued on Page 20*)

Program Control at WJR

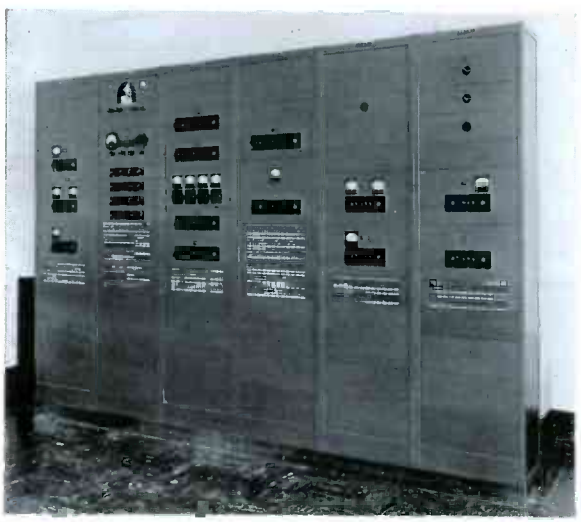
(*Continued from Page 12*)

outputs of which are amplified to a plus 10 db level and fed to the control room.

Another original idea incorporated in this installation is the two-way talkback system accomplished without the use of keys. The two-way talkback permits instantaneous talking facilities from the booth to the studio during rehearsals without in any way affecting the use of that studio. Loud speakers are automatically disconnected when the studio takes the air.

Studios C and D are equipped with one microphone each and the channels on these two studios are made up of 104A pre-amplifier and 105A line amplifier. These amplifiers are located in the master control rack assembly. The four studios are on the 28th floor while the new control room is on the 21st floor of the Fisher Building. The outputs of the 23B consoles and the line amplifiers enter the master desk mixing and switching system at a plus 10 db level and finally reach the telephone line at the standard zero level, through 106A repeater amplifiers. The 10 channels shown on the desk are Studios A, B, C, D, Remote 1, Remote 2, 78 r.p.m. Lateral Turntable, Transcription Channel 1, Transcription Channel 2, and CBS Channel.

The two transcription channels are independent of each other and are equipped with 104A pre-amplifiers, one each for each tone arm, and line amplifiers of the 105A type. Facilities are provided for monitoring each channel from its own monitor winding which is part of the output transformer of each amplifier. This winding is so designed, that a monitor level of minus 10 db is available at all times without interfering with the plus 10 program level of that channel. This monitor winding can be shorted or grounded, without affecting the program output of the channel. The monitor winding is utilized to feed headphone and loud speaker monitoring back to each studio, as well as to the executive offices and also to supply the duo recording machines. In addition, these monitor windings provide a rapid and accurate master control check as to what is occurring on each channel. With the exception of the 104A pre-Amplifiers, all other amplifiers and consoles are equipped with these windings.



Western Electric speech input bays at WJR.

Transcription controls at WJR.

In the rack assembly, four additional line repeaters are available for feeding other stations. The inputs of these repeaters are arranged on jacks for either 600 or 20,000 ohm inputs. The 105A amplifiers are arranged on jacks for either 600 or 30 ohm inputs and are capable of accommodating a low level microphone without the use of a pre-amplifier.

A rather unique idea is carried out in the handling of 33⅓ transcriptions. Four Western Electric machines are mounted on a special frame designed by C. W. Jones, of the WJR engineering department. The discs of these machines are mounted 42" above the floor, this height being the most convenient for operation. Facilities are available through two separate 4-channel mixers and pre-amplifiers as well as line amplifiers to permit playing of vertical or lateral recordings on the air or for auditions without throwing keys, switches, or whatnots. Another innovation incorporated by Jones is the magnetic brake which stops the 33⅓ motors after a record has been cued.

The specifications also called for headphone or loud speaker monitoring of either the vertical or lateral records before being put on the air. This is accomplished by pushbuttons which connect a monitoring amplifier across the pick-up pre-amplifiers whether they be on or off the air. This feature is a decided improvement over anything heretofore used at this station. These push buttons are a part of the switching panel which is located in the center of the 33⅓ disc mounting.

H. F. Scarr photo

The Fisher building, Detroit, home of station WJR.

Among other items, facilities are available for accommodating 20 program circuits, 20 common battery or central office telephone circuits, and 10 magneto ringdown phone circuits. Although this station uses common battery telephones on all of the remote points and inter-studio communicating system, magneto facilities were incorporated to accommodate stations using magneto phones. Equalizaton of loops is accomplished through the use of an oscillator and four equalizers which are associated with the incoming lines bay. Distortion and noise measuring equipment is also a part of the incoming lines bay.

The rack mounted equipment is housed in the new type enclosed racks of which there are six, located in the master control room. The master desk houses the master mixing assembly and the 30 remote order wires and also patching facilities for connecting the studio phones to the remote points.

The frequency response of the entire assembly is within 1 db from 20 to 10,000 cycles. The distortion under normal operation measures less than 2 per cent at any one frequency. This extremely low figure can be attributed to the reverse feedback, which is a part of each amplifier circuit with the exception of the 104A pre-amplifiers. The entire setup is ac operated. Noise and hum measure minus 61 db below program level.

The writer wishes to commend H. F. Scarr and the Bell Telephone Laboratories engineers for the splendid job of engineering, and the members of WJR's engineering staff for their suggestions and cooperation in the installation of this equipment.

KHQ—Spokane, Wash.

(*Continued from Page 8*)

Hotel comprised the office and studio. The operating staff consisted of one technician and one announcer, both of whom are still associated with the organization. By 1928 the need for further expansion necessitated a move to more adequate quarters in the Radio Central Building. With the change in location came an increase in power to 2000 watts daytime, 1000 watts night. Still steadily forging ahead KHQ donned another feather in its cap a short time later when it became the major outlet for NBC programs in the Spokane area.

The station has always been aware of the part that expert showmanship plays in building a responsive and widespread audience. It also has appreciated the fact that technical perfection is necessary if it is to serve properly the rich surrounding country where the famous mines of the Coeur d'Alenes, the gold belt of British Columbia, the rolling wheat fields of the Palouse and Big Bend sections, the forested lands of the Idaho Panhandle and Coulee Dam, are to be found. To reach this vast and prosperous market KHQ recently installed a new Western Electric 5000 watt transmitter.

The antenna tower which radiates KHQ's high fidelity signal is claimed to be one of the tallest self-supported vertical towers in the world. Looming 826 feet skyward it overtops the Woolworth Building in New York by 36 feet and is 328 feet higher than the tallest building west of Chicago. The height and slenderness of the structure disguise its actual solidity. Forty-two feet square at the base, tapering to 18 inches at the top, it contains 126 tons of structural steel and base plates.

A complete new speech input system has been installed in the studios using Western Electric salt-shaker microphones and 94C amplifiers. In addition a 110A amplifier has been installed at the transmitter.

Since the new equipment has been operating, approximately 9,000 square miles have been added to the immediate coverage area, which, it is estimated, contains an additional population of 47,000. The new transmitter building, located at the south city limits of Spokane, has provision for future expansion and for television equipment. Average field strength has been increased better than 250 per cent.

Today, two entire floors of the Radio Central Building are necessary to house KHQ's 75 employees. Mr. Wasmer, president of the organization, heads the following executive staff: Harry Wixson, manager; Harry Lantry, chief announcer; Al Sparlin, chief engineer; Marion Boyle, musical director; Don Norman, continuity and production director; Harold Parr, news editor; Sylvia North, office manager; Jessie McGrew, traffic manager; Earl Trimble, sales manager; Dorothy Irvine, director of women's programs.

Minneapolis Police Radio

(*Continued from Page 9*)

In the business part of town the patrol car is hailed by a man who points to another man lying prone upon the sidewalk. One officer investigates. "Just a dead drunk," he reports to the officer in the car who reaches for his radio handset and reports to the radio dispatcher: "Car 16, send wagon for drunk at corner of ——— and ———."

Two minutes later the wagon arrives and the drunk is on his way to the lockup. Sounds simple, and that's just what it is. Without two-way, the officer would have spent a good many more minutes hunting up the nearest telephone box to call the wagon.

Another instance: Cruising leisurely along a busy street, the patrol car is passed by an antiquated "jalopi" filled with six young boys each singing at the top of his lungs. In a moment the police car overtakes the traveling wreck. In another moment the office is connected by two-way radio with the license bureau and the license number and ownership is checked. Everything is in order and with a precaution against reckless driving the boys are released. Another simple case, but it took less than a minute to check the license where it would have taken perhaps 15 had there been no two-way in the police car. Fifteen minutes is a long time to keep a car out of service in modern police work.

"With two-way equipment, the radio dispatcher and the officers in the cars are always in instant communication with each other," says Howard Kelly. "That, and, of course, emergencies, are the greatest values of two-way. The officers never have to leave the scene of the disturbance to communicate with headquarters. If they want a wagon, more help, information, an ambulance, all they have to do is lift the handset in their cars and give the order to the dispatcher.

"Before we had two-way, the dispatcher worked in the dark at all times. When he sent orders to a car he never knew whether the officers had received the call or not. Often when no word was heard from the car for a long period, he would dispatch another car to the scene to make sure the call was answered. This caused the unnecessary tieing up of cars. Two-way has relieved the dispatcher of all worry and tension, because every call is immediately acknowledged by the patrol officer.

"Two-way is at its best in emergency cases when minutes count. The patrol officer at the scene of a disturbance has the authority to control the entire force if need be. To get more help or to direct every patrol car in the city, or what not, all he has to do is to pick up his handset and give the order.

"With two-way there are no alibis. No officer can claim he didn't get the call because every call must be acknowledged. Before two-way it was necessary for the dispatcher to repeat all calls three times to make absolutely sure that they had been received correctly. Now the dispatcher makes only one call and repeats only upon the request of the officer in the car. Naturally this cuts the transmitter time on the air to one-third of the time formerly required, and keeps it open for other calls.

"With two-way equipment in the car of each of the six deputy fire chiefs, the work of the fire department has been tremendously facilitated. The radio dispatcher at KGPB knows the complete battery of fire fighting equipment in each station house and also the code number which calls out each piece of equipment. Thus, if a fire chief arrives at a fire and finds he needs more equipment, he simply picks up the handset in his car and gives the proper code number to the dispatcher who calls the station by telephone and more equipment is on the way.

"During a recent grain elevator fire, in which more than 500,000 bushels of wheat were destroyed, the entire fire fighting equipment of the city was called out and directed through one deputy fire chief and his two-way radio car. Working with him was a radio patrolman who controlled and re-routed traffic. Three bridges across the river were closed and the monumental job of re-directing traffic and unsnarling the jams were co-ordinated by this one car."

The radio system at Minneapolis is unique in that it is the largest combination intermediate and ultra-high frequency system in the country. All calls sent out from KGPB are on their intermediate frequency assignment while reception from the police cars is in the ultra-high frequency band. The transmitter employed is the Western Electric 400 watt 14C transmitter, having dial selection of any one of ten frequencies. Thus, simply by twirling the familiar telephone type dial a frequency for any one of the many services can be selected in an instant. An earlier type of Western Electric transmitter is employed as a stand-by for local traffic, and another transmitter about four miles distant from KGPB is operated remotely as a booster.

Transmission from cars to KGPB is made on the ultra-high frequency police band using Western Electric five watt car transmitters. Only one Western Electric ultra-high receiver is used to pick up signals from all car transmitters. This receiver is located on top of the Bell Telephone building in the heart of the city. The output of the receiver is fed through land wires to loud speakers at KGPB. So efficient is the system, there does not exist a single dead-spot in the entire city. There has never been an instance where headquarters has been unable to carry on efficient two-way conversation with any one of the 36 cars. Even though this perfect transmission and reception exist, five additional receivers are to be installed at strategic points in the city, each to feed its output into the loud speaker system at KGPB.

In addition to the ultra-high frequency receiver system, eight receivers are required to handle the various services at the station. There are four

receivers for interzone work (working and calling for night and day frequencies); two zone receivers (working and calling); and two receivers for monitoring all St. Paul calls.

Six land telephone lines terminate at the station affording duplicate lines to police headquarters and other important points. When a citizen wants a policeman, he can call police headquarters where the operator immediately connects him with the radio dispatcher at KGPB, or he can call the telephone operator who switches him directly to the radio dispatcher.

The calls go out from KGPB in an almost endless stream, each one another spoken evidence of the service police radio is rendering the citizens of Minneapolis. Crime prevention is just one feature of this service. Day and night calls go out which show that radio is enlarging and broadening the scope of police work, making cities more comfortable, peaceful and pleasant places in which to live.

Listen to the calls: Barking dog keeping whole neighborhood awake—Small boys playing on railroad tracks—Holy roller meeting disturbing entire block—Car blocking drive at 2523 Harriet—Family trouble at 2431 Emerson—All cars recover stolen Chevrolet, license number B335093—Summit and Hennepin, two drunks in an accident.

And so it goes, day in day out. The radio patrolmen get their calls and reach the scene in an average elapsed time of 90 seconds. For the month of May a total of 15,246 telephone calls came into KGPB and 6,453 calls were put on the air, each one sending a patrol car to the scene, each one bringing a new era of peace and lawfulness to a large city.

Howard Kelly—KGPB

Howard Kelly would probably be one of the most hated of men if a lot of crooks inside and out of prison walls knew what he had done to them.

Kelly is Superintendent of Communications for the Police Department of the City of Minneapolis, and mainly through his efforts, the city now has one of the finest police radio systems in the country. Anyone knows that an efficient police radio system spells doom to almost any criminal career.

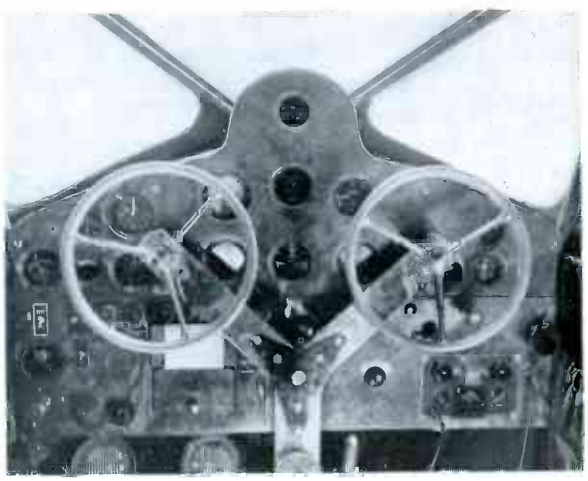
Kelly was born in Omaha and life progressed for him as it does for most boys until he moved near the State Agricultural college at Manhattan, Kansas. There something happened to him which altered his life and made him different from other young men. A radio bug, lurking in the hay-wire of the college's amateur spark set, bit him. He has suffered pleasantly from the malady ever since.

School finished, he is next to be seen working feverishly as operator at WLAG in Minneapolis in 1921. This station later became WCCO.

Howard Kelly, Superintendent of Communications of the Minneapolis Police Department, at his amateur radio station W9CCX.

Some time later the Northwestern Bell Telephone Company claimed him and he remained there until 1929. Then it was that the city fathers of Minneapolis decided to install police radio. Howard was the man to do it. A Western Electric transmitter was installed at police headquarters, and everything was rosy until his former employer, the telephone company, erected a skyscraper which completely absorbed the police signal. How Howard got out of that and many more troubles for the next few years is an epic which could be written only of a man who had been bitten by the radio bug.

During the ensuing years there were many administrations and many police chiefs. Some of them didn't think much of police radio, but that didn't stop Kelly. Today, under the administration of Superintendent of Police Frank P. Forestal, he now has a police radio system from which others are patterned.



Good news for airplane owners is Western Electric's new 15 watt aviation radio transmitter. Shown (lower right) on the instrument panel of a new Waco "N", this compact unit, using plug-in type crystal holders, transmits on any desired private flyers' or airline frequencies.

KSL—Salt Lake City

(*Continued from Page 15*)

they get it immediately.

To KSL microphones the agricultural specialist is no stranger. For more than 10 years the Utah State Agricultural College has broadcast regular programs giving the people invaluable instructions in irrigation and all the other agricultural problems indigenous to the territory.

Such educational authorities as Dr. John T. Wahlquist of the University of Utah, and Dr. L. John Nuttall, superintendent of the Salt Lake public schools, have conducted air courses in education in cooperation with the Extension Division of the University which enable teachers to obtain university credit. Other educational broadcasts emanate from Brigham Young University at Provo, Utah.

The outside world is brought to KSL listeners through air interviews with the famous people who visit Salt Lake City and the supply of such is inexhaustible. Salt Lake City is the mecca of hundreds of thousands of tourists each year. During three summer months each year, approximately 4,000 people a day are conducted through the beautiful grounds of Temple Square and the world-famous tabernacle.

KSL is not content to be represented to its listeners by its voice alone. Glade makes from three to four appearances a week in cities and towns throughout the territory. With him go favorite KSL artists who appear in the flesh before the thousands who gather to hear and see these traveling representatives of the station they call their own.

KSL claims a record as the greatest program producing station in the Inland West. It originates 30 per cent of the 19 hours of daily programs. Many of its regular and special programs have been released nationally and internationally by both major chains since the earliest days of network operation. It could rest its claim to fame on the Tabernacle Choir program, alone, this being one of the best known programs in the country. The "Sunday Evening on Temple Square" program broadcast at 11 p.m. is a close runner-up.

The history of KSL reaches back to April 21, 1922, when it received its license, making it one of the pioneer stations. It has steadily grown in power and prestige. Its original power of 1,000 watts was increased to 5,000 watts in 1928. Shortly after it became affiliated with the National Broadcasting Company. Power was again increased in 1932, this time to 50,000 watts with a Western Electric transmitter. In this same year the station switched its affiliation to the Columbia Broadcasting System.

The names of two men stand out in KSL history. They are Bishop Sylvester Q. Cannon, president of the company, and Earl J. Glade, managing director. For years Bishop Cannon has been in charge of the physical assets of the Church, an enterprise whose resources are variously estimated at three to four hundred million dollars. Despite the terrific drain upon his time and energies from this enterprise the radio station has, for the last 13 years, been one of his favorite cares.

Realizing to the fullest the tremendous effectiveness of radio, and proud of its many accomplishments, he yet feels that much more is to be accomplished before broadcasting reaches the peak of its service possibilities. Much must be done to develop a real educational program, he believes. There must be a closer mating of education and broadcasting showmanship and program technique in order to produce an educational program which will entertain at the same time it instructs.

In appearance Bishop Cannon is a tall, kindly man, deliberate in speech and action. One hardly sees in him the keen, sagacious business man, which he is, and is more apt to see the contemplative, intellectual, spiritual side of him which forms the complement to his business activities. Recently the Church awarded him one of its highest honors by making him an Apostle.

Earl Glade is the exact opposite in appearance and action. His body radiates physical power. His blue eyes, the quick, incisiveness of his speech, claim and receive the instant attention of his

Two views of the Western Electric 50 kw. transmitter at KSL.

audience. His gestures and movements are those of the practiced public speaker. His dynamic energy is spread over many activities. He is president of the Rotary Club, and is engaged in many public works. For 14 years he taught advertising and selling at the University of Utah and at one time was chairman of the commercial section of the National Education Association, all of which is splendid background for the job of managing one of the country's great stations.

The people of the West, once isolated from the quick sources of news and the march of events, owe much to the splendid career of KSL. As the years roll on, they will owe even more because the station looks ahead to even greater things. Today, it stands ready to widen its hearing circle and increase the power of its voice should the government grant greater power. Even more ambitious plans are in the projected stage.

Eugene G. Pack—KSL

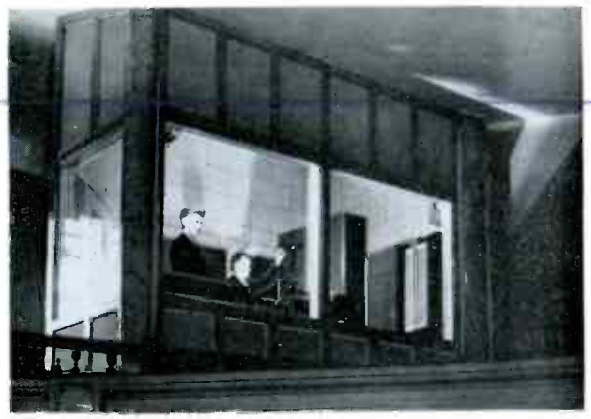
There seems to be a destiny which makes radio engineers out of men in spite of themselves. Eugene Pack, chief engineer of Station KSL, Salt Lake City, was graduated from the School of Geology of the University of Utah, and thought he was headed for a career in that branch of science, but he wasn't.

Eugene Grant Pack

Back in his high school days he had an amateur radio transmitter. Almost anyone knows what that will do to a man. It did it to Gene for he soon forgot about rocks and substrata and went to work for Station KLO at Ogden, Utah. He helped install the transmitter and remained there as operator. The station was owned by Earl Glade who, in 1929, gave Gene a job at KSL. Four months later, January 1, 1930, he was made chief engineer.

In 1932 a 50 KW Western Electric transmitter was installed under his supervision, and in 1936 completely new studios were constructed with Western Electric speech input equipment. Gene is particularly proud of the control equipment which he has installed in a special sound proof booth in the Mormon tabernacle. Complete recording equipment permits the recording of any program which emanates from there.

One of the biggest thrills in radio for Gene came in building a special transmitter to handle the speed runs of Sir Malcolm Campbell on the Bonneville salt flats. With the first run set for Tuesday morning, not even the transformers had arrived for the transmitter by Sunday night. But by a good deal of rush work, some amount of haywiring, and a dash of luck the transmitter went on the air late Monday night for its first test with the boys back at Salt Lake. The runs took place the next day, and the transmitter handled the entire broadcast which was put on the network. Since then Gene and his crew have handled every run which has been made on the famous salt track, including the one in which Sir Malcolm first broke 300 miles per hour. In July of this year Gene was busy lining up equipment and men for the run to be made by Champion Eyston.



KSL's Western Electric speech input equipment in the great Mormon Tabernacle.

There are 14 men in the engineering department under Pack. Two of them have obtained masters degrees from the University of Utah while working for KSL. The station has provided a large part of the experimental and test equipment for the men for their research work in connection with writing their theses. One of the operators has become a member of the bar while working at the station.

Another job which gave Pack much pleasure was the test program he carried out for Bell Telephone Laboratories in connection with the design of the now famous 110A Amplifier.

His work in drawing up plans for a high power international station for KSL has won him unusual recognition among radio engineers. With much experimental work in addition to the many regular duties at KSL, Gene Pack is more than a busy man.

He is married and the father of two young boys. A new home overlooking the entire city of Salt Lake is, next to his family and job, his pride and joy. Having been born and raised within sight of Salt Lake he has no inclination to leave. He sees plenty of activity and room for growth in radio in his present job to keep him busy and contented for years to come. He is a member of the Institute of Radio Engineers and is widely known and liked throughout the industry.

CBS—KNX Hollywood Studios

(*Continued from Page 3*)

with their double glass windows are arranged on the left and right of the auditorium, giving an unobstructed view of the entire stage.

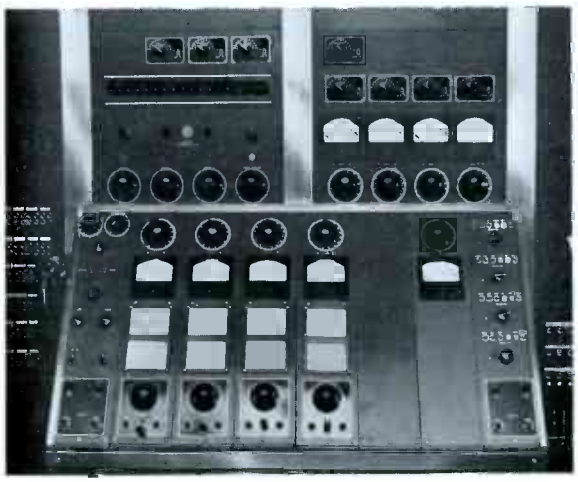
In addition to the auditorium, there are seven regular broadcasting studios housed in the main building. Two of these are 30 feet wide, 50 feet long and two stories in height. The next in size is a general purpose studio 21 by 34 feet. Studio 4 is slightly smaller and is equipped with a magnificent organ. Studios 1, 2 and 3 are equipped with glass enclosed observation rooms for visitors.

The smaller studio units, 5, 6 and 7 are located on the second floor. The latter is used exclusively for local announcements, news broadcasts and transcription purposes.

All of the regular studios are acoustically treated and air conditioned. One of the many unusual features of their design is the use of sloping walls. These, together with the careful distribution of sound absorbent material result in excellent acoustical characteristics.

Complete sound insulation is achieved by the independent suspension of the walls, ceiling and floor. All potential sources of noise, such as rotating machines and air conditioning facilities, are remotely positioned with respect to the studios and effectively treated to prevent the transmission of noise into the studios.

The design of each studio control room is the result of a comprehensive study made of a full size experimental model of Studio 2 erected in New York over a year ago. The control room floor is raised above the level of the studio floor to the point where the eyes of a person standing in the studio are on a level with the line of sight of the seated occupants of the control room. The double glazed windows, sloping out into the studio, are set at a precise angle which prevents reflection in either direction.



KNX Master Control switching position where the selection and distribution of programs to the CBS networks take place. The new type volume level indicators can be seen here.

The Western Electric audio facilities for each of the studios are the same except for the number of microphones which can be handled at one time. The larger studios are equipped with eight-position mixers which include six microphone channels and two line positions. The smaller studios are equipped for four microphone channels and two lines. The front panel of the control console is sloped for maximum visibility of the controls which include volume controls, key switches and signal lamps. The signal lights over each key switch show the channels in use. Two utility key switches, a line key and rehearsal-break key are also mounted on the control panel.

The line key in its three positions performs three different functions. During rehearsals the key is operated in its up position and the circuits are set up for regular operation except that the program is not transmitted to the line. Oral direction of the performance from the control room is then possible.

In the center or standby position of the key, the occupants of both the studio and control room can listen to the cue program from which the starting cue is obtained.

In the down or on-air position of the line key, the circuits are arranged for transmission to the line, and the rehearsal-break facilities are disconnected.

The volume level indicator, designed by the CBS Engineering Department is mounted on top of the control console. It has many unusual and eminently desirable characteristics. It is briefly described as a medium speed, almost critically damped, direct current meter, using a full wave copper-oxide rectifier. The characters are black and red on a yellow-orange dial which has a voltage scale as well as a decibel scale. The reference point of zero db is located at about 70 per cent of the scale, or 3 db down from the scale end. The use of this meter over a period of six months on all types of programs has definitely demonstrated its superiority over older types.

The microphone amplifiers are Western Electric type 104A. An additional 104A amplifier is connected between the output of the mixer network and the master gain control. The output of the latter is fed directly to the line amplifier which is a Western Electric type 105A. These are mounted in a cabinet rack which also contains a Western Electric 94C monitor amplifier, jack field, relays, pads, coil and miscellaneous equipment.

Each studio is complete in itself, even to emergency sources of 110 AC and high and low voltage DC and is capable of transmitting a level of 10 milliwatts to a line.

All of the studio audio wiring is carried in rigid conduit and steel ducts. A duct extending from the wall box to the rack and thence to the control desk carries the cable connecting these units.

Signal circuits and low and high voltage circuits are run in conduit separate from that which carries the audio circuits. A wall box divided into four compartments is used to mount a 12 volt rectifier, a main switch and fuse panel, relays and terminal blocks. All conduit terminates at this box and the cable is cross-connected as required, except the microphone cables which terminate in the equipment rack to insure continuity of shielding.

The Master Control room located as it is in the main lobby, is the center of attraction for all visitors to the new studios. It is enclosed on three sides with large panes of double glass and the entire equipment installation can be seen from the foyer.

The chief function of master control is the selection of programs from one or more of 18 sources and the distribution and transmission of these programs to one or more of eight lines. In addition to the equipment necessary to perform these functions, there are also visual and aural monitoring facilities, amplifiers for the operation of office loud speakers, a complete private telephone line installation connecting all program sources, and elaborate facilities for measurement purposes.

Many of the last named devices were developed by the CBS Engineering Department specifically for the work involved in the maintenance of a plant of this size.

The program sources include eight studios, two Radio Playhouses, three remote channels, the CBS Pacific network and the CBS Transcontinental network lines. All incoming program lines including the network and remote lines terminate in master control in a resistance of the proper value. These lines are treated as buses, across which the outgoing line amplifiers are bridged by means of selector switches and relays operated by momentary-contact keys. The pre-selection and selection of any program bus by any outgoing line is indicated both on the selector switch and on two opalescent glass panels. The illuminated number or letter designating the bus appears in green on the pre-selection panel and in red on the on-air panel.

Each outgoing line channel consists of a high-impedance bridging coil, volume control, a Western Electric type 106A amplifier, volume level indicator, line pad and coil.

The incoming remote and network line channels consist of a coil and variable equalizer, a Western Electric type 105A amplifier, volume level indicator, and distribution resistance network.

The aural monitoring equipment consists of Western Electric 94C amplifiers and loud speakers which may be bridged across any incoming or outgoing line by means of selector switches.

The arrangement of equipment on the 15 cabinet type racks is the result of considerable study. The more active units are closely grouped around the central operating position with all controls within reach of the technician. The racks which

Cabinet type racks house the Western Electric 104A, 105A and 94C amplifiers with which each studio is equipped. The design of the control console permits, full, unobstructed view of the studio.

are 10 feet high and of special design are arranged on three sides of an octagon. All of the switching system is contained in the center section. The left wing is devoted to the monitoring amplifiers and outgoing line amplifiers while the right hand section contains the remote line terminating facilities and the measuring equipment. A private telephone switchboard is placed immediately to the right of the central operating position and is convenient both to the operator and to the remote line equalizing panels.

Ample provision is made for the future expansion of these facilities. With respect to the physical layout of the racks themselves, there is panel area available for nearly 100 per cent increase in equipment. From the electrical standpoint, the switching facilities will take care of double the present number of outgoing lines.

An interesting feature of the KNX master control is the location of wall boxes above the racks. The terminal blocks for each rack are mounted at the top rather than the bottom of the rack as has been usual in the past. Conduit from the various parts of the building is brought to these boxes and the cable terminated on blocks and thence cross-connected to the several racks. This represents a marked saving in cable, conduit and duct work and reduces the time and labor which would be ordinarily required when the older method is used.

Twisted pairs in lead cable carry AC to each rack and are run in a steel duct beneath the racks from the main switch panel. Each rack is separately fused.

Attention was directed throughout the planning of this project toward the simplification of the many complex operations of a modern broadcasting plant to insure against interruption of service. The new CBS Hollywood studios have been in daily operation since the spring of 1938 and have demonstrated the merit of the functional design.

New Coaxial Antenna

(*Continued from Page 5*)

ground having infinite conductivity. For the finite conductivity case, the effect of high angle radiation is increased. For antenna lengths longer than shown in Figure 3 the effect becomes continuously aggravated. For ultra-high frequency broadcasting and police services the resultant impairment in local coverage is

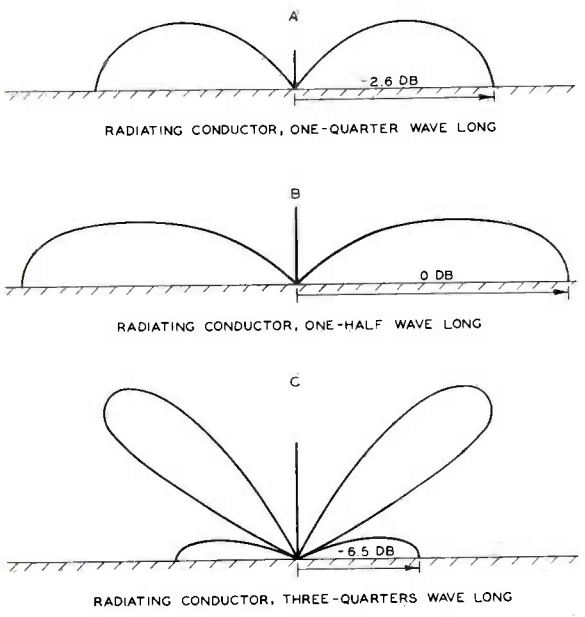


Fig. 3—Vertical directivity patterns for grounded vertical antennas.

obvious since only the signal along the ground is effective and the high angle radiations are wasted. This makes it imperative to take precautions to confine the radiated power to the antenna only, for by so doing, the ideal characteristics of a dipole antenna in free space are closely approximated, i.e., a maximum signal in horizontal directions is obtained.

Referring to Figure 4, an antenna one-half wave long is shown above the top of a pole and isolated from it by means of an anti-resonant high impedance circuit. If this could be done, it appears evident that conductive coupling between antenna and pole would be materially reduced.

The new coaxial antenna performs this function and thereby reduces pole radiation to a minimum. To clarify the description of the coaxial antenna, a brief resume of the development of this antenna is given in Figure 5.

Figure 5A represents a simplified diagram of a quarter-wave rod extending from the inner conductor of a concentric line. The current in the base of the rod is equal to the current travelling down the outside of the concentric line at the feed point. It is evident that the actual radiator consists of the rod and the outside surface of the line and radiates throughout its length all the way to the ground and consequently it produces undesirable effects. Figure 5B represents an approach in the right direction by terminating the outer conductor in two quarter-wave rods and consequently reducing the line radiation effects since the current tends to flow in the two rods rather than return to earth over the outer surface of the line.

Figure 5C is one form of coaxial antenna in which four quarter-wave rods in the form of a cage are used for terminating the outer conductor of the line. These rods are insulated from the structure except at the feed point. The rods are bent down to surround the line and less current flows back to earth over the outer surface of the line.

Figure 5D is similar to Figure 5C except the open cage has become a tube connected at the top to the outer conductor of the line and elsewhere insulated from the line. It is essentially a length of concentric line which has had the sheath turned back on itself for a quarter-wave length leaving the inner conductor uncovered by an equal amount. This arrangement introduces a new circuit element not evident at first inspection and represents a preferred form of the coaxial antenna.

By reference to Figure 6 which shows a cross-section of an elementary form of a coaxial antenna this new circuit element is more evident. The enclosed sheath of the transmission line acts in conjunction with the inner surface of the larger surrounding tube to form a short-circuited quarter-wave concentric line. The characteristics of this shorted section of line cause an extremely high impedance to be created across points A and B. By simple analogy this is equivalent to a high Q anti-resonant circuit which isolates the pole below point B from the antenna and reduces the stray pole current to a minimum.

When this antenna is supplied with power, the center of the antenna is at minimum po-

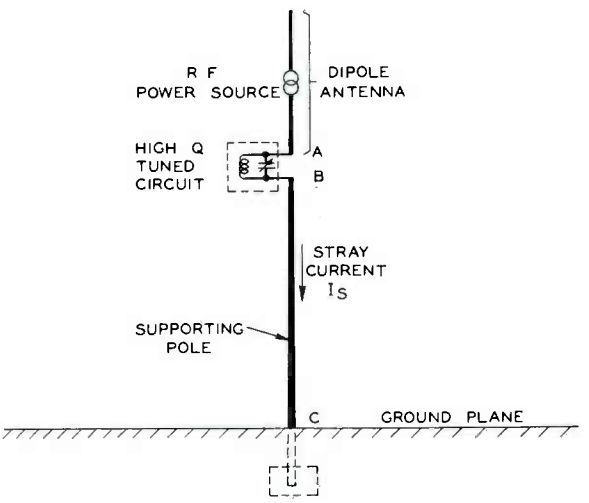


Fig. 4—Action of High Q Tuned Circuit in reducing stray currents.

tential, the top is at a high potential and the bottom of the tube is at a high potential. The presence of the high Q anti-resonant circuit element at the bottom of the tube allows this high potential to exist even in the immediate proximity of the transmission line.

The lead illustration shows an early form of this antenna now known as the KS-10017 Coaxial Antenna that has the features described above. Unlike the simplified construction shown in Figure 6, this antenna has additional desirable mechanical design features which have been added for practical reasons. The concentric line which feeds the antenna is a standard seven-eighths inch diameter gas tight line and is placed for mechanical strength inside a heavy brass supporting pipe approximately 2 inches in diameter both terminating in a solid brass bushing at the feed point, i.e., center of the antenna. A three-inch diameter coaxial tube is attached solidly to this bushing at the feed point and elsewhere is kept insulated from the 2-inch pipe by internal ring insulators. The quarter-wave rod projects through a sturdy insulator at the feed point and is connected at the feed point to the inner conductor of the transmission line.

Electrically, this coaxial antenna is a center-fed doublet and consequently closely matches the surge impedance of a standard seven-eighths inch concentric line. The doublet or dipole antenna consists of the quarter-wave rod and the outer surface of the three-inch tube which is also one-quarter wave long making a total active radiator length of one-half wave.

At a frequency of 35.6 megacycles, a coaxial antenna was substituted directly for a "J" type antenna and comparative field intensity measurements of the signals were made in two directions and at two distances away from the station. The measurements in this case showed an 8 db increase in signal strength in favor of the coaxial antenna for equal power input. To obtain a similar increase in signal strength from a 500 watt station by changing the carrier power alone would require an increase in the power of the station to 3 kilowatts.

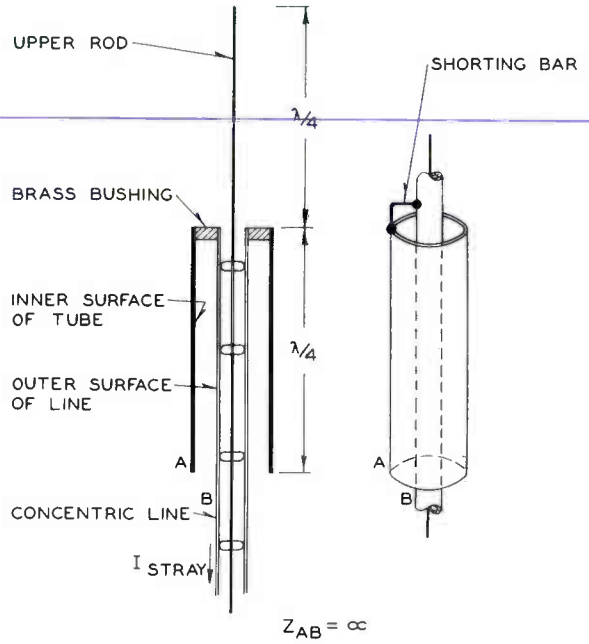


Fig. 6—Method of terminating lower end of coaxial antenna in a very high impedance.

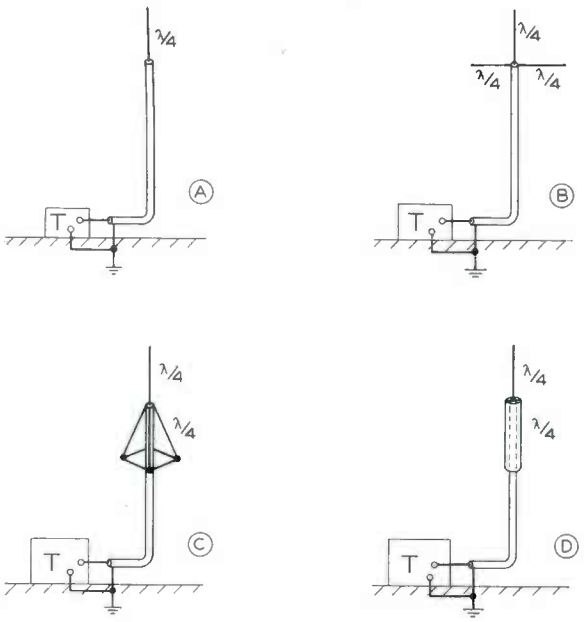


Fig. 5—Evolution of the coaxial antenna.

Major Edward Bowes, who has "rung the bell" on many an aspiring amateur, can now ring land telephone bells from his palatial yacht "Edmar". Using his newly installed Western Electric 25 watt marine radio telephone, the Major can pick up his handset and, connected by radio to the nearest Bell System shore station, call any number he wants.

One of the phenomena of broadcasting is the number of good candid cameramen the business has produced. When broadcasters get together there are more cameras present than jitter bugs around a swing band. Pick-Ups here and henceforth offers to its readers rare examples of this curious craze.

FACES the camera CAUGHT

Turning the tables on candid cameraman G. Richard Shafto, President (WIS, Columbia, S. C.), Salesmanager J. D. Saumenig clicks the boss's camera — catches him hanging a prize shot.

Is he swooning or crooning! No, he's concentrating. It's a natural of Jose Rodriquez, Musical Authority (KFI-KECA, Los Angeles, Cal.), caught by Manager Harrison Holliway.

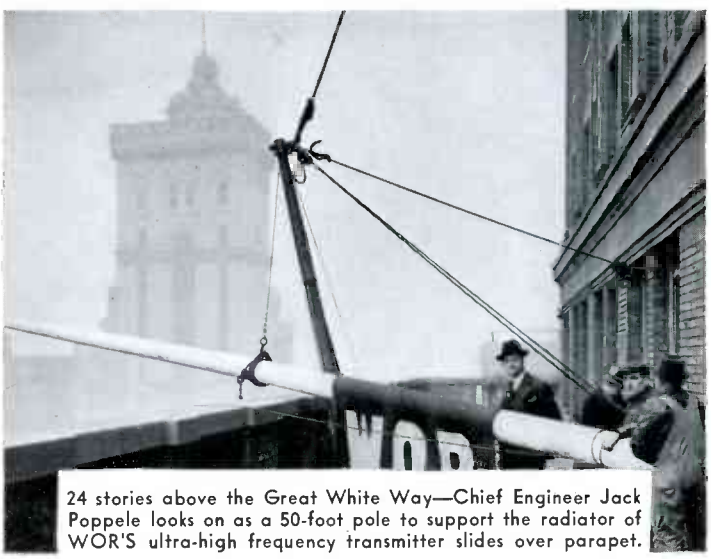
"Sears Roebuck can send you anything but a high fidelity signal," says Chief Engineer Edward Hurt (left). "Bragging again about that KFXD signal," replies Announcer Clyde Scott (KFXD, Nampa, Idaho).

CBS reaches a milestone—lays a cornerstone. Vice-president Donald W. Thornburgh tells about it as ground is broken for Columbia's $2,000,000 studio and office building in Hollywood.

Pick-Ups hopes to carry more candid-camera shots of radio personalities. Contributions are welcome.

Manager Luke L. Roberts (KOAC, Corvallis, Ore.) snapped by Lincoln Miller as he locates a response center in the station's secondary area.

News Editor Foster May leads Manager John J. Gillin, Jr., (left), to WOW's 8-ball after he has been selected as the outstanding Omahan by the Junior Chamber of Commerce.



24 stories above the Great White Way—Chief Engineer Jack Poppele looks on as a 50-foot pole to support the radiator of WOR'S ultra-high frequency transmitter slides over parapet.

Under supervision of Chief Engineer George P. Rankin, Jr., (left), and Manager E. K. Cargill (right), a movie cameraman reels off scenes of WMAZ (Macon), for Georgia's theatres.

Technical Supervisor R. J. Rockwell (WSAI, Cincinnati, Ohio) describes the transformation of a flagpole into an antenna as Announcer Gordon Shaw and Chief Engineer Joseph Whitehouse follow each step of the job.

Continuity Chief and Flying Instructor Charley Bush (right), and Chief Engineer Nate Wilcox (KTUL, Tulsa, Okla.), test equipment before broadcasting flying instructions from the air. Both Bush and his student do the broadcasting from the student plane.

"Imagine this guy trying to tell me
that Western Electric
didn't introduce stabilized feed back"