Western Electric

OSCILLATOR

New Multi-Network
Radio Center in Hollywood

Number 11 May 1948

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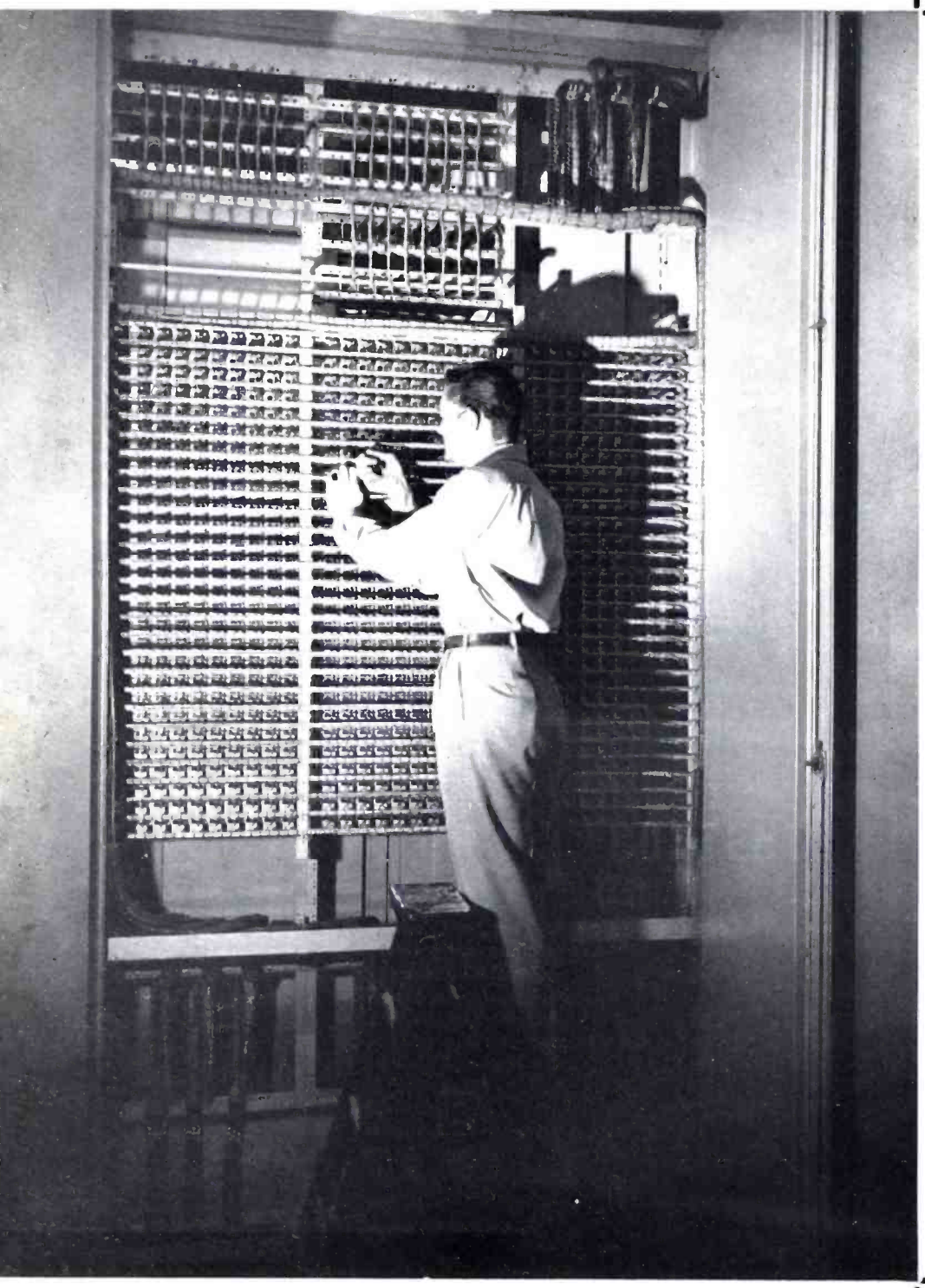

ON THE COVER

Take a lot of clever planning and much hard work by Don Lee and Western Electric engineers; add, among other things, 821 relays, 41 amplifiers, 29 rectifiers, 2500 jacks and 11 miles of shielded wire; hook everything together with 75,000 soldered connections—and you have the impressive Master Control in Mutual-Don Lee's new Hollywood studios, shown on the cover. That's Robert Arne, Engineering Supervisor of Studios, at the controls.

It's a behemoth in size as such switching centers go—30 feet long and 10 feet high—and it almost thinks for itself when it comes to switching from one station and network set-up to another. Program conditions are set in advance, the switching sequence is put into action by pushing one button, and an automatic "time delay" circuit completes the operation at the correct instant. All in all, it's one of the most flexible and versatile systems ever designed—and one of the easiest to operate.

At the left is a behind-the-scenes view of one section of the same Master Control. This bay is devoted entirely to the 821 relays which make the system "tick."

You can read all about this new departure in broadcast audio facilities in two articles which begin on pages 4 and 12.

Western Electric

OSCILLATOR

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The men of the broadcasting industry, meeting in Los Angeles for the 26th Annual Convention of the National Association of Broadcasters, must have a feeling akin to that of riding a whirlwind. What is happening to the radio industry in the year 1948 is more like an explosion than it is like "growth" or "expansion". Every major development that has been brewing for the last decade or more seems to be coming home on a giant scale, and all at the same time:

AM broadcasting, through the widespread use of directional antennas and other technical developments, is spilling generously over what was long considered the "absolute top", with 2000 stations in sight and more coming;

Frequency modulation is flooding in to double the industry on top of that, with a big part of its growth in the single year 1948;

Television is adding another revolution with speed and power enough to exhilarate the industry, while leaving it a little dizzy;

Citizen's radio, mobile telephony, microwave relay systems, hundreds of new services using radio alongside the broadcast industry or in cooperation with it are growing just as fast, to stimulate the growth of broadcasting while, in some cases, adding to its spate of problems.

The difficulties of working out technical, economic, and programming practices for this huge new broadcasting industry, operating in several new dimensions, are not all that face the men of broadcasting. The responsibility of a medium that carries such weight and power in the cultural and political affairs of the world are heavy and unavoidable. The political conventions and elections of this year will carry radio, with the resources of television pushing it, to an even higher place of importance in American politics. International unrest will continually intensify the major-scale activity of broadcasting in world politics.

It will take all the brains and sweat that the men of the broadcasting industry can find to give this seam-bursting giant a firm, practical foundation in an uneasy world.

—R.S.L.

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Mutual-Don Lee's New Hollywood Home

A NEW BUILDING has gone up in Hollywood . . . a new home for the West Coast operations of the Mutual and Don Lee Broadcasting Systems, which we believe to be one of the finest and most complete installations of its kind ever to be erected. The steady growth of Mutual and Don Lee has required repeated expansion of the program production and studio facilities in use at the Hollywood headquarters. However, when our present requirements became clear, we decided to make a complete break with the past and design a new network center from the ground up, with completely new equipment designed specifically to provide the most efficient facilities for our existing and future needs.

The new, 3 million dollar, block-square building that resulted from this determination to have the finest facilities is now going into service and is proving to be a splendid realization of our hopes and plans.

Description of the building divides naturally into two parts which will be taken up in the order given: (1) Studio complement and acoustic design; (2) Program control equipment, including program routing to the various networks associated with Don Lee and Mutual.

The complement of studios included in the new building is based on our need to develop not only the Hollywood-originated programs for Don Lee and Mutual, but in addition, to provide facilities that would allow complete flexibility in originating programs for the various affiliated networks on the West Coast. In order to take care of our present needs and any foreseeable demands in the future, we decided on the following studio setup:

(a) Four large "Auditorium" type sound stages which would allow production of the audience participation or symphony orchestra shows with stage room for more than 100 musicians and an audience of 350 people.

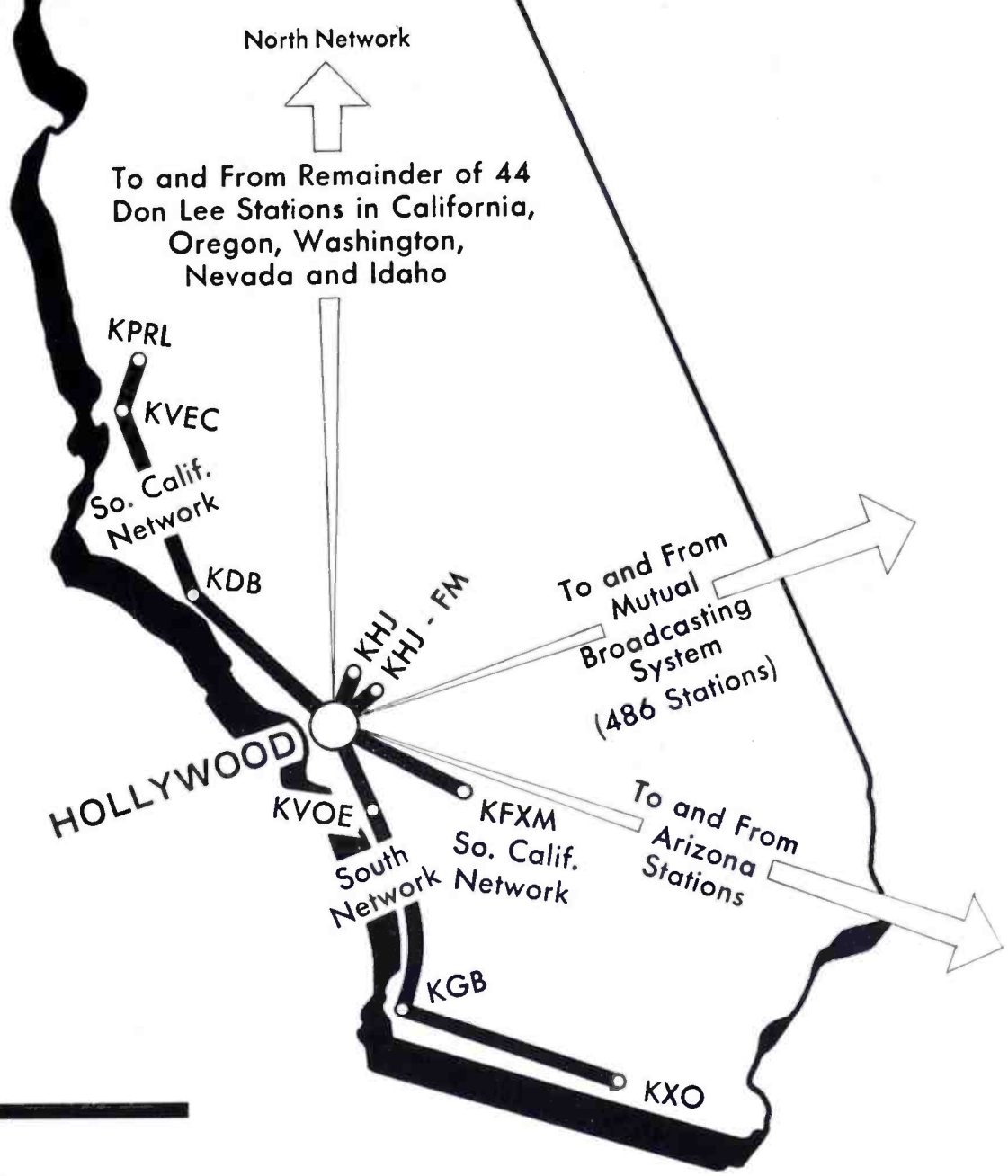
(b) Four large "Dramatic" type studios in which a great variety of shows requiring fewer people than the types referred to above could be produced.

(c) Three small studios allowing for production of commentary, group discussion or similar shows involving one to ten people grouped around a table, with convenient transcription equipment in the control rooms allowing for production of disc-jockey shows.

(d) Three announce booths which include not only microphone input equipment, but complete transcription equipment, allowing the announcer to insert announcements in any program as desired, or play recordings for program fills.

These requirements are embodied in the ground floor of our new building as shown on the simplified floor plan and isometric drawing on pages 8 and 9. The four large auditorium sound stages which can be seen at the four corners of the building are each in mean dimensions approximately 110 feet long, 55 feet wide and 28 feet high . . . one of the largest sound stages ever built for radio use, with a volume of 170,000 cubic feet. The four dramatic studios, two of which are 51,000 cubic feet and the other two 24,500 cubic feet, are disposed in a line across the center of the floor as shown. The three smaller studios,

Multi-network operation at Don Lee camplicates their switching problems. Two transmitters and five network lines are fed from their new Hollywood radio center.



by Walter Carruthers

Chief Engineer, Studio Division,
Don Lee Broadcasting System

which average about 1800 cubic feet, and the three announce booths can be seen conveniently arranged in the front center of the building.

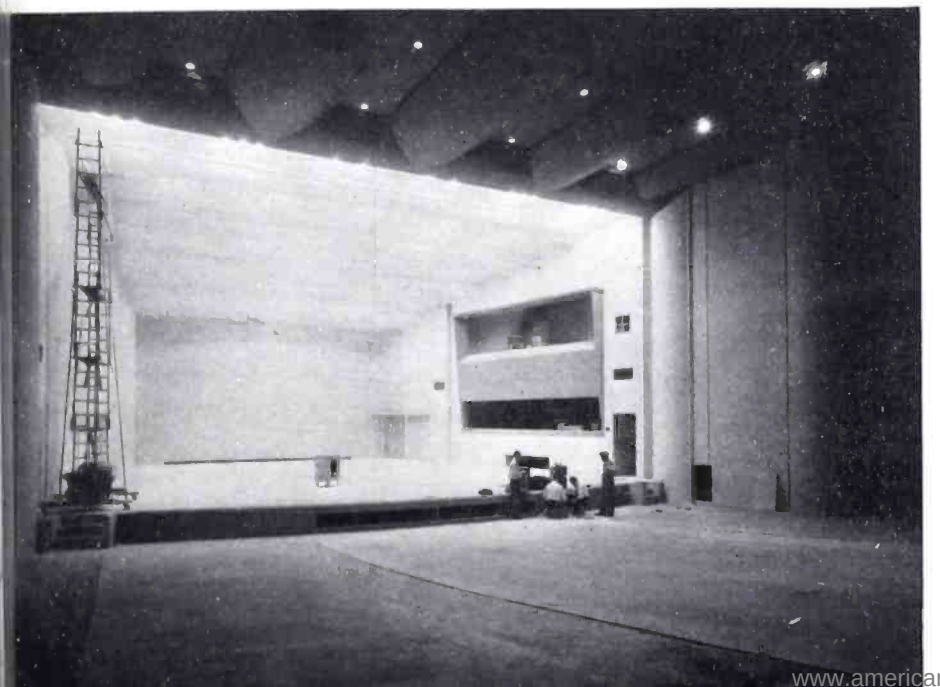
Acoustical Research for Finest Tone Quality

In contemplating the design and acoustical treatment of the new Don Lee Broadcasting System auditoriums, consideration was first given to the optimum reverberation characteristic. That is, the determination of the length of time that tones, upon being interrupted, will persist. The curve, produced by graphically plotting the reverberation time and frequency, is the objective criterion which is compared with the subjective enjoyment of the sounds produced.

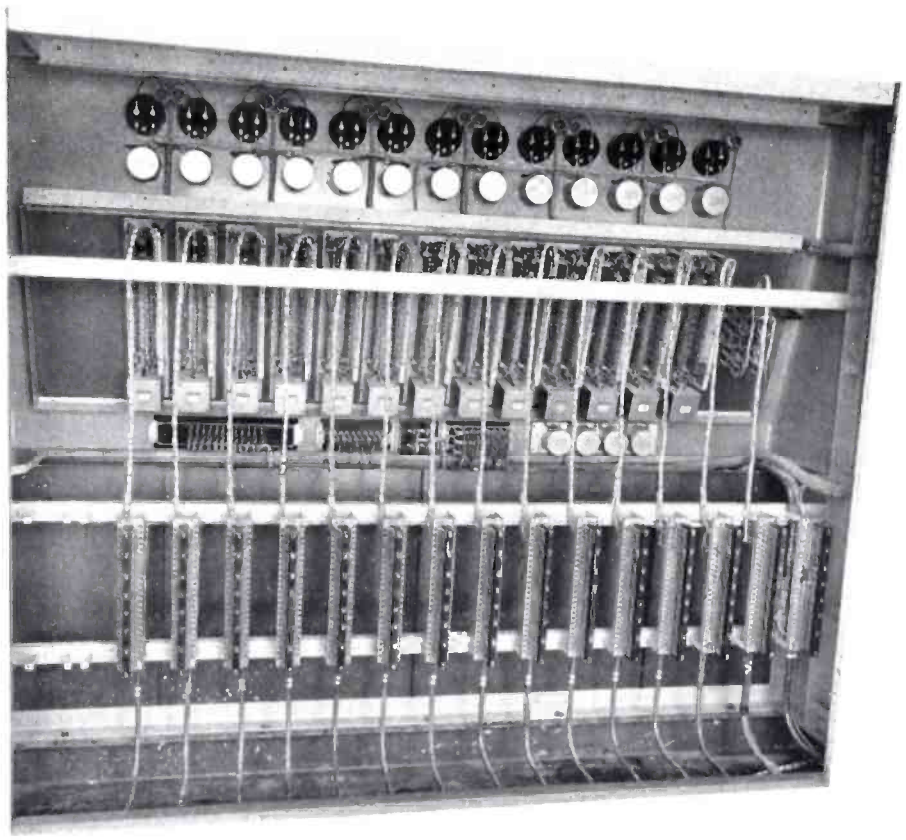
In the growing art of broadcasting the optimum reverberation characteristic for a given room size has been controversial, like most things dealing with the aesthetic. However, in pooling our listening experiences, programs emanating from certain music halls seemed to score a unanimity of opinion as to the sound excellence. Equipment capable of producing tones and graphically recording the time of sound decay was moved into these favorite places and the resulting curves were compared. There was an unmistakable similarity about all of them. An average of these measurements became our optimum reverberation characteristic. The music hall which had a sound characteristic nearest to our selected standard was chosen as a place to produce a series of musical programs, so that a more careful study could be made in listening tests.

The next problem was to design an auditorium which would conform to the optimum sound characteristic. In earlier building history, such an undertaking would be difficult. However, today, with the science of acoustical engineering, it is possible with mathematical formulae known to the art to calculate the sound treatment for a given volume enclosure so that the desired reverberation characteristic can be obtained.

Many subtle factors must be considered in the sound treatment in order to enhance the enjoyable quality of



The four auditorium sound stages — each 110′ x 55′ — are among the largest ever built for radio. Here a reverberation test is being made.



Close-up of the control turret on the Master Control is shown below, with rear view on the left. The thirteen outgoing lines are designated on the VU meters at the tops of the relay selector strips. Inputs are indicated by the lamps in the vertical rows. Relay selector knob is at bottom of each strip. Master switching buttons are in lower center panel.

sound. However, we will consider only the optimum reverberation characteristic. The audible spectrum was divided into three regions—high, middle and low frequencies. Each group was studied separately and given a different type of treatment in an effort to gain the desired results.

Convex Splays for Low Frequency Control

Low frequency reverberation is usually excessive in auditorium design because materials found there do not absorb the lower tones with a consequent tendency for them to persist after the higher tones have died away. Through use of diaphragmatic areas, control can be exercised in the dissipation of low frequency energy. That is to say, if we have areas which are free to vibrate, the low frequency sound energy will be spent in setting these members in motion. A "polycylindrical diffuser" is a form which has been used as a low frequency reverberation control element. It is constructed with a thin sheet of veneer wood bent over a convex form. In so doing the wood is at a tension and by virtue of the ribs which are spaced at random, many diaphragms are created which vibrate at different frequencies. By use of many convex splays the multiplicity effect in the vibrating diaphragms causes an evenness in the attenuation of the low frequency reverberation. The curved shape and number of "polycylindrical diffusers" have a qualitative effect; however, our discussion is quantitative.

The absorption of middle frequency sound is controlled by the amount of exposed area of such common materials found in the auditorium as—(1) upholstered seats, (2) carpet, (3) drapes and (4) wall treatment. Each material has a different coefficient of absorption and all surfaces in the room must be taken into account. It is relatively simple to multiply the coefficient by the exposed area of each material and enter the total units of absorption into a mathematical equation and derive the reverberation time for the mid-band frequencies. Usually more absorption is needed for these frequencies than that provided by the seats, carpet and drapes. In our case the wall area between the "polycylindrical diffusers" was treated with a carefully calculated amount of Acousti Celotex. This material is ineffective at the low frequencies, which are controlled by the convex splays.

High frequencies are usually absorbed to a greater degree by the same material affecting the mid-band frequencies and to further exaggerate the condition, sound travel through the air acts as high frequency absorption. To help compensate for this natural attenuation the convex surface was painted with hard enamel so that while it was acting as a low frequency control it could be highly reflective in maintaining high frequency persistence.

Needed—Multi-Network Master Switching

The program control requirements in this network center are among the most complex to be found anywhere in the country. As shown on the map on page 5, programs to and from five different network sources are received and redistributed regularly at this location: (a) Mutual network, (b) Northern branch of Don Lee, (c) Southern branch of Don Lee, (d) Southern California network leg "A", (e) Southern California network leg "B". In addition distribution to Arizona stations is occasionally made, for which provision must be included in the program control system.

Besides the incoming and outgoing network lines, there are lines to the eleven studios and three announce booths of the Hollywood center itself; the KHJ and KHJ-FM transmitters; the 96 remote lines, of which four may be used simultaneously; and the recording channels and tech-

nical and managerial monitoring. All are parts of the program switching problem. A central design requirement of the installation was, therefore, a program dispatching unit which would allow the recombination of any or all of these incoming and outgoing lines, at the "station break," in an efficient and fool-proof manner.

The present Don Lee Broadcasting System Master Control equipment, probably the largest in the world, is a result of a vast amount of collective study over a period of many years and is a system that evolved from the engineering ingenuity in fulfilling the needs of a growing network. The needs were unique to the Don Lee system of operation.

From Patch Cords to Interlocking Relays

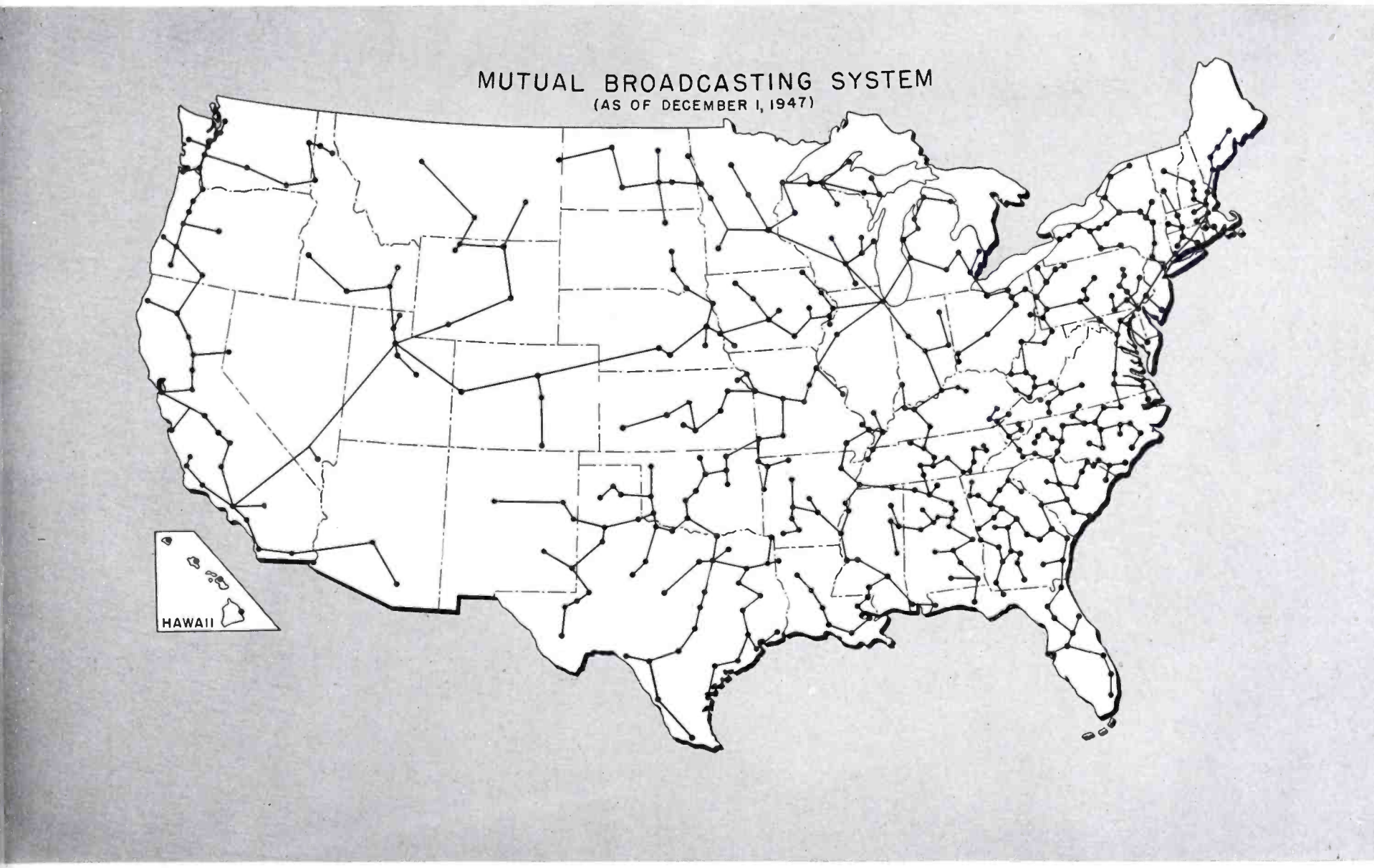
In the early days of the network the switching was done by patch cords in which the line from the originating studios was manually patched into the telephone lines. The "patch up—bridging bus system" of program distribution proved inadequate as it became common for a number of programs to stop and others to start at the same time.

There grew a need for a coordinating center in program switching. Relays were substituted for patch cords. A system of preset selection followed, allowing the operator to anticipate forthcoming programs rather than acting under the pressure of time.

With the rapid advance in the scope of Don Lee Broadcasting System network activities, the installation became overloaded and obsolete. In 1934 a Master Control switching panel was set up using Western Electric locking 92-type keys to activate the relays. One hundred and forty-four program switching possibilities were represented by 144 keys. There were twelve incoming and twelve outgoing lines.

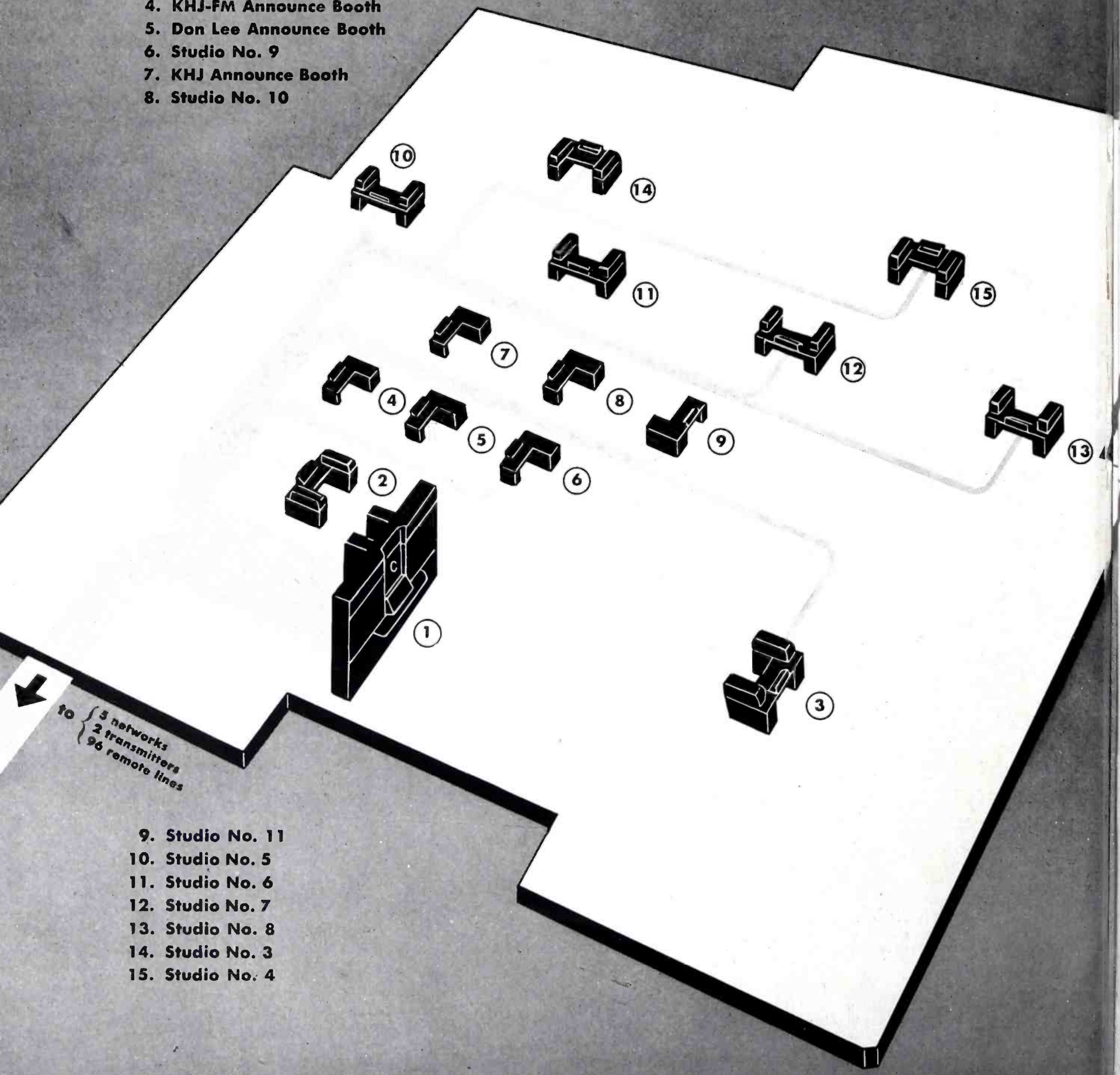
In 1940 a move to the Melrose Avenue location gave rise to a larger and more complex Master Control system. The switching panel was expanded to a 17 x 20 board with 340 possible connections. For presetting, 92-type keys were replaced with rotary switches at the bottom of strips of green and red lights. Above each strip was located a volume indicator. It was then only necessary to rotate the switch until a green light stopped opposite the

(Continued on page 10)



PLAN for large-scale program production

1. Master Control Room
2. Studio No. 1
3. Studio No. 2
4. KHJ-FM Announce Booth
5. Don Lee Announce Booth
6. Studio No. 9
7. KHJ Announce Booth
8. Studio No. 10



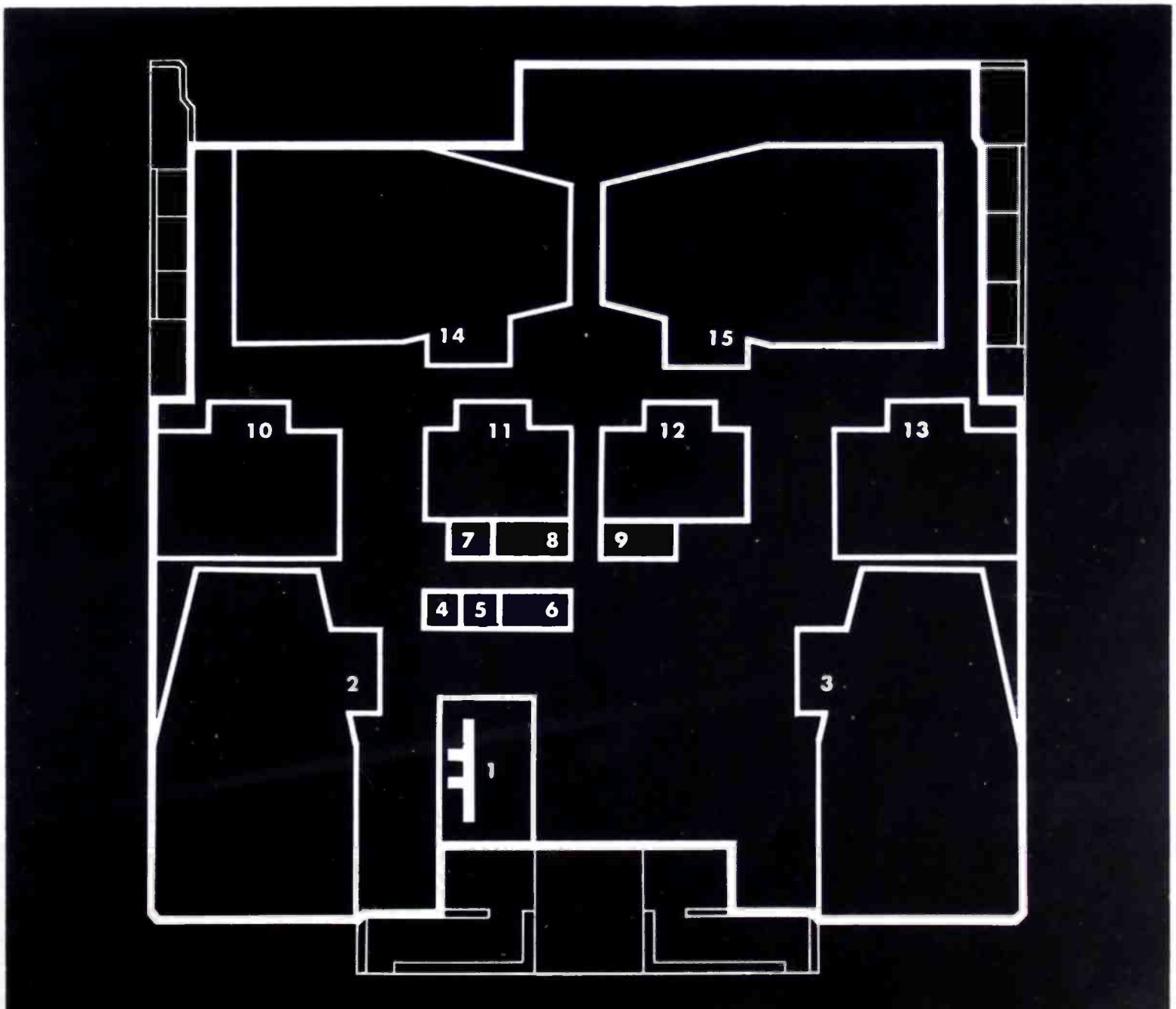
9. Studio No. 11
10. Studio No. 5
11. Studio No. 6
12. Studio No. 7
13. Studio No. 8
14. Studio No. 3
15. Studio No. 4

THE eleven studios and three announce booths in the new Mutual-Don Lee network center have been laid out to promote efficiency in programming and easy handling of the public. The first-floor layout below shows the arrangement of the Master Control Room and studios only. Offices, recording room, lounges, dressing rooms, conference rooms and service areas are arranged around the studios.

The four huge auditorium sound stages for audience participation shows (numbered 2, 3, 14 and 15) have been strategically located in the corners of the building, with separate public entrances for each. The four dramatic studios, smaller than the auditoriums but large by usual standards, are placed in a line across the building (numbers 10, 11, 12 and 13, below), so that all programs requiring studios of this size and type will be together. The three small studios (6, 8 and 9) and the three announce booths (4, 5 and 7) have also been grouped together for more efficient handling of commentary and discussion shows, and station and network announcements.

The interesting and impressive Master Control (number 1, below) is located behind a plate glass wall off the large entrance lobby for all visitors to see.

The equipment layout on the opposite page shows the Master Control and the studio and announce booth control desks in their approximate locations in the building. The numbers beside them correspond to the numbered locations in the floor layout below. Size of building is evident from floor dimensions — 288 by 280 feet.



The Men Behind Don Lee

LEWIS ALLEN WEISS

Chairman of the Board of Directors
Mutual Broadcasting System

"Our pride in the beautifully utilitarian equipment, pictured and described in this issue of the 'Oscillator', is coupled with a profound sense of gratitude to the executives and technicians of the Western Electric Company who made possible this outstanding achievement in broadcasting engineering. We are especially indebted to Mr. F. L. Hopper for his sympathetic and enthusiastic interpretation of our needs as outlined by our Chief Studio Engineer, Walter Carruthers, and his assistant, Robert Arne."

WILLET H. BROWN

Vice President,
Don Lee Broadcasting System

"In viewing the technical equipment in our new broadcasting center, in Hollywood, one cannot fail to sense and appreciate the new and effective designs as well as the utility of the Master Control and streamlined consoles designed and fabricated for us by Western Electric. While we have standardized our studio equipment for twenty years with Western Electric products, this company has reached a new 'high' in design and efficiency in the equipment proudly portrayed in this issue of the 'Oscillator', which provides the arteries of our modern studios."

(Continued from page 7)

desired switch to be made. Then by pushbutton, a red light would be lighted opposite the green showing the switch had been completed.

Switching 800 Program Combinations

In 1948 a system was evolved which was a far cry from the early days of patch and cord switching. Western Electric engineers were invited to survey the traffic problem and equipment need of the expanding Don Lee Broadcasting System network. The outgrowth of many round table discussions between Western and Don Lee engineers was a Master Control equipment with a switching system of over 800 possible program combinations requiring 821 relays, 49 amplifiers, 850 indicator lamps, 2,500 jacks, and 13 volume indicators.

This massive unit, occupying a wall 33 by 10 feet, is installed in a room just to the left of the main lobby as shown on the isometric drawing and floor plan on pages 8 and 9. One entire wall of this room is a plate glass window giving a dramatic view to visitors in the entrance lobby. All incoming and outgoing lines from the studios, networks, KHJ and KHJ-FM transmitters, remotes, etc., are brought into this unit, which contains the 41 repeater amplifiers and the rack of 821 interlocking relays which allow switching connections between any of the incoming-outgoing lines in any desired combination.

The control operation is carried out at the desk section which can be seen in the center of the panel, at which all controls are concentrated for the single operator required for the switching operations. The thirteen vertical relay selector strips represent the thirteen outgoing lines which are built into the unit. Each one of these thirteen outgoing trunks can be connected to any one of 27 regular inputs, which are chosen by the knob at the bottom of the strip and indicated by one of the signal lamps in the vertical row.

In order to allow the operator to perform the necessary multi-switching recombination which will occur at the sta-

tion break, the preset functions of the switching system are called upon. These allow the operator, during any program period, to preset his switching combinations for the ensuing set of program conditions. At the station break he can drop all existing connections and simultaneously establish all the preset connections merely by pushing a single button, or by switching individually or in two groups, as desired. In addition, he can insert a predetermined amount of delay, up to 30 seconds, into the actual switching operation which allows him to push the control button and proceed with other requirements, and the switch to the new program condition will take place automatically at the end of the delay period.

In addition to the switching combinations represented by the relay selector strips, the jack panels on the front of the unit allow patching of any of the 96 remote lines to one of the four remote inputs represented on the relay selector strips. Other controls on the unit are the buttons in the lower left of the turret which allow for reversing the telephone company repeaters on the Mutual line toward the East and on the Don Lee North and South networks.

Monitoring of each of the outgoing trunks is provided by the VU meters at the top of the relay selector strips. In addition four separate loudspeaker monitoring circuits are provided which can be connected to any of the incoming or outgoing lines.

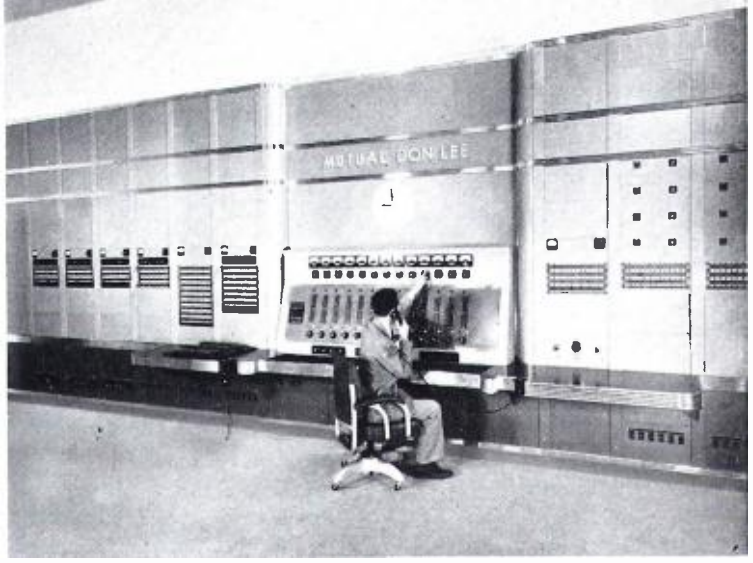
Complex switching operations of all types are readily handled by this system. Such switching problems involve the supply of programs to local KHJ AM and FM, and various Mutual networks. Connections to remote pickup points, substitution of local announcements, and circuit reversals are all a part of the system's functions.

Studio Consoles Designed for Adaptability

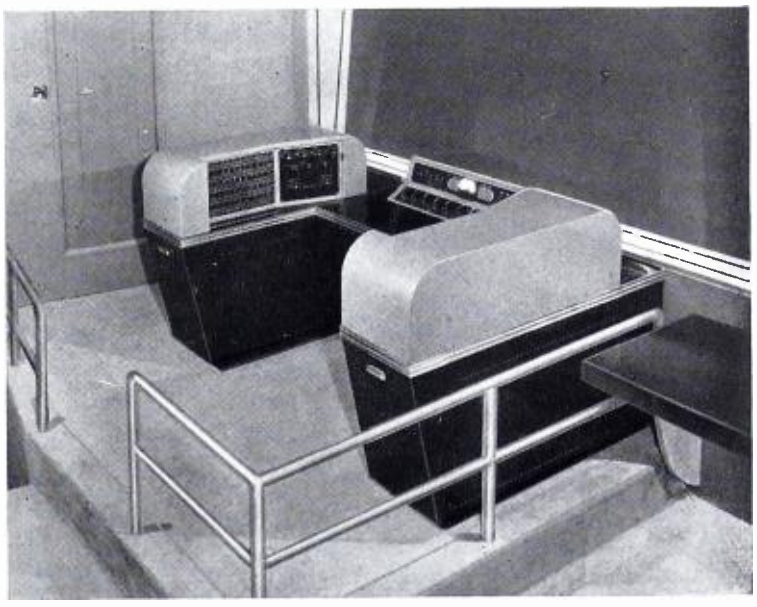
For several years prior to the new building, Don Lee engineers were compiling information relative to a mixing console which would incorporate facilities necessary to the needs of radio production. Many schematics were drawn and revised in an effort to satisfy the ever-changing art. It was desired to have the greatest amount of flexibility, and facilities for fulfilling the demands of all types of programs and yet, in attempting to do this, the mixing console became excessively complicated. Often it has been said that an engineer's job is that of making the best compromise and here a compromise was necessary.

With this in mind, less frequently used special effects equipment was deleted with the idea of housing such equipment in a separate cabinet so that it could be wheeled to the side of any console when the occasion demanded. The desk circuits were treated to gain maximum flexibility through the use of jack bays. The eight channel mixer, operationally speaking, was simplified by keys, which by choice of the technician, split the board into channel groupings controllable by sub-masters. On certain types of

(Continued on page 36)



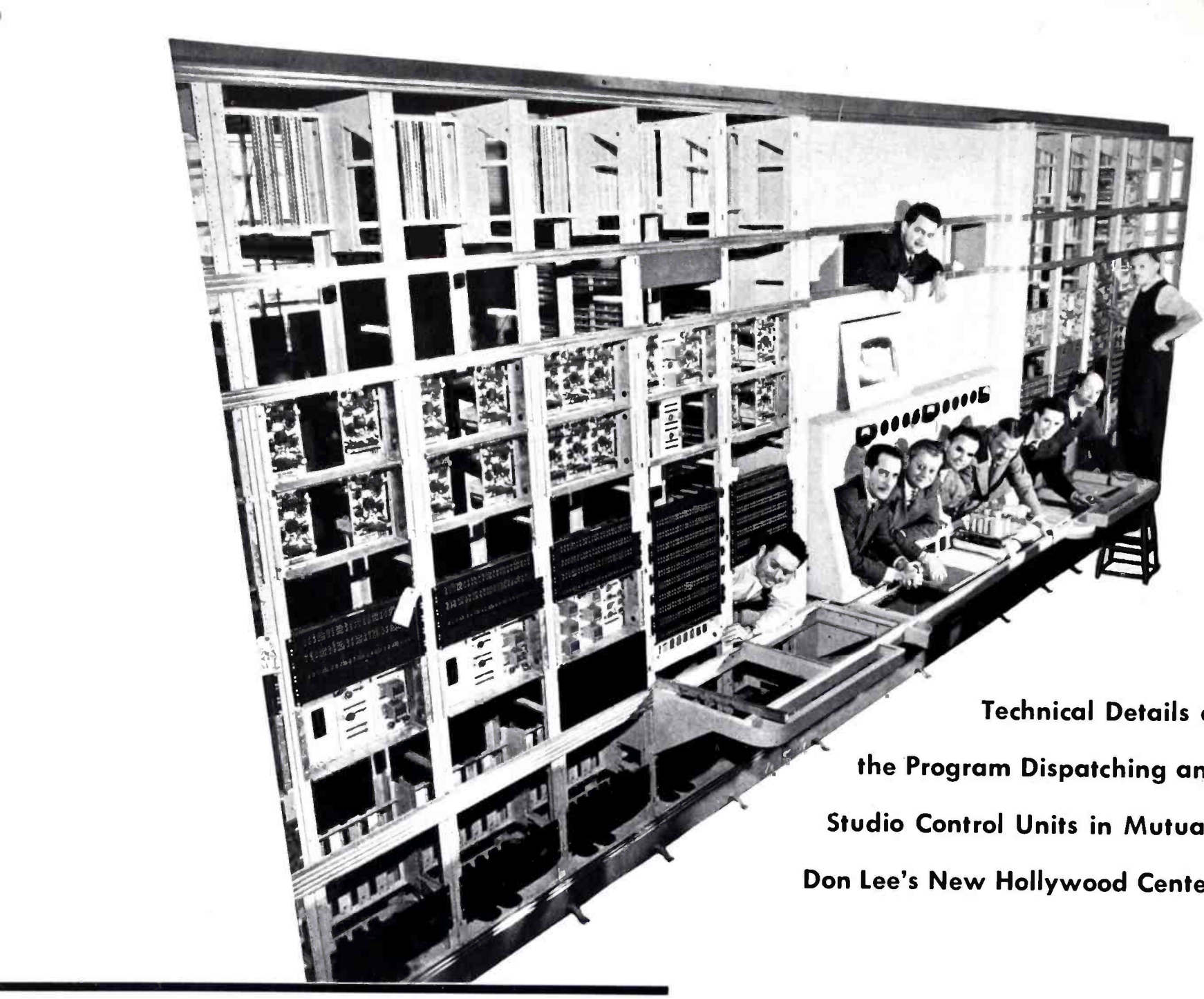
View of the Master Control above shows the operator adjusting signal level on an outgoing line, with VU meter above gain control as guide.



Above, interior of control room for "auditorium" studio, with one of the eight studio type audio consoles custom built for the system.

Studio type transcription cansale, above, controls studio for discussion or commentary program, and allows production of disc-jockey shows.

At right is the announce type transcription console, used for inserting announcements and playing recorded material for program fills.



Technical Details of the Program Dispatching and Studio Control Units in Mutual-Don Lee's New Hollywood Center.

BUILDING THE AUDIO SYSTEM for Mutual-Don Lee

by F. L. Hopper

Electrical Research Products Division, Western Electric Company

THE audio and program control equipment built by Western Electric for Mutual-Don Lee's new Hollywood studios represents one of the most complete systems yet developed for American broadcast installations. A thousand relays, 212 amplifiers, 100,000 soldered connections, and 7,000 jacks are used in a custom built, completely integrated system designed and constructed specifically to meet the Mutual-Don Lee program requirements.

System function, operation and performance characteristics of this equipment were determined by Don Lee engineers after intensive investigation, as outlined in the preceding article, "Mutual-Don Lee's New Hollywood Home." The responsibility of Western Electric audio engineers, in particular those of the Electrical Research Products Division in Hollywood, included component and system design, construction of all mechanical and electrical features, and testing of all units before installation.

Since it is impossible to cover the system completely in limited space, consideration will be given only to the salient features of the master dispatching system and the studio consoles.

The Master Control Unit functions as the "director" of the entire operation. Each incoming network is provided with terminal apparatus, receiving repeater amplifiers, and volume controls having small incremental steps which allow the engineer to compensate for small level differences during the early morning network lineup. Outgoing network circuits are similarly equipped and have volume level indicators for visual monitoring of the outgoing programs, as shown on the photograph on page 6. Major network circuits are equipped with station-controlled reversing circuits. This allows the Master Control operator

to reverse the repeaters on the transcontinental and coastwise loops. Reversals of transmission from "New York to Hollywood" to "Hollywood to New York" require a very few seconds. Similar circuits, except that repeating amplifiers are not in all instances required, are provided for each studio, announce booth and recording channel.

Each of the incoming circuits in the Master Control feeds its individual switching bus which has a normal operating level of +18 dbm and an impedance of 600 ohms. Any or all of the outgoing circuits may be bridged across any switching bus. All switching connections are made with U-type relays which are operated by non-locking keys, to provide the preset dispatching feature of the system. This system allows each connection to be made individually, or in unison with other switching connections by operating a master button as previously described. A section of the 821 relays which are mounted together on the Master Control is shown in the photograph on page 2.

Master Control Monitors All Programs

When two or more programs are being transmitted simultaneously it was difficult with the earlier systems used in some stations for the operator to monitor all of them efficiently. As pointed out in the preceding article, the Master Control in the present system is often required to handle several programs simultaneously. This problem was solved by equipping all major circuits with the KS-8218 Volume Indicators, shown on the turret above the center desk section, and providing four monitoring loudspeakers. The keys for connecting the loudspeakers are at the operator's finger tips for rapid and accurate control. In addition, jacks are provided for headphone monitoring when desired.

An elaborate house monitoring system is also included, with circuits to all executive offices, sales offices, rehearsal and audition rooms. At any monitoring point in the building, any program circuit is available by a dialing operation.

In addition there are eight "fixed tune" AM and FM receivers and one each "variable tune" AM and FM receiver which can be dialed. Provision is made for an expected expansion of television activities, for which both audio and video circuits are being installed.

Electrical Characteristics of System

The electrical performance specifications, which follow, were exceeded for the Master Control system.

Signal to Noise:	70 db for normal input levels.
Frequency Response:	± 1 db from 50 to 15,000 cycles.
Distortion:	Maximum of 0.5% at 1000 cycles with an output level 10 db higher than normal.
Crosstalk:	60 db signal-to-crosstalk ratio.

The electrical performance specifications, which follow, were exceeded for the three types of consoles—studio type, studio transcription type, and announce transcription type.

Signal to Noise:	60 db for an input microphone or transcription level of —60 dbm.
Frequency Response:	± 1 db from 50 to 15,000 cycles.
Distortion:	Maximum of 0.5% at 1000 cycles with an output level 10 db higher than normal.
Crosstalk:	60 db signal-to-crosstalk ratio.

Functional Arrangement of Studio Console

The studio type console, designed for use in controlling each of the eight large drama and audience participation studios, where numerous audio facilities are required, is contained in four main physical sections, three in the console and one in a separate power cabinet. The console furniture consists of a center section, each end equipped with a pedestal and turret, as shown in the photograph on the left below. The furniture is of sheet metal construction, finished in an attractive two-tone color which was selected by the customer after consulting with our designers.

Picture at left shows construction of audio console designed for controlling auditorium and dramatic type studios at Mutual-Don Lee.

Above is the studio type transcription console, showing the convenient placement of the transcription tables at operator's right hand.

The center desk section consists of a black cigarette-proof, plastic topped table on which is mounted the mixer turret containing the mixer control elements (potentiometers, keys, volume indicator and talk-back microphone). The mixer section is hinged at the rear and may be opened 90 degrees for complete access to the components and wiring. The left and right hand pedestals contain the low level "plug-in" amplifiers and high level apparatus respectively. The amplifiers are mounted on drawers equipped with plugs which engage with receptacles mounted on the pedestal shelves. This feature permits the amplifiers to be withdrawn for inspection or maintenance. Each turret is arranged for forced air ventilation, when required.

Complete Accessibility to Console Components

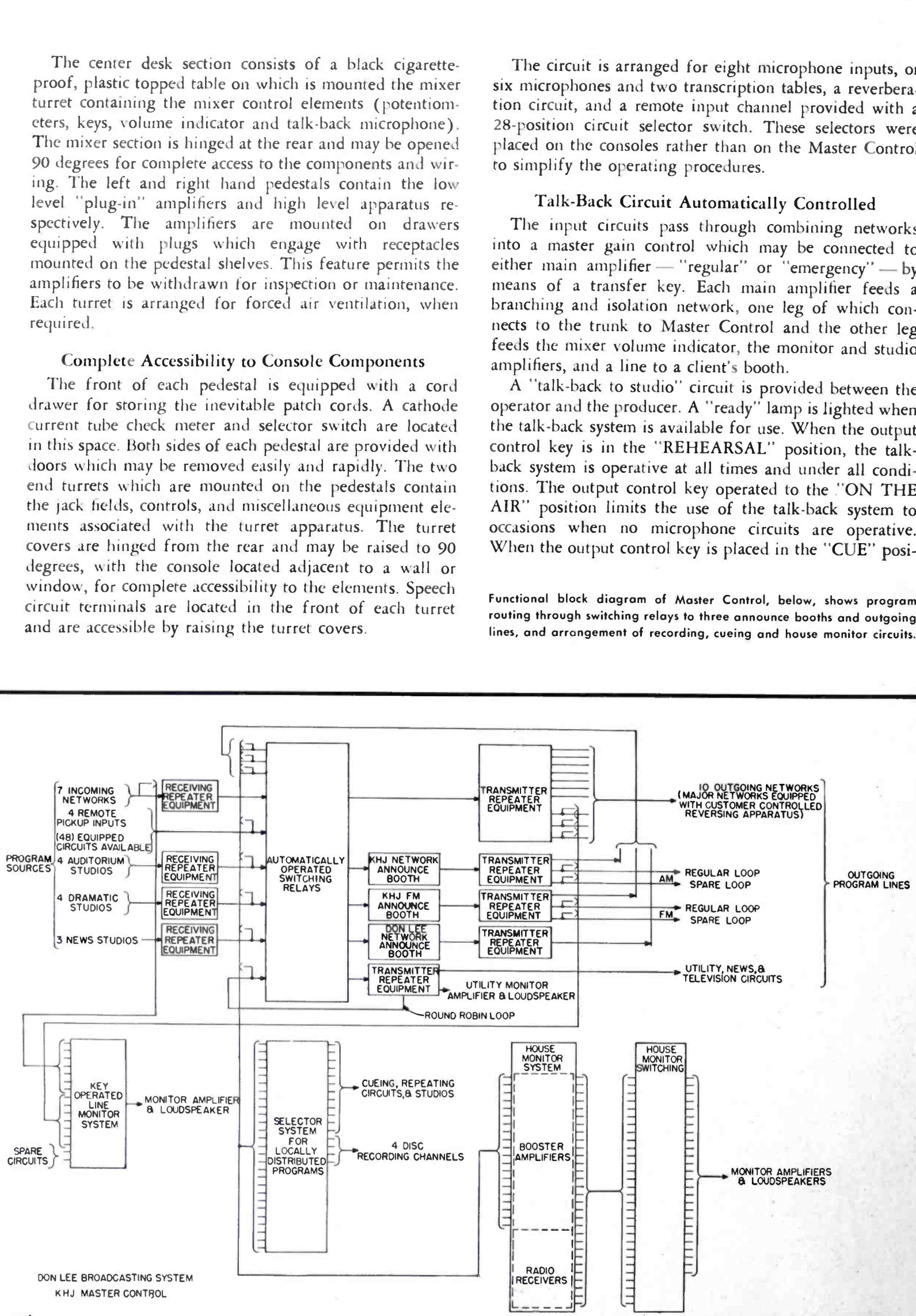
The front of each pedestal is equipped with a cord drawer for storing the inevitable patch cords. A cathode current tube check meter and selector switch are located in this space. Both sides of each pedestal are provided with doors which may be removed easily and rapidly. The two end turrets which are mounted on the pedestals contain the jack fields, controls, and miscellaneous equipment elements associated with the turret apparatus. The turret covers are hinged from the rear and may be raised to 90 degrees, with the console located adjacent to a wall or window, for complete accessibility to the elements. Speech circuit terminals are located in the front of each turret and are accessible by raising the turret covers.

The circuit is arranged for eight microphone inputs, or six microphones and two transcription tables, a reverberation circuit, and a remote input channel provided with a 28-position circuit selector switch. These selectors were placed on the consoles rather than on the Master Control to simplify the operating procedures.

Talk-Back Circuit Automatically Controlled

The input circuits pass through combining networks into a master gain control which may be connected to either main amplifier — "regular" or "emergency" — by means of a transfer key. Each main amplifier feeds a branching and isolation network, one leg of which connects to the trunk to Master Control and the other leg feeds the mixer volume indicator, the monitor and studio amplifiers, and a line to a client's booth.

A "talk-back to studio" circuit is provided between the operator and the producer. A "ready" lamp is lighted when the talk-back system is available for use. When the output control key is in the "REHEARSAL" position, the talk-back system is operative at all times and under all conditions. The output control key operated to the "ON THE AIR" position limits the use of the talk-back system to occasions when no microphone circuits are operative. When the output control key is placed in the "CUE" posi-



DON LEE BROADCASTING SYSTEM
KHJ MASTER CONTROL

Functional block diagram of Master Control, below, shows program routing through switching relays to three announce booths and outgoing lines, and arrangement of recording, cueing and house monitor circuits.

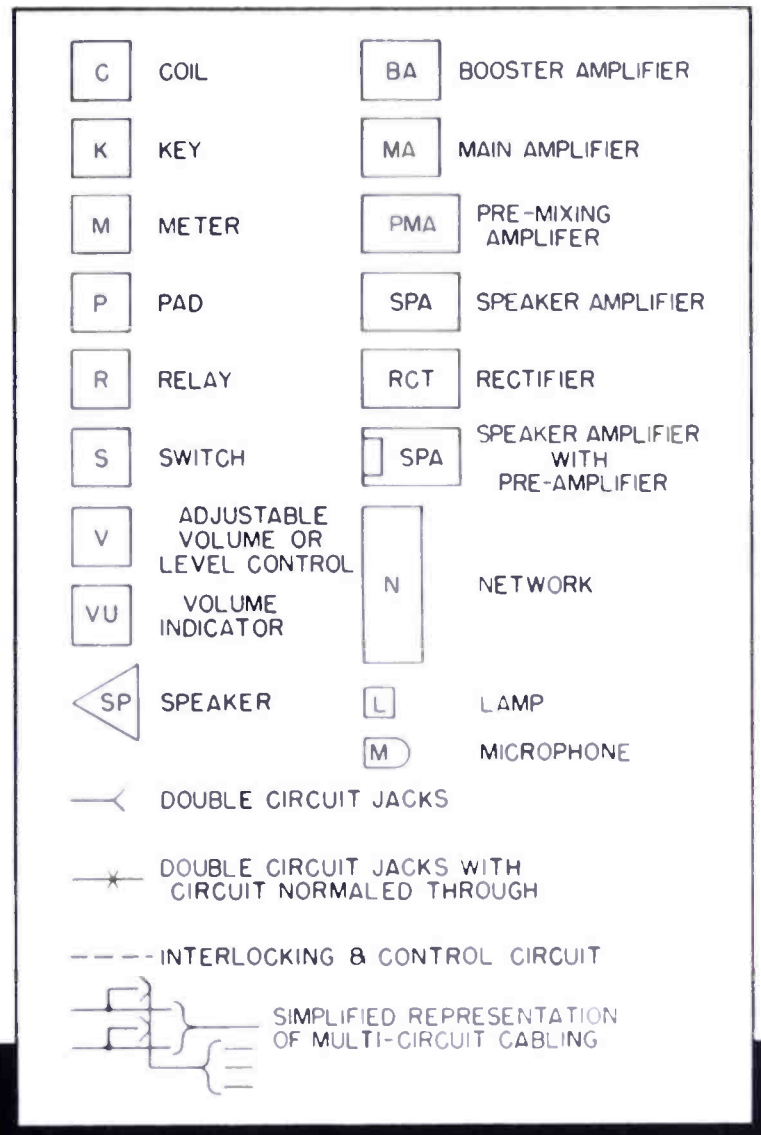
tion, the talk-back system is not available, and programs may be transmitted by means of the remote inputs only, which may be used for cueing purposes. Further, in the "CUE" position, both the monitor and studio speakers are on the cue program bus.

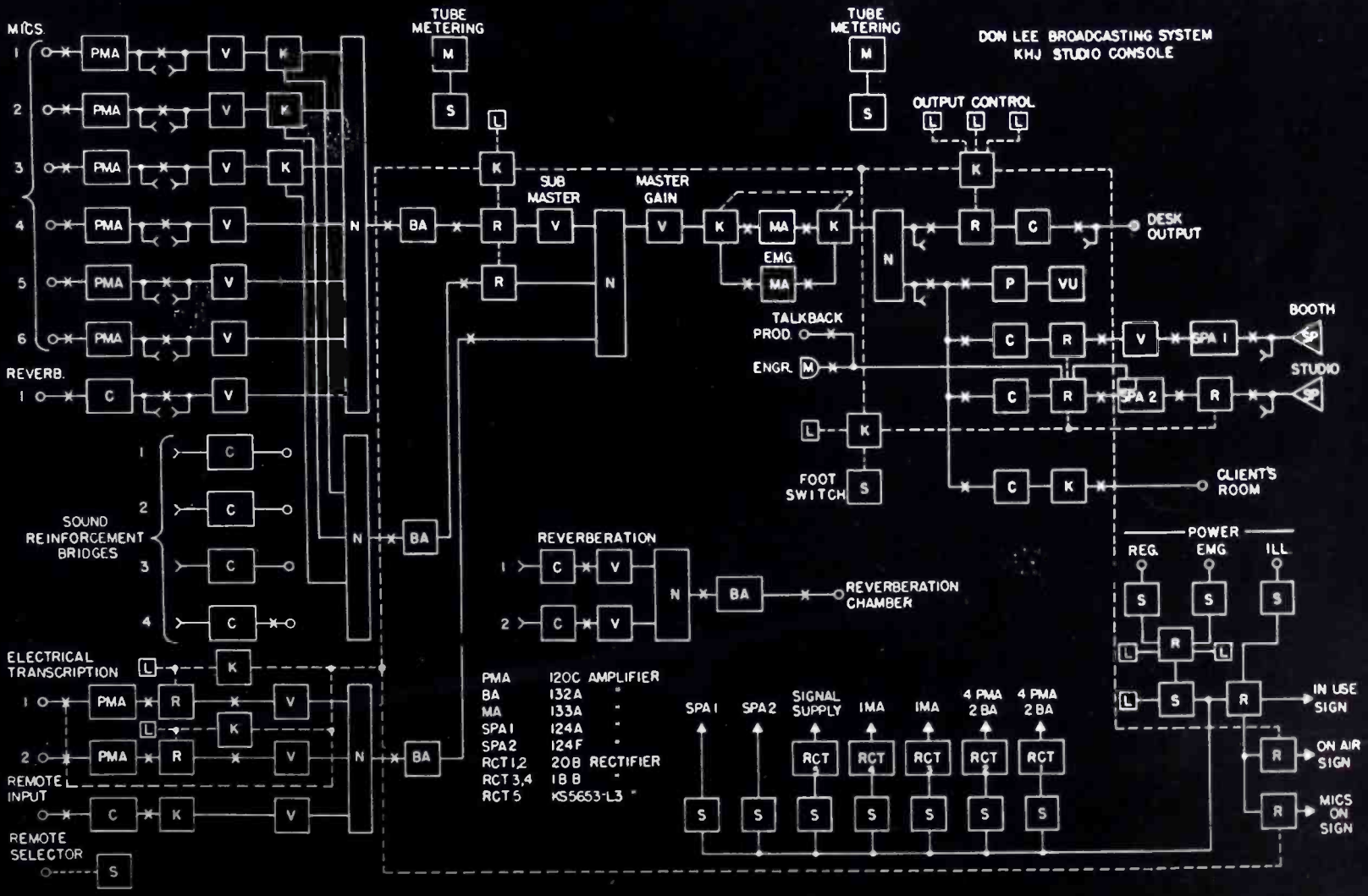
Connections Included for External Echo Chamber

Either or both electrical transcription circuits may be used for microphone circuits by patching, which sets up connections automatically in the talk-back interlock circuit to prevent feedback. Microphone circuits 1, 2 and 3 can be connected to bypass the sub-master gain control by means of switching individual transfer keys as required. A two-channel reverberation mixer, for connecting an external reverberation chamber to the equipment, is included. The two bridging circuits may be patched to multiple jacks at the pre-mixing outputs or to any circuit on which an echo is desired, providing a means of connecting in and adjusting the amount of echo. The console is equipped with sound effects filters, utility keys, matching coils, jack multiples, etc.

An auxiliary equipment cabinet arranged for flush wall mounting contains all of the rectifiers, which are arranged with plug-in facilities, similar to the plug-in amplifiers previously described. A main power switch and magnetic

Console used to control the larger studios has functional arrangement of block diagram below. As shown, microphones can be split into two groups, electrical transcription inputs have separate booster amplifier.





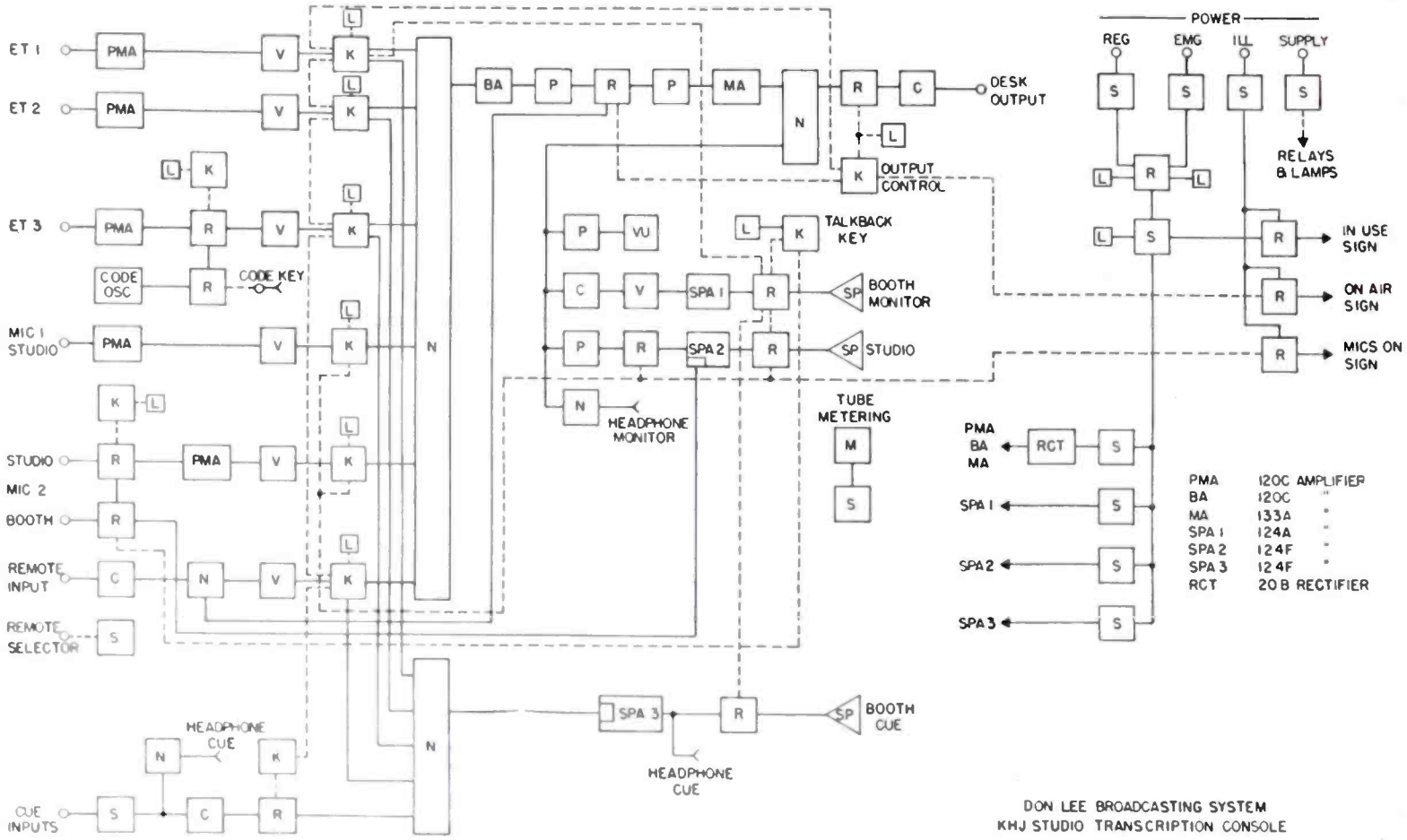


Diagram above is studio type transcription console. Three transcription inputs, two microphone inputs, and a remote selector feed one mixer network, with a second network provided for cueing circuits.

circuit breakers for the individual circuits are provided. Transfer relays switch automatically from any "regular" power circuit to an associated "emergency" power circuit in case of failure. Signal lamps located at the top of the cabinet indicate the circuits that are in use.

"IN USE", "MICS ON", and the "ON THE AIR" studio sign relays are mounted in the power cabinet and are operated by the control circuits within the console.

Circuit Design of Studio Transcription Console

The studio type transcription console, as shown in the photograph on page 13, has the right part arranged for mounting two turntables, in a convenient location for one-man operation. Below the turntables, behind an access door, are mounted relay, network coil, terminal strip, and the code oscillator elements. The mixer on the center section is similar to that used on the studio console, and contains the control, key and V. I. elements. The left end of the table top is supported by a narrow pedestal. Plug-in amplifiers and the tube metering apparatus are contained in a compartment located directly beneath the mixer and table top.

The functional line-up includes three electrical transcription inputs, two microphone circuits and one remote input. The built-in code oscillator may be "keyed in" to transcription input number 3 for use during news broadcasts. Microphone circuit number 2 may be used for either a second studio microphone or for a booth announce microphone. All of the above circuits, with their associated pre-mixing amplifiers, mixing controls and keys, are combined and fed to a booster amplifier, a main amplifier and to a branching network. One branch feeds the trunk to Master Control through an output control relay and isolation coil. The other network branch feeds the volume indicator, the monitor amplifier, and studio amplifier circuits.

Network Cue Circuits on Transcription Console

Keys are provided in each of the three electrical transcription and remote input circuits and have "ON", "OFF", and "CUE" positions. By operating the keys to the "CUE" position the three electrical transcription and remote circuits together with a network cue circuit having a choice of six inputs are fed to a combining network, speaker amplifier and the cue speaker. The circuit is arranged for talk-back operation by using the announce microphone. The talk-back circuit is interlocked with the output control key in a manner similar to the studio console arrangement already described. All circuits are arranged for optional headphone monitoring.

A power cabinet, similar to the type used with the studio

consoles, is provided with each transcription console and contains essentially the same variety of power apparatus. However, the speaker amplifiers are included in the power cabinets, rather than in the console itself, as the two transcription tables occupy the right pedestal, and a smaller number of rectifiers, etc., are required in the power cabinet.

Components in Announce Transcription Console

The metal furniture used for the announce type transcription consoles is identical to that used for the studio type transcription console just described. The announce type desk has two electrical transcription inputs, an announce microphone input, and a remote or network input. No talk-back system with output control circuits is provided. Interlock circuits are employed to disable the monitor and cue speakers when the microphone keys are on. The electrical transcription and remote input circuits are equipped with "ON", "OFF", and "CUE" keys. These circuits together with a network cue circuit may be switched to a cue amplifier and speaker. The circuit also provides headphone monitoring. Signal lamps indicate that program circuits are connected to the channels. The announce microphone gain control is located below the mixer to prevent unauthorized adjustment.

A power cabinet, of the kind used with the studio type transcription consoles, is used with each announce type console and contains the same general type of power apparatus and speaker amplifiers.

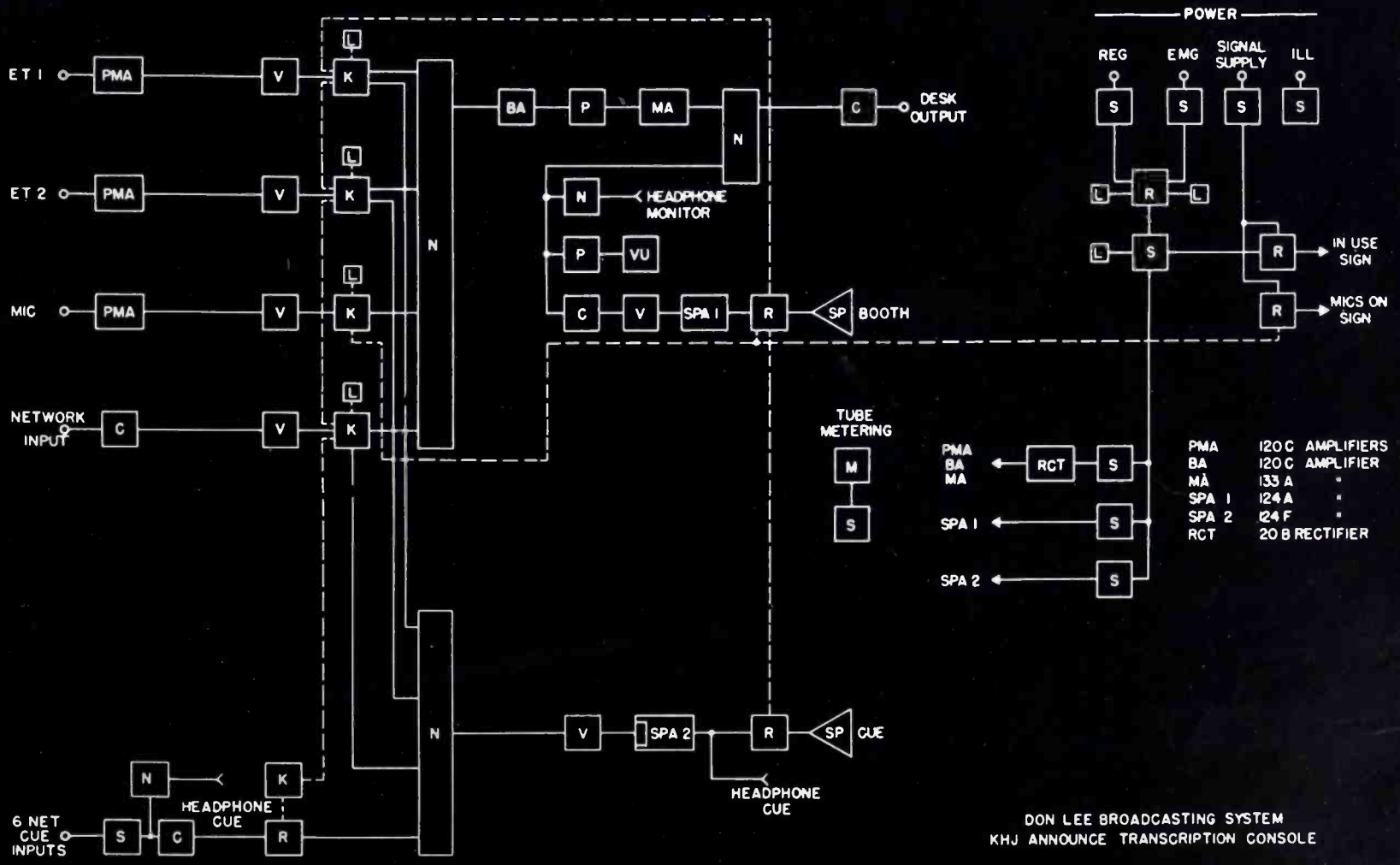
All consoles, Master Control center section, and the cabinet bays of apparatus were individually tested to meet electrical specifications and were checked for power operation. Installation was materially expedited, since all equipment components were delivered to the customer as tested operating units, together with suitable drawing information.

Custom Building for Efficiency in Manufacture

In the design and manufacture of custom built equipment such as that for Mutual-Don Lee, many unique problems arise which require a flexibly organized engineering group. The interval of delivery requested is normally so short that complete manufacturing information cannot be prepared before manufacturing starts. It is, therefore, necessary that the engineers not only have a complete understanding of the design and manufacturing processes, but they must also be intimately familiar with the station's operating practices.

This kind of knowledge and experience applied to the particular problems of any broadcast installation produce the most efficient and from an over-all point of view, the most economical facilities for any application, no matter how complex. Due credit should go to the many Don Lee and Western Electric engineers who participated in the cooperative effort required to complete this project.

Diagram below is announce type transcription console, with two transcription circuits, microphone, and network input, headphone and loudspeaker monitoring, and six net cue inputs to guide booth announcer.



This is the first article in a series to appear in the *Oscillator* devoted to various phases of maintenance and operation of low and medium power broadcast transmitters.

Rx for long transmitter life

Some basic rules and procedures for the care and treatment of 250 watt and 1 kw broadcast transmitters

THIS story is aimed at you, the engineering operator of a 250 watt or 1 kw broadcast transmitter. You are a man of real importance, because the smooth functioning of a broadcasting business depends to a great extent on how well you and that transmitter entrusted to your care get along with each other. This means the faithful application of a few simple rules of maintenance that are indispensable to the technical well-being of a broadcast installation.

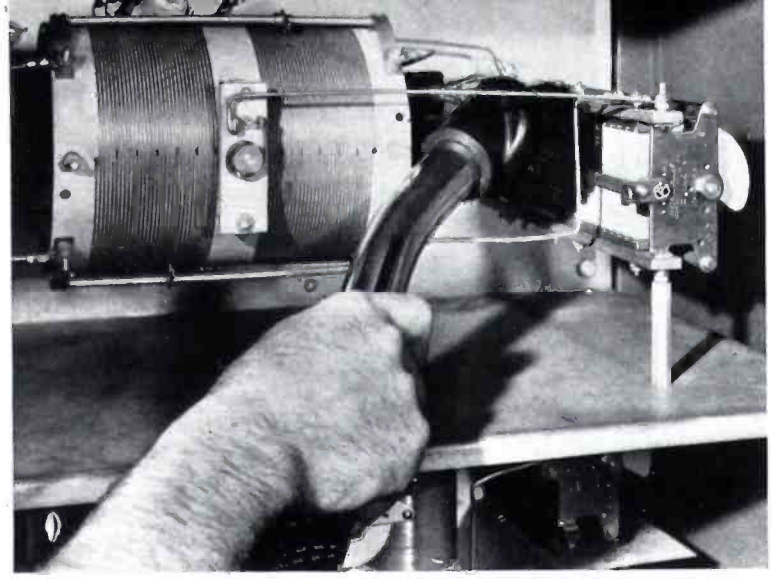
Proper maintenance is not something "extra" that you as the transmitter engineer can throw in for good measure. It is *required* to prevent deterioration of equipment which may lead sooner or later to unnecessary and costly repairs or replacements, lost air time, and last, but most important to you, the more than likely cooling of the management's affection for the engineering staff. A well-designed modern transmitter has built into it considerable "plus value" in the form of extra stamina and ability to survive definite amounts of harsh treatment. But it is fundamentally a complex, delicate piece of machinery, and over the long run, *any* transmitter, if neglected or abused, will surely bring trouble for you and the station management.

Good Maintenance Demands Good Tools

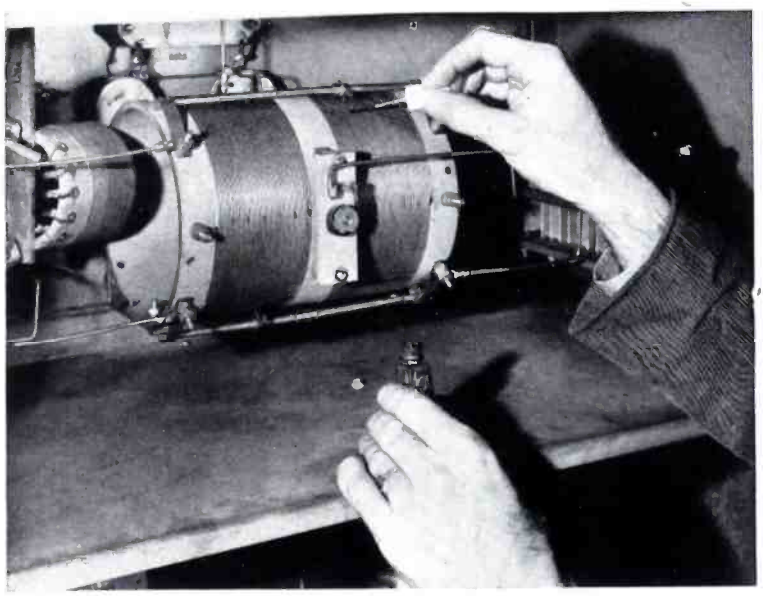
The first requirement for proper maintenance is possession of the tools necessary to do the job. Following is a list of the test equipment, spares and tools that should be on hand to allow efficient maintenance of the smaller broadcast transmitters. It does not include all the equipment that might be useful. It does include those tools that on the average can be expected to pay for themselves by saving repairs, replacements, lost air time, managerial and engineering agony, and gradual deterioration of the station's technical quality. Following the list of tools and equipment, the uses to which they should be put will be discussed, together with the simple, basic requirements of maintenance for any low power broadcast transmitter. In buying any of these tools, it pays to get equipment of the best quality. Here is the list:

A. Test Equipment
   1. A volt-ohm-milliammeter, 20,000 ohms per volt. (Yes, there *are* stations without one.)
   2. A standard three-inch—or larger—oscilloscope.
   3. An audio oscillator with good waveform.
   4. A dummy antenna, that is, a non-reactive load of a value equal to the transmission line input impedance, capable of dissipating the modulated output of the transmitter, at least for short periods.
   5. A mutual-conductance type tube checker—this is optional but will greatly facilitate maintenance.
   6. A multi-range VU meter for checking audio levels.

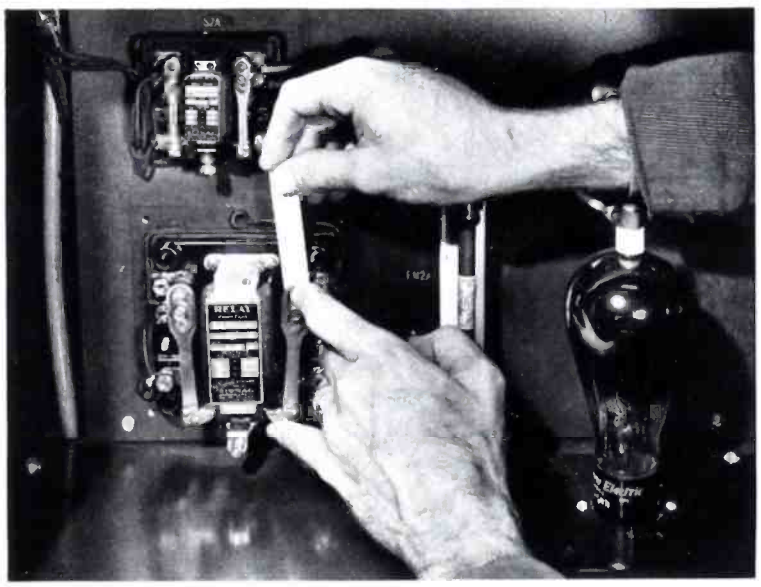
B. Supplies
   1. A complete set of spare tubes, one for each socket, is recommended—rather than the minimum set allowed by F.C.C. rules.
   2. An assortment of ½ watt, 1 watt and 2 watt carbon resistors, 50 ohms to 1 megohm.
   3. An assortment of small mica and paper condensers, .0001 to .01 mfd.
   4. A bottle of red fingernail polish (This will be explained later.)
   5. Spools of 1/16" and ⅛" rosin core solder.
   6. Insulating tape.
   7. Flexible hook-up wire with high-voltage insulation.
   8. A quantity of bus-bar wire.



A tank type vacuum cleaner and the soft brush attachment used for furniture is an efficient way to remove dust and dirt from a transmitter.



Fingernail polish, applied to taps on open coils, panel dials, etc. is insurance against accidentally losing the proper control settings.



A fingernail board can be used to remove oxidation from relay contacts. For telephone-type relays, use the special burnishing tool recommended.

An important maintenance "tool" is familiarity with test point voltages established for normal operation, as read on built-in panel multimeter.

9. In addition, all spares and supplies not included in the above, which are recommended by the transmitter manufacturer.

C. Tools

1. A tank type vacuum cleaner with flexible "sucker" attachment.
2. A set of small ratchet wrenches, $\frac{3}{16}$" to $\frac{5}{8}$".
3. Set of hex wrenches, $\frac{1}{4}$" to $\frac{5}{8}$".
4. A pair of long nosed pliers.
5. A pair of good 6" diagonal cutters.
6. At least 3 screwdrivers—6" x $\frac{1}{8}$", 6" x $\frac{1}{4}$", and 6" or 8" x $\frac{5}{8}$".
7. A 100-watt soldering iron—the best quality you can get.
8. A set of "Allen" wrenches.
9. A trouble light with 20-foot extension cord and insulated guard.
10. A 20-foot extension cord with multiple outlet.
11. A pen light.
12. A standard flashlight.
13. A fingernail filing board.
14. A small file or burnishing tool of the type designed for cleaning relay points.
15. Puller for indicator lamps.
16. Adjustment tools for jacks, plugs, relays.
17. Small dental-type mirror for inspecting relays.
18. In addition, the tools not included in the above, which are recommended in the Instruction Book issued by the manufacturer of your transmitter.

As already stated, the above list of tools and equipment is the *minimum* for the pay-off level in dollars and cents. Additional tools can be added to make the operator more efficient, to make his job easier and more convenient and to make sure of keeping the transmitting equipment at the very peak of its operating condition.

Dirt—Transmitter Enemy No. 1

The vacuum cleaner is placed first on the list of tools for a reason. Control of dirt is by far the most important single factor in keeping a transmitter in trouble-free operation. Different makes and models of transmitters differ in their arrangements for minimizing the entry of dirt into the equipment, and different locations have widely varying amounts of material in the air. However, on the average, the operator should *once a week* remove the dirt from every part of the transmitter interior with the vacuum cleaner, being sure that all of the dirt is sucked into the cleaner bag, and not just blown away to some other location. At the same time, if the transmitter uses a filter on the input to the air cooling system, this filter should be washed thoroughly, in accordance with the instructions accompanying the transmitter, then immediately replaced, for it is very easy to forget to replace filters after washing.

In rural locations where the air is unusually clean, or in installations which have very close control of the air for

the whole transmitter building, transmitter cleaning can be done less often. On the other hand, in certain of our cities—no names need be mentioned—the operator of a broadcast transmitter has a continuous cleaning headache because of "smog," that oily, smoky, man-made dirt storm. With a serious smog to contend with, complete air conditioning for the transmitter building will often prove to be economical, not only in preventing transmitter deterioration but in promoting operator efficiency and comfort.

After regular cleaning, the next most valuable maintenance habit is a parts inspection, *made about twice a week,* immediately after the transmitter is shut down. All parts such as transformers and chokes, by-pass condensers, small resistors not intended to dissipate appreciable power, etc., should be felt for abnormal temperatures. This will involve a good knowledge of the *normal* operating temperatures of the various parts in the particular transmitter, as obviously certain parts in any transmitter, such as heavy chokes carrying large amounts of current, and resistors dissipating more than a few watts, are *designed* to run at various levels above room temperature. If a mica or paper by-pass con-

Bolted joints carrying current in transmitter must be kept tight to avoid vicious circle of resistance, heat, oxidation — more resistance.

denser or 1 watt resistor is too hot to touch after the transmitter is shut down, a failure of some kind has occurred or is on the way. An immediate investigation is in order. *Don't short-cut safety rules and precautions during this inspection.*

During the temperature inspection, all relays and contactors can be examined for pitting of contacts, and excessive deterioration found should be removed with the fingernail board, or in the case of telephone-type relays, with the special thin file or burnishing tool designed for this purpose, to the extent recommended by the manufacturer. Wholesale filing of relay points to remove slight discoloration or irregularities, if the relay is operating properly, is *not* recommended.

You should study the manufacturer's maintenance instructions for blowers, circuit-breakers, and other auxiliary apparatus, as well as for the various types of relays.

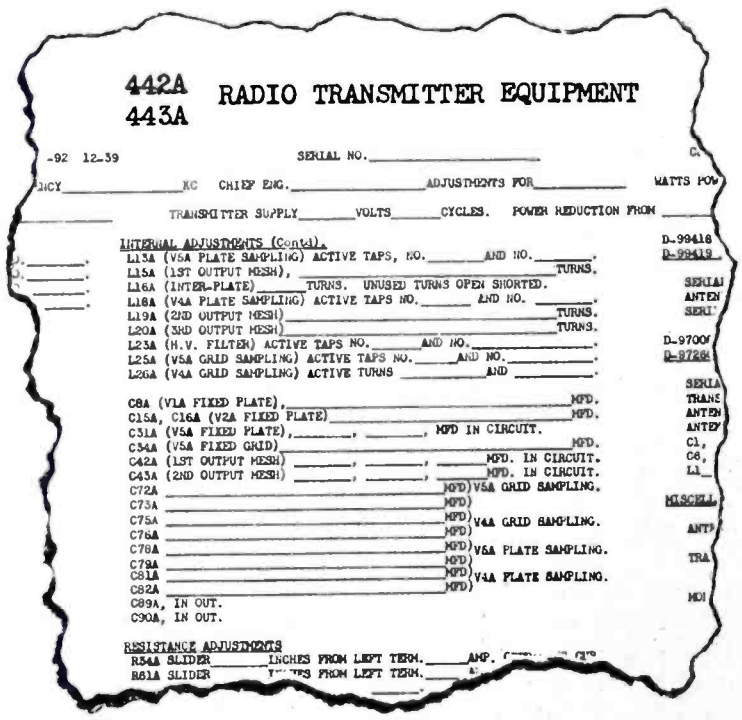
A special case of abnormal temperature is that arising when a bolted junction carrying large current becomes loose, and dirt gets in the joint. The high resistance develops heat, causing oxidation across the joint, which increases the resistance, and this vicious circle will go on until the transmitter is inoperative or seriously out of adjustment. To avoid loss of service from such an oxidized joint, *tighten all the bolts on transformers, condensers, terminal strips, etc., and in the frame, periodically.* If a high-resistance joint with considerable oxidation has developed, clean it out thoroughly before retightening. This can be one of the more mysterious causes of transmitter failure, since normal testing procedures can show every part of the transmitter in perfect condition, without indicating a high resistance in some part of the ground circuit, for instance.

If your transmitter has a multimeter on the panel which can be switched across various circuits to read tube currents and voltages, etc., have a schedule of normal readings handy at the operating point, for rapid checking. (See below, on tuning chart and instruction book.) It may be insulting to many engineers to suggest that they ought to learn what the normal test point voltages in their transmitter are, but here again experience has shown that there *are* individuals who make no use of this most valuable guide to normal operation of the transmitter.

"Lost — The Proper Control Settings"

And now we come to that fingernail polish. Every transmitter has a sizeable number of control settings, including panel dials, switches, resistor sliders, taps on open coils, etc., which are determined and set when the transmitter is tuned. Nothing can cause more unnecessary lost service, mysterious and headache-producing "bugs", and post-mortem sense of foolishness, than an inconspicuous control setting which has been accidentally moved from its proper

(Continued on page 41)



442A
443A RADIO TRANSMITTER EQUIPMENT

-92 12-39 SERIAL NO.

ADJUSTMENTS FOR WATTS POW

TRANSMITTER SUPPLY VOLTS CYCLES. POWER REDUCTION FROM

INTERNAL ADJUSTMENTS (Contd).

L15A (V5A PLATE SAMPLING) ACTIVE TAPS, NO. AND NO.
L15A (1ST OUTPUT MESH), TURNS.
L16A (INTER-PLATE) TURNS. UNUSED TURNS OPEN SHORTED.
L18A (V4A PLATE SAMPLING) ACTIVE TAPS NO. AND NO.
L19A (2ND OUTPUT MESH) TURNS.
L20A (3RD OUTPUT MESH) TURNS.
L23A (H.V. FILTER) ACTIVE TAPS NO. AND NO.
L25A (V5A GRID SAMPLING) ACTIVE TAPS NO. AND NO.
L26A (V4A GRID SAMPLING) ACTIVE TURNS AND

C8A (V1A FIXED PLATE), MFD.
C15A, C16A (V2A FIXED PLATE) MFD.
C31A (V5A FIXED PLATE), , MFD IN CIRCUIT.
C34A (V5A FIXED GRID) MFD.
C42A (1ST OUTPUT MESH) , , MFD. IN CIRCUIT.
C43A (2ND OUTPUT MESH) , , MFD. IN CIRCUIT.
C72A MFD) V5A GRID SAMPLING.
C73A MFD)
C75A MFD) V4A GRID SAMPLING.
C76A MFD)
C78A MFD) V5A PLATE SAMPLING.
C79A MFD)
C81A MFD) V4A PLATE SAMPLING.
C82A MFD)
C89A, IN OUT.
C90A, IN OUT.

RESISTANCE ADJUSTMENTS
R54A SLIDER INCHES FROM LEFT TERM.
R61A SLIDER

D-99416
D-99419
SERIAL
ANTEN
SERI
D-9700
D-9726
SERIA
TRANS
ANTEN
ANTEN
C1,
C6,
L1
MISCELL
ANTE
TRA
MOI

Control settings established in final tuning are shown in detail on tuning chart. Above, portion of chart furnished with W.E. 442A and 443A.

Radio City for Rochester

WHAM and WHFM Have a New Home with Floating Studios and Centralized Audio System

IT'S an ultra-modern Radio City—this new $1,000,000 studio and office building that WHAM and WHFM, Rochester, New York, opened to the public on February 14th. The sweeping curved front with its continuous band of windows symbolizes the care, expert planning and engineering imagination that went into the design and construction of this program center for the Stromberg-Carlson stations—WHAM with 50,000 watts on AM, and WHFM with 1,000 watts on FM. Studio equipment for every type of program, and a novel "centralized" audio system custom built by Western Electric are features of the new building.

The building itself is 230 feet across the front and 180 feet deep, and is supported by 158 column foundations which go down to bedrock. Unusual technique used to isolate the building acoustically from the ground consists of a two-inch layer of felt wrapped around each column, with a rubberized paper coating and a four-inch concrete facing over it. The felt wrapping extends from rock level to the top of each column.

In addition the whole studio section floats separately from the main structure of the building, with isolation provided by heavy pads of felt which form the only connection from studios to building.

Production of programs for WHAM, WHFM, and whenever needed, for the NBC network, is provided for in a large auditorium studio and five additional smaller studios. The auditorium studio has seats for approximately 400 people and a stage 44 by 40 feet in size. Of the five additional studios, three are approximately 35 by 20 feet, and two are approximately 15 by 15 feet.

The auditorium studio and one of the intermediate studios are provided with separate control rooms. Each of two additional control rooms serves two studios, allowing for flexibility and efficiency in the handling of programs that follow each other at short intervals, or in the case of cut-in, news flashes, or guest speaker announcements on musical programs. In addition to the six studios described, a room approximately 45 by 55 feet is proposed in the west wing of the building which will be used as a television studio when the station's plans in this field have matured.

An elaborate air conditioning system serves the entire building. The air is cleaned by filters and by an electrostatic precipitator and the temperature and humidity are closely controlled to optimum conditions, winter and summer. An emergency power plant is installed, with a gasoline-engine driven generator which takes over automatically in case of power failure.

Central Room for Amplifier Equipment

The control room consoles contain only the gain controls, preamplifiers, program switching and monitoring, cueing, and talk-back switching equipment. The main, monitor, and line amplifiers are located in a central apparatus room. By separating the "operating position" equipment from the other apparatus, smaller, more compact consoles are possible without reduction in facilities provided. Eight microphone inputs, two electrical transcription inputs, and four remote inputs are provided on each console. The two audio lines, one regular and one spare, feed from the console to the central apparatus room.

In the central room all of the main, monitor, and line amplifiers, including a complement of spares, are mounted together in open racks, as shown in the photograph on page 41. There are six outgoing trunks—WHAM, WHFM, NBC network, an audition line, recording line, and a spare.

(Continued on page 41)

THESE MEN SERVE

RADIO DIVISION **Western Electric**

F. R. Lack
Vice President
and Manager

S. P. Taylor
Manager
Distributor Sales

A.B.Kouwenhoven
Administrative
Assistant
Distributor Sales

H. D. Wilson
Manager
Electronic
Products Sales

J. H. Ganzenhuber
Manager
Broadcast Sales

L. C. Tyack
Field
Engineering

L. F. Bockoven
Broadcast Sales
Engineer

C. E. Snow
Sales Engineer
Eastern District
Application
Engineering

D. S. Frankel
Sales Engineer
Central Area

M. H. Brown
Sales Engineer
Western Area

R. H. Lindsay
Staff Engineer

R. S. Barbaras
F M Transmitters

C. W. Corbett
A M
Transmitters

H. L. Hamilton
Sales Engineer
Electron Tubes

J. E. Tweeddale
Sales Engineer
Electronic
Products

E. N. Poole
Merchandising

J. C. Herbet
Field Engineer

L. C. Mueller
Equipment
Engineer

DISTRIBUTOR SALES ORGANIZATION

J. G. Lawrence
Audio Facilities

H. F. Scarr
Audio Facilities

BROADCASTING

Graybar ELECTRIC COMPANY

HEADQUARTERS, NEW YORK

C. S. Powell
Vice President

J. W. La Marque
Radio Sales Manager

L. H. Whitten
Washington Representative

R. W. Griffiths
Assistant Radio Sales Manager

MANAGERS OF BROADCAST EQUIPMENT SALES

J. P. Lynch
Boston

E. H. Taylor
Chicago

J. R. Thompson
Cincinnati

W. S. Rockwell
Cleveland

C. C. Ross
Dallas

E. Stone
Atlanta

W. C. Winfree
Jacksonville

R. B. Uhrig
Kansas City

R. B. Thompson
Los Angeles

W. G. Pree
Minneapolis

F. J. Stahl
New York

P. L. Gundy
Detroit

F. C. Sweeney
New York

G. I. Jones
Philadelphia

R. F. Grossett
Pittsburgh

E. C. Toms
Richmond

J. P. Lenkerd
St. Louis

B. R. Cole
San Francisco

D. Craig
Seattle

Ben Strouse,
Vice-President and General Manager,
WWDC and WWDC-FM.

How to boost FM . . . or How WWDC-FM Gave Its New 10 KW FM Transmitter A Big Send-Off

Norman Reed, Program Director, WWDC and WWDC-FM.

Helen K. Mobberly, National Sales Manager,
who directed successful mystery contest for WWDC-FM.

Ross H. Beville, Chief Engineer of WWDC and WWDC-FM.

CHIEF ENGINEER ROSS BEVILLE started it early in December 1947, when he announced to Manager Ben Strouse that WWDC-FM would be on the air with full rated effective power of 20 kilowatts within a month—the first FM station in Washington, D. C. to reach full authorized power. The Western Electric 506B-2 10 kw FM transmitter had been delivered. Installation, including erection of the new 350-foot tower to carry the six-bay Clover-Leaf antenna, was under way. WWDC-FM was about to reach the goal that the management and every member of the staff had looked forward to for several years: the wideawake Washington independent, on 250 watts AM since 1941, would have the high-quality day-and-night coverage of the entire Washington metropolitan area that the 20 kilowatts of frequency-modulated r-f would bring.

It was then that the now famous "Mr. FM" contest was born. It was evident that an outstanding promotion of the FM operation was desirable to enlighten the public on the advantages of FM, promote the sale of FM receivers in the Washington area, and alert the listening public to availability of WWDC-FM's full-grown FM service. With interest in the just completed "Miss Hush" network contest at its height, Helen Mobberly, National Sales Manager, with the assistance of Norman Reed, Program Director, and their staffs, worked out Washington's and FM's own "mystery person" quiz.

A $5,500 Gift From "Mr. FM"

Special recordings were made of the voice of a person who was presumably well known to the radio audience—in this case Peter Donald, star of a transcribed program regularly presented by WWDC and WWDC-FM. Over a period of three weeks, excerpts from the recordings were played several times each day, and WWDC announcers read a series of clues to his identity. The winner of the contest had to give Mr. FM his proper name and write

twenty-five words or less on "Why I think Mr. FM is....." $5,500 worth of prizes for the winner were donated by Washington merchants, including a $3,000 Frazer automobile. Newspaper advertising, displays of the prizes in windows of the donors, placards and streamers at the dealers selling FM receivers, all drew attention to the contest.

Contest Draws 25,000 Washingtonians

The flood of contestants nearly carried WWDC away from its moorings. Over 25,000 people in the Washington district sent in entries. On the final night a gala presentation program was held in Washington's Hotel Statler with all the prizes on view, a company of notables and leading radio entertainers on hand, and the winner still unknown to the public. The big drama of the affair came when a remote crew knocked on the winner's door, made the announcement to him and the radio audience, and then whisked him and his family to the Statler to take over the prizes.

The station generated a most satisfying volume of interest in itself and in FM with this stunt. Not only was there the wholesale participation in the contest in Washington, with excellent coverage in the local papers, but its planning and execution were enthusiastically noted throughout the industry.

WWDC went on the air May 3rd, 1941, with a Western Electric 250 watt AM transmitter, and a second 250 watt transmitter, seven miles from the first one, as a "satellite" to boost the station's coverage.

From its opening, WWDC has been a strong champion of FM, actively planning for the day when it would have an FM signal as a companion to the AM signal. With the interruption of the war, it was April 9, 1947, before WWDC-FM officially took to the air, with a 1 kw Western Electric 503B-2 transmitter. Now with WWDC-FM so effectively launched on its career, as one of the first independent local stations in the country to reach full authorized power on FM, Ben Strouse, Vice President and General Manager, is assured that his station has its proper place in the community.

Mr. Strouse became professionally involved with broadcasting at an early age. As a high school student in Baltimore, he wrote a radio column for the *Baltimore Post* for $5.00 a week. This experience must have had a decisive effect, because in 1941 he left his 13-year career in merchandising and advertising in Baltimore and Washington to join the staff of WWDC. He became Manager in 1944. The station is owned and operated by the Capital Broadcasting Company, of which Joseph Katz, a Baltimore advertising man, is President.

Norman Reed, Program Director, started in radio as an announcer for WPG in Atlantic City in 1928, succeeding Norman Brokenshire. He was General Manager of the ocean-side station from 1935 to 1939. He came to WWDC as Program Director on its opening in 1941. Consistently, he has planned his programming to develop the widest possible appeal for listeners in metropolitan Washington and the surrounding communities. Special emphasis is put on a comprehensive coverage of local news and local public interest features. With the multifarious activities of the National Government at hand, there is an abundance of events, such as the meetings of the many Congressional Committees, which rank high in listener interest.

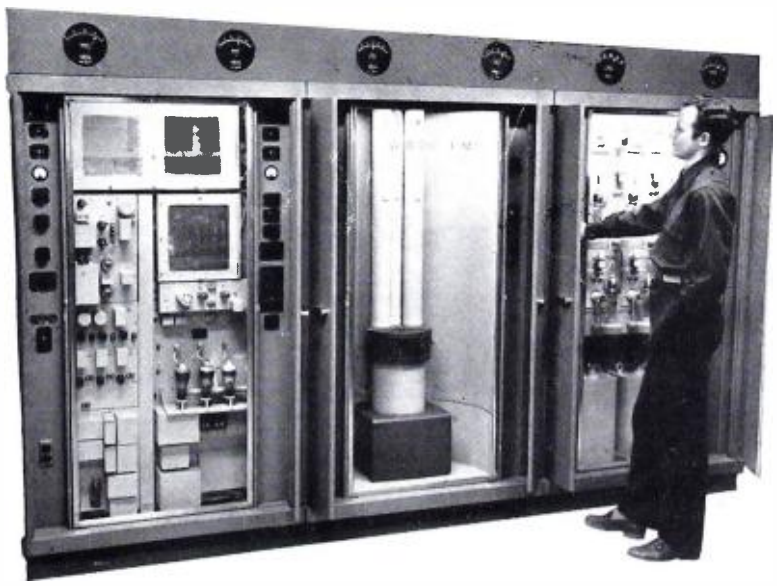
Programs in the Public Interest

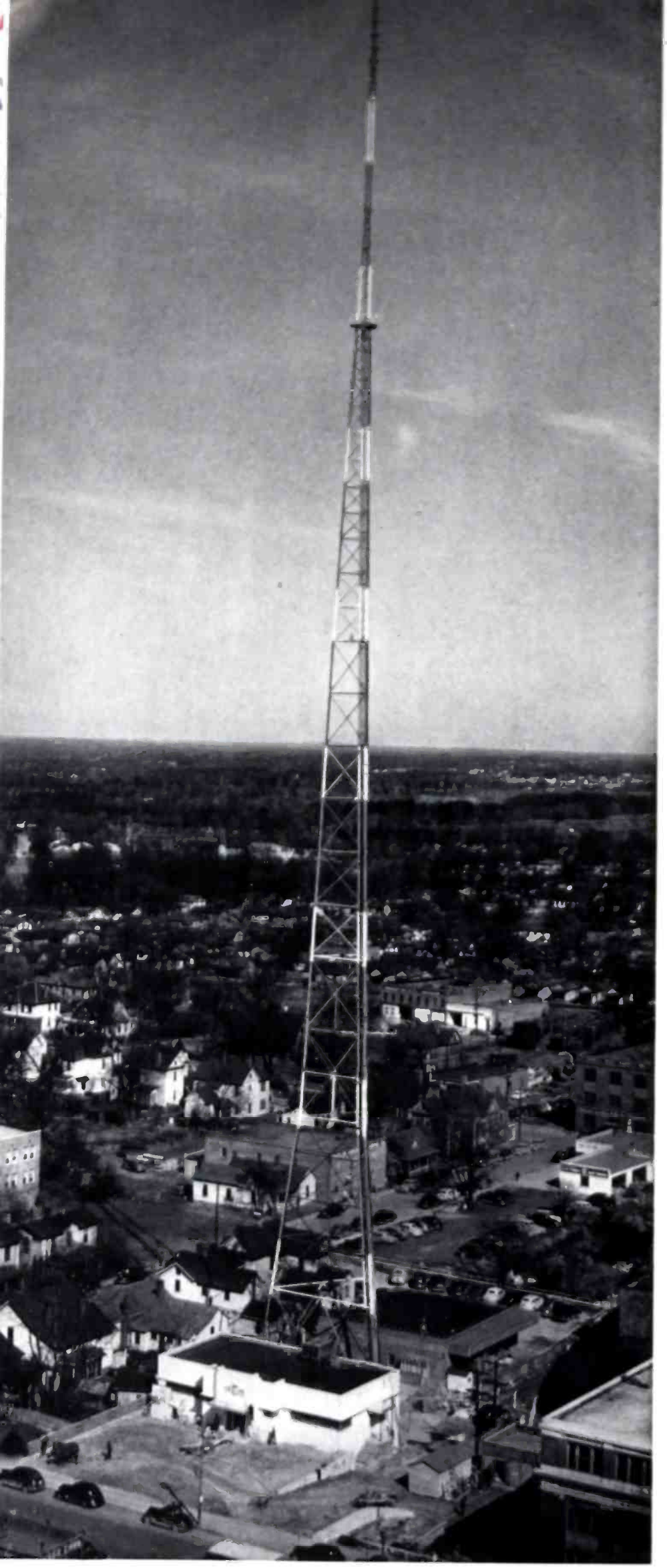
Definite sections of air time are set aside for public service broadcasting: these hours are never sold. Among the important public interest programs developed by the station: "United We Stand", devoted to improving religious and racial understanding; "Your Government and Mine", featuring interviews with prominent officials, which is of special interest to government employees; "Scholastic Sports Association", promoting high school sports; "Death

(Continued on page 40)

Control room at WWDC and WWDC-FM has view of two main studios. Transcription equipment in foreground is within easy reach of operator.

New 10 kw transmitter which brings WWDC-FM to full authorized effective power of 20 kw is adjusted by Transmitter Engineer Ken Cox.





wfmy

It's "FM only" for the Greensboro Newspapers' first venture in Radio

THE *Greensboro Daily News* and *The Greensboro Record* have been published in the North Carolina city for half a century. Morning and evening, they are read throughout the state from the ocean to the mountains, as fine examples of the "regional" newspaper which has been built over a long career into a permanent, respected agency of information and enlightenment.

On March 14, 1948, these two papers stepped into a new dimension with radio broadcasting. Their brand-new FM station went on the air as WFMY, with 23 kilowatts effective radiated power produced by a Western Electric 506B-2 10 kw transmitter and six-bay Clover-Leaf antenna. Directly in back of a new studio-transmitter plant next to the newspaper building, a 450-foot tower carries the Clover-Leaf high above the city of Greensboro and the surrounding territory.

This is the papers' first venture into radio, and it is an FM-only project . . . no experience or installation on AM led the Greensboro News Company into the FM field. It is rather that the post-war development of FM into a full-grown sister of the AM industry has opened the way for the Greensboro papers, as it is doing for many other groups, into this new medium of community service.

P. T. Hines, General Manager of the Greensboro News Company, publisher of the two papers, expresses the desirability of adding the immediacy of radio to the permanence of the printed page as a means of reaching the public, in these words:

"WFMY can complement the services of our two newspapers by providing a vehicle for the expression, encouragement and development of our people. Our facilities will be available for local programs of public and educational

interest, and we will offer a well balanced schedule of news, local events, drama and music of the best classification, to satisfy every segment of FM-ers. Our papers give the complete story of local, national and international happenings. WFMY will do a like job, enabling us to round out our services with all the varied resources of the broadcasting art."

WFMY got its official start with the issuance of its CP on November 21, 1946. Construction of the building, in a downtown space next to the home of the Greensboro News Company, was begun in the early summer of 1947. The building has one story and a basement, 68 feet long and 38 feet from front to back. The main floor contains the two studios, news room, control room, and transmitter room, as well as a lobby, music library and program director's office. In the basement are the business offices, shop, storage, and the heating and air conditioning equipment. As can be seen in the photograph, the building is a straightforward, attractive exponent of contemporary architecture, housing this complete radio enterprise in a most efficient and pleasing manner.

Equipment Made "Next Door" at Burlington, N. C.

The studios and control functions are entirely Western Electric equipped. The single studio control point uses a 25B console. 633A and 639A microphones, 9A reproducers, 1126 type limiter amplifier, and 120- and 124-type program amplifiers are included. Seven type 728B, three 755A, and two 753C loudspeakers are used for technical and managerial monitoring. Two complete 22D outfits are used for remote pickups. WFMY's transmitter, microphones, loudspeakers and amplifier equipment were all built right "at home" . . . in Western Electric's new Radio Shops at Burlington, only 22 miles away. The 10 kw transmitter was delivered on Monday, and was on the air by midnight Friday of the same week.

Chief Engineer is James E. Winecoff, who comes to WFMY from eleven years in radio operation and supervision for U. S. Air Corps and commercial airlines, including a period as instructor in the U. S. Air Corps Technical School.

Responsible for building the new station into a full-fledged partner of the newspapers is Gaines Kelley, who was appointed Manager soon after the CP was granted in November 1946. Kelley was Classified Advertising Manager for the Greensboro News Company from June 1932, until he took over the direction of the just-born radio station. He says:

"WFMY signed, on Friday, February 13th, 1948, as the 13th affiliate of the Dixie network, which proves that we have no doubts about our success. We have the finest kind of equipment, and we know that FM is the best in aural broadcasting. The future is up to us at WFMY and we intend to make the most of our opportunities."

Telling the City About the New Station

Manager Kelley has conducted a vigorous campaign to make his station a known and accepted part of the community. Before the station went on the air, special meetings were held with a large number of clubs and civic groups in the city of Greensboro and the vicinity, at which the staff of WFMY explained the advantages of FM, and described the role that the station hoped to play in the life of the city. An interesting stunt was developed to provide entertainment at these meetings. Members of the group were invited to display their entertainment abilities in front of the station's newly acquired wire recorder. The recording was then played back for the group, and good or bad, this material naturally assured a 100 per cent focusing of the group's interest in the proceedings.

Central in the new station's programming plans is its affiliation with the Dixie Network, already mentioned above. At the local level, WFMY has already identified itself strongly with local events of regional and national interest. It managed to put on for sports-minded North

(Continued on page 38)

James E. Winecoff,
Chief Engineer, WFMY.

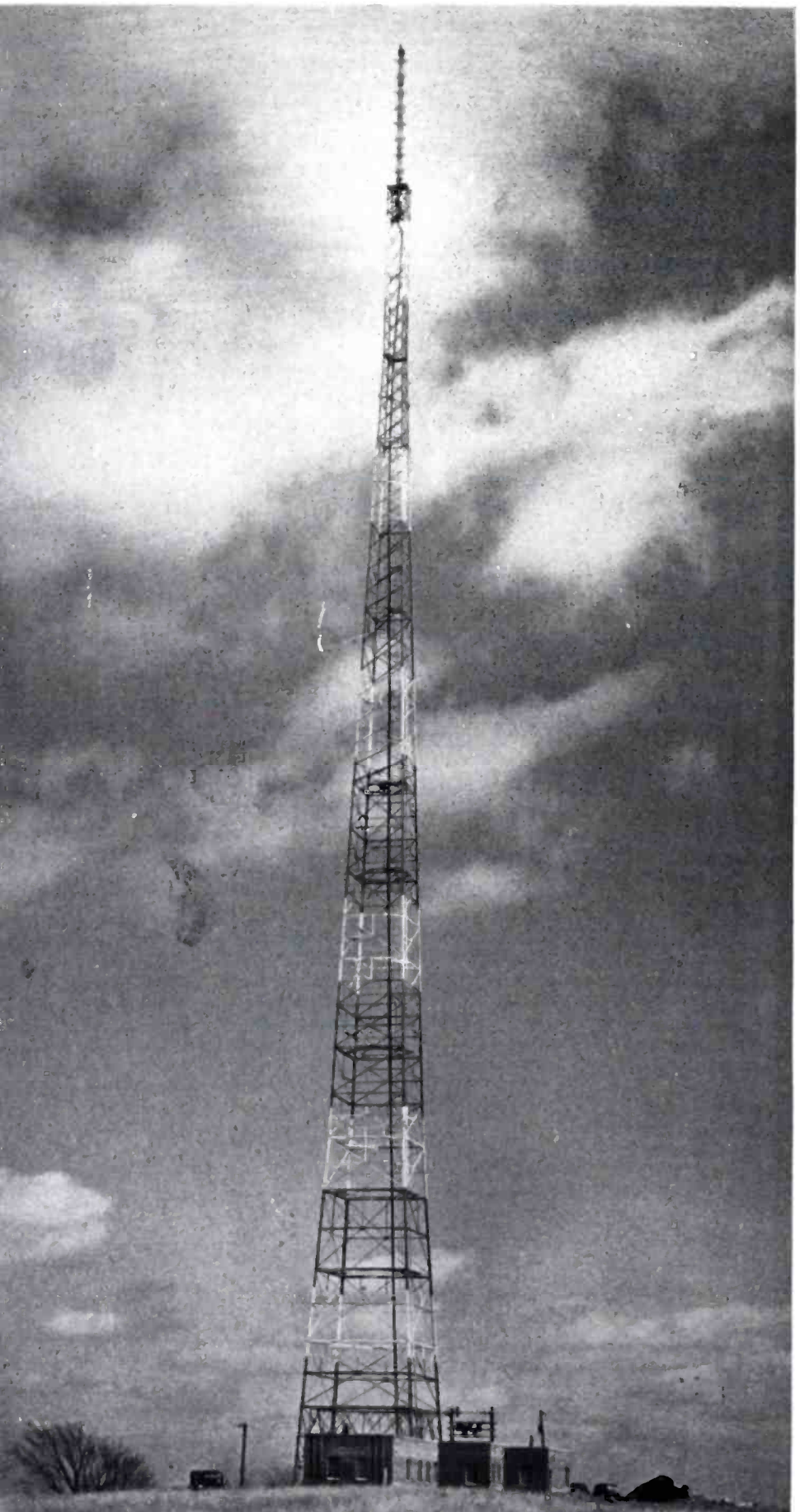
Gaines Kelley,
Manager WFMY.

P. T. Hines, General Manager,
Greensboro News Co.

Six-bay Clover-Leaf antenna starts toward the top of the 450-foot tower erected in back of WFMY's modern studio-transmitter building.

KDTH-fm

50 KW of alert coverage in Dubuque's Tri-state area.



Kenneth S. Gordon, General Manager, KDTH and KDTH-FM.

THE state line that separates Illinois and Wisconsin runs from Lake Michigan to the broad, murky Mississippi and points like an arrow at the progressive city of Dubuque, Iowa, on the river's western shore. Just eight miles south on a high bluff above the ancient river, a slender needle-like tower punctures the sky with a new eight-bay Western Electric Clover-Leaf FM antenna.

Visible for dozens of miles in all directions, the tower is located on an ideal site and proclaims to the people of the three states that something new has come to this section of the Midwest's rich farm area. Exactly what was new was revealed to all people of the region who own FM receivers when this new transmitter went on the air for the first time at noon April 11, 1948, as the FM outlet of Dubuque's popular KDTH.

This latest addition to Iowa's growing number of FM stations (the tenth strong FM voice in the state) is new evidence of the forward-looking, public spirited service which has characterized the role played for many years in this section by *The Telegraph-Herald*, newspaper owner and operator of KDTH and KDTH-FM. KDTH-FM is now on the air with a Western Electric 10 kw 506B-2 FM transmitter with effective radiated power of 90,000 watts based on the eight-bay Clover-Leaf and effective antenna height of 650 feet. All provisions have been made for increasing effective radiated power to 180 kw by adding a 50,000 watt final amplifier to the present transmitter.

FM to Serve Area With 1,300,000

The story of the growth of KDTH to its position of prominence and importance in the unique "tri-state" region is the story of typical American will-to-do-things-better. It was in February 1944 that *The Telegraph-Herald* filed its original application with the F.C.C. At that time it was planned to construct a three kilowatt FM station which would serve an estimated 350,000 people. But a year and a half later the potentialities of FM had become so forcibly apparent to KDTH's management that the application was amended. In September 1945, the F.C.C. was asked to consider granting 50,000 watts power to KDTH-FM which would enable the station to cover an area made up of

chunks of Iowa, Illinois and Wisconsin with a population of almost 1,300,000 persons. A construction permit was granted for the 50 kilowatt station in July 1946.

Complete Western Electric transmitting and studio equipment—from antenna to turntables, consoles, microphones—was immediately ordered from Graybar Electric Co. In April of last year the foundations of the tower were constructed. Two months later the transmitter building itself began to take shape and was completed March 1st of this year. The tower went skyward 415 feet from its perch on the Mississippi bluff in December 1947.

Supplying the "drive" and enthusiasm needed to push this job through to completion was the entire staff of KDTH led by Ken S. Gordon, who has been General Manager of the station since its founding. KDTH engineers, Donald Abitz, Robert Hancock, Wilbur Emerson and Keith Jones teamed with Richard Davidson of Western Electric and Phil Woodward and Frederick Nearing of Graybar Electric in the installing, testing and tuning needed to get the station ready to go.

Newspaper Sections Mark Inaugural

When at last all was "set" and KDTH-FM went on the air, it was an important event in "Dubuqueland," the culmination of four years of planning and hard work. *The Telegraph-Herald* marked the day, a Sunday, by publishing two special fourteen-page FM sections, telling in pictures and articles the complete story of FM and KDTH-FM. All major national manufacturers of FM receivers were represented in cooperative advertising with local merchants. Dealers held "open-house" that Sunday so that prospective FM customers could come to see new sets and hear FM for themselves. As a concentrated, hard-hitting newspaper promotion for FM these two sections of *The Telegraph-Herald* were outstanding and undoubtedly succeeded in accelerating tremendously the acceptance of FM in Dubuque.

A statement by Ken Gordon in *The Telegraph-Herald* promised the general public that it would "enjoy KDTH-FM fully as much as KDTH during the last seven years." He added, "KDTH-FM will have many advantages over AM broadcasting and we invite suggestions on how we can better serve you."

Programming for "Dubuqueland"

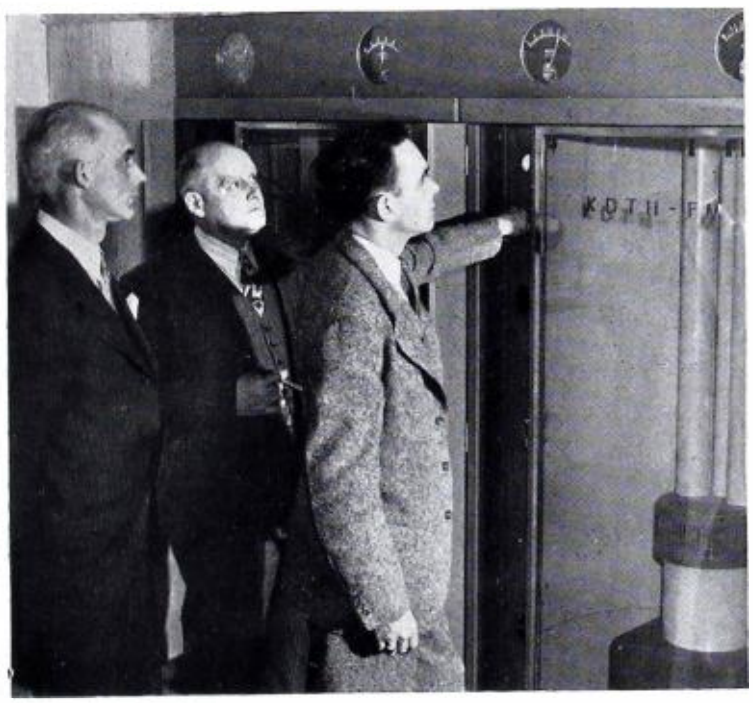
So far as listeners are concerned, the future popularity of Dubuque's new FM transmitter is in the experienced hands of Arnie Steirman, Program Director, and George Freund, News Editor, both of whom were members of the original staff of KDTH. On the station's initial broadcast, seven years ago, it was Freund who supplied the Mississippi River sound effects with the help of water in a washtub.

Programming will follow the general pattern established by KDTH and well liked by its audience, except that possibly there will be greater accent upon music than ever before due to the high fidelity capacity inherent in FM. Although a Mutual Network affiliate, KDTH has always endeavored to arrange a daily program menu in which the local "Dubuqueland" flavor is strong. Typical is "Down Melody Lane," a musical stroll through a mythical neighborhood peopled by the sort of persons you like to know. A telephone survey, measuring the radio audience when this show is on the air, indicates that "Down Melody Lane" is one of the top favorite programs in the area. This program will be aired simultaneously over KDTH and KDTH-FM.

The spring and summer schedule will also bring a full quota of news and sports. Fifteen minute newscasts are

(Continued on page 38)

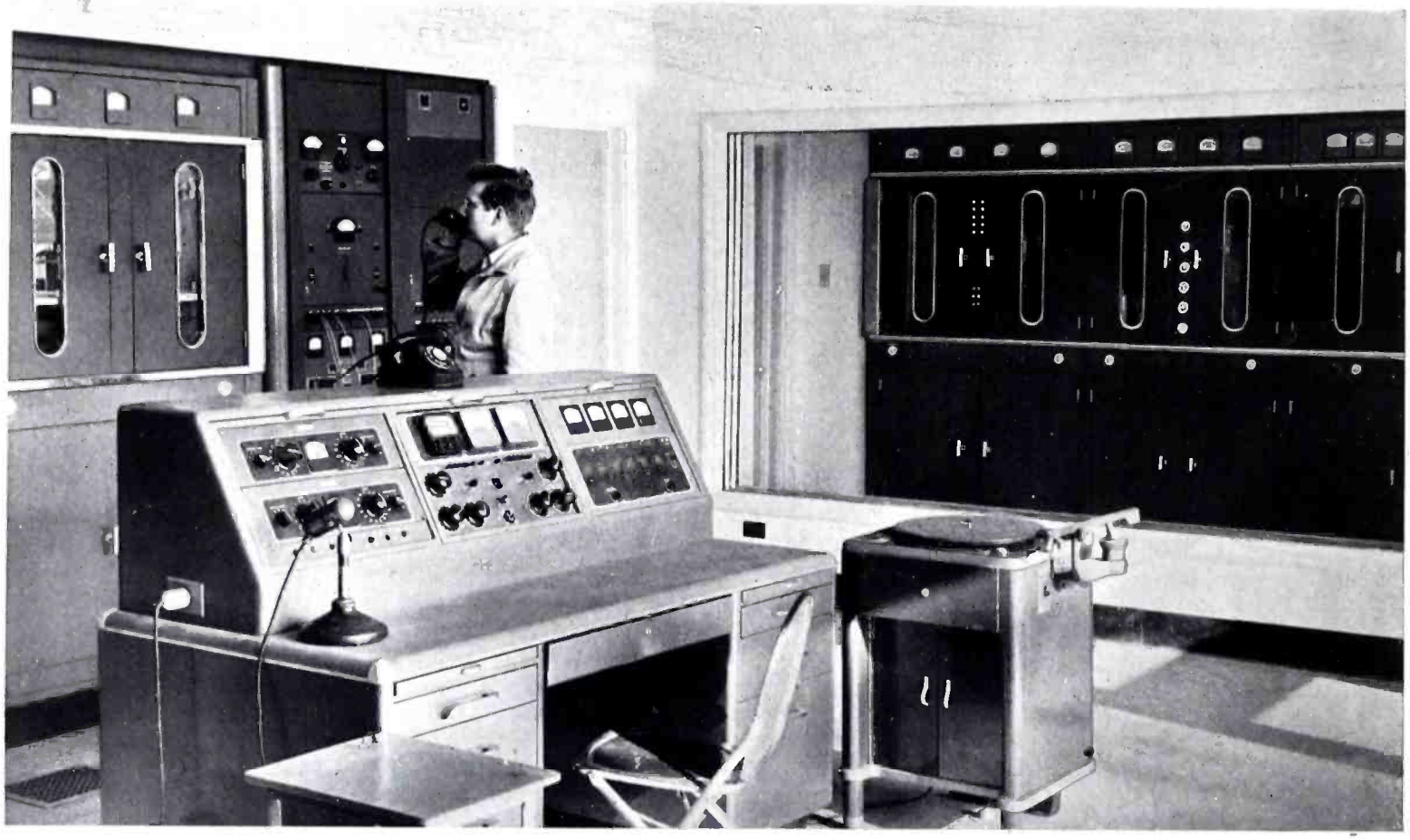
W. R. Emerson, KDTH and KDTH-FM engineer, and F. W. Woodward, President of the Telegraph-Herald Company, watch while R. M. Davidson of Western Electric throws switch to start KDTH-FM's 10 kw transmitter.



All studio facilities and offices of KDTH and KDTH-FM are in this modern building in the center of Dubuque, constructed especially for the broadcast operations of the Telegraph-Herald Company.

A big step ahead for WDNC, Durham

North Carolina station jumps from local 250 watter to powerful regional voice on both AM and FM



Control room in new dual AM-FM transmitter building for WDNC and WDNC-FM. Console for control of both transmitters in foreground, 5 kw AM transmitter in right rear, and audio and phasing equipment at left across the back of room. The 10 kw FM transmitter faces into room from side opposite the AM equipment.

IT'S A RETURN engagement for WDNC of Durham, North Carolina. Exactly seven years ago, in May 1941, *Pick-ups,* predecessor of the *Oscillator,* hailed this station in the beautiful, prosperous Piedmont city. In 1941 WDNC was, as it is today, a smartly run, highly successful enterprise, a CBS outlet for the area, which had won national notice for alert promotion. A Western Electric 310B transmitter produced the station's allotted 250 watts of r-f output, which served an estimated potential audience of 165,000 persons in the Durham area.

Today, WDNC makes its appearance on a completely new level of service and opportunity. On February 28, 1948, its signal power was increased to 5 kw—and at the same moment, a companion signal of 36 kw effective power on FM went into action! A new dual AM-FM transmitter plant was completed and on the air for WDNC with a 5 kw AM Western Electric 405B-2, and a 10 kw Western Electric 506B-2 FM transmitter.

There are two main chapters to the story of WDNC and WDNC-FM in the new full-grown size:

(1) Its service area is naturally increased many times over, with an estimated potential audience of 1,400,000 persons for its well balanced local-and-network programming;

(2) Its combination AM-FM transmitter plant is a splendid example of complete, effective planning, literally from the ground up, for dual operation, a product of the design efforts of the Raymond Wilmotte organization of Wash., D.C., with Associate Paul De Mars supervising the job.

WDNC was the first broadcast station in Durham. It was originally WRAM of Wilmington, N. C., and was moved to Durham in 1934 to start a new career under the new call letters.

It has been owned since 1936 by the Durham Herald Company, publishers of the *Durham Herald* and *Durham Sun*. Carl C. Council, President of the Durham Herald Company, has pushed hard for the "big voice" that the station now possesses. He stated what the new transmitters mean to the ownership as follows: "We believe that we have now given Durham's radio broadcasting voice as wide a coverage as is possible today. We obtained the best permit we could for Durham. We went the limit to provide the finest plant, with the best equipment obtainable. Now we are deeply conscious of the increased responsibility arising from our new operations. We want the people of our area to know that we will at all times try to operate the station for the highest interests of our community".

Kenneth Taylor, Chief Engineer WDNC and WDNC-FM.

Carl C. Council, President, the Durham Herald Company.

J. Frank Jarman, Manager of WDNC and WDNC-FM.

From Architecture to Broadcasting

Among other assets of the station which moved from Wilmington to Durham was J. Frank Jarman, then Commercial Manager, who became Manager in 1935 and has remained in that post ever since. The inferred connection between the success of the station and the fact that Frank Jarman has been its Manager for the past 13 years, is an accurate one. This architectural engineer (North Carolina State, 1929) who progressed from a career as commercial artist to become a manager of broadcast stations, is known not only as the "daddy of radio in Durham", but as one of the mightiest "movers and shakers" in the business. In 1941, when asked for the secret of success in broadcasting, he said "well balanced programming". Fully alert to the needs of his community, Jarman has continued to give listeners of the station a varied fare, in which the network programs of CBS and the local programs which make the station a part of the community have occupied the earnest attention of the programming staff.

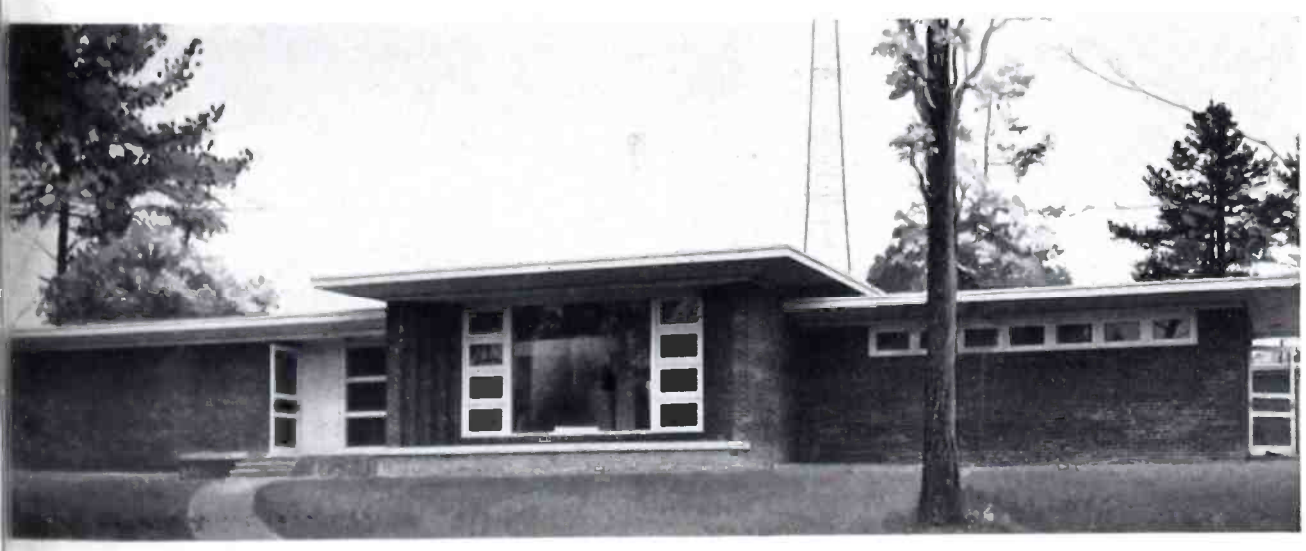
Prominent in the "local" fare which is part of the station's regular service are the sports broadcasts which WDNC has emphasized for many years. These cover not only the football, baseball and basketball contests involving Duke, University of North Carolina, North Carolina State and Wake Forest, but a complete gamut from Soap Box Derby to marbles, from tennis to track, with fencing, golf, swimming, and boxing thrown in. Anyone who has been in North Carolina and met any number of inhabitants of that progressive state knows that the sports programs of the "Big Four" occupy a good part of their waking thoughts and conversation. WDNC is on solid ground in giving its listeners a thorough coverage of the many athletic contests in which intersectional rivalry and in many instances, national interest, are involved.

Naturally the station's newspaper ownership gives it an intimate connection with sources of news, and news broadcasts are featured. The newscasters are drawn from the regular staffs of the two papers. WDNC's experience in this respect parallels that of most U. S. stations today: regular news has become an indispensable part of balanced programming.

Record Library — Ted Lewis to Spike Jones

Manager Jarman's "balanced" program fare further includes recorded music of every variety, from straight longhair to the latest swing, produced from an outstanding collection of some 25,000 recordings. A sizeable number of the records were brought to Durham with the original move

(Continued on page 39)



Sweeping modern exterior of new transmitter building for WDNC and WDNC-FM is expression of efficient planning which made it ideal dual AM-FM transmitter plant.

Gotham speaks through WNYC

Municipal station gets 20 kilowatts on FM to serve its owners, the citizens of New York City

NEW YORK is a mettlesome city, bursting with vitality in hundreds of directions, and it is gratifying to citizens of the city that they have a mettlesome, enterprising, uniquely successful broadcast station as their own. This is WNYC, the only broadcast station in the country which is completely owned and operated by a municipality for the entertainment and enlightenment of its citizens.

WNYC is a function of the government of the city of New York, supported by general tax funds, with no income from broadcast operations. Thus the station differs in many ways from a commercial station, and stands as a unique example of a type of broadcasting that is largely unfamiliar to the industry.

That WNYC has "arrived", in its own field of "municipal service", is not a matter of conjecture. The station's Hooper rating in the first quarter of 1948 stood around 3.5. Its daily mail pull averaged 350 to 400 during the same period.

A list of awards received by the station for programming excellence would fill nearly a column of type. A small selection of the outstanding awards is as follows: Ohio State Institute for Education by Radio, First Awards for various educational and cultural programs in 1940, 1941, 1942, 1944, 1945, 1946 and 1947; National Association of American Composers and Conductors, Certificate of Award for service to American music 1938, 1939, 1940, 1943, 1944, 1945; Certificate of Merit by Municipal Art Society of New York for outstanding cultural service to the City of New York; Certificate from the Radio Manufacturers' Association through the N.A.B. for public service and contributions to peace and harmony, 1945; George Foster Peabody Award for public service by local stations, 1945; U. S. Marine Corps *Career Call* Award for service in the Marine Corps recruiting program, 1947; *Billboard Magazine* Award for outstanding achievement in radio promotion in 1947; Veterans of Foreign Wars Award for programs aiding the American veteran, 1947.

WNYC's audience is loudly possessive to a degree that would appal a commercial station manager—its listeners never forget, and never let the station forget that as taxpayers of the city they own the station lock, stock and barrel. And since the management of the station must be extremely sensitive to the wishes of its "owners", the unquestioned success of the station with the people of the city is not accurately indicated by a Hooper rating or other audience count of the type employed by commercial stations. It is rather that the city has accepted the station for the variety of specialized functions it performs.

The station is a combined AM-FM operation. The 1 kw AM transmitter is installed in the Greenpoint section of Brooklyn and affords primary coverage of the New York area. This Western Electric 106B is WNYC's original AM transmitter, and has been operating, with some rearrangement and modernization, since the station went on the air in 1924.

Seymour N. Siegel, Director of WNYC and WNYC-FM.

The FM transmitter, and the studios and offices, are on the 25th floor of the Municipal Building, city-office skyscraper that rises near the Manhattan end of the Brooklyn Bridge. On February 11, 1948, WNYC-FM installed a 10 kw FM Western Electric 506B-2 transmitter, which, with the Clover-Leaf antenna on the roof of the building, brings the station to its full authorized effective radiated power on FM of 20 kilowatts. The station has been on FM since 1943 with a Western Electric 1 kw 503 type transmitter—first on 43.9 megacycles—and later modified for operation in the new band on 93.9 megacycles. When the station was ready to go to full power, the installation of the 10 kw amplifier and rectifier units, and conversion of the 1 kw unit into a driver, were all accomplished by the Western Electric field engineering force with the able assistance of WNYC-FM's technical staff under Acting Chief Engineer William H. Pitkin. The completion of the FM installation gives WNYC-FM its planned high quality coverage on FM throughout the metropolitan New York area.

Programs From a Great City's Activities

The first fact about WNYC's operation that proves startling to a commercial broadcaster is that the city station cannot spend a cent for program material, beyond the regularly budgeted salaries of the staff. WNYC has overcome this apparent handicap to effective programming by digging aggressively into its own backyard. It has gone out and identified itself with activities of significance and interest in the city, finding program material in the ferment of cultural, commercial, political, educational and scientific enterprise that makes New York a great city. The extent of this "going to the city" can be realized from the fact that the station maintains more than 50 remotes in permanent or semi-permanent use.

The station was started with high expectations, but it took some twenty years to grow to maturity. During the Jubilee in 1923 that celebrated the twenty-fifth anniversary of the founding of Greater New York, station WJZ broadcast many of the ceremonies, one of the earliest examples of "public service" broadcasting. The effectiveness of this new art of communication, this broadcasting that carried a message to a population in a way not possible before, deeply impressed the city fathers, among them Grover Whalen, then City Commissioner of Plant and Structures. A resolution was passed by the Board of Estimate to the effect that the city would be "derelict in its duty" if it did not provide broadcasting facilities for municipal use. The station was authorized and went on the air with its Western Electric 106B 1 kw transmitter, on July 7, 1924.

La Guardia Gives Station a Push

It was not until Fiorello La Guardia became Mayor, in 1934, however, that the potentialities of the station began to be fully realized. New York's "Little Flower" threw his titanic energy into the municipal broadcast station, as into everything else. In Seymour Siegel, now Director of the station, La Guardia—and the city—found a man with the vision and ability to grasp the station's opportunities and turn them into accomplishments.

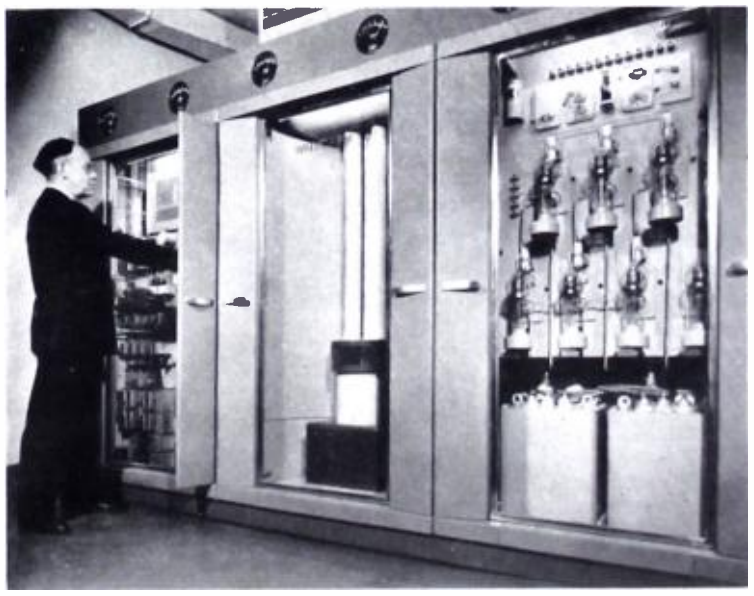
Mr. Siegel was graduated from the University of Pennsylvania in 1929, and got his start in radio programming during his college career by producing University dramatic club shows for Philadelphia stations WIP and WFIL. He did graduate work in economics at Columbia University, and during this period had a stock quotation program on several local stations. He came to WNYC as Director of Programs, under La Guardia, in 1934, and became Director of the station in 1947, after his war duties which kept him in the Navy from June 1941 to February 1946. He left the Navy with the rank of Commander.

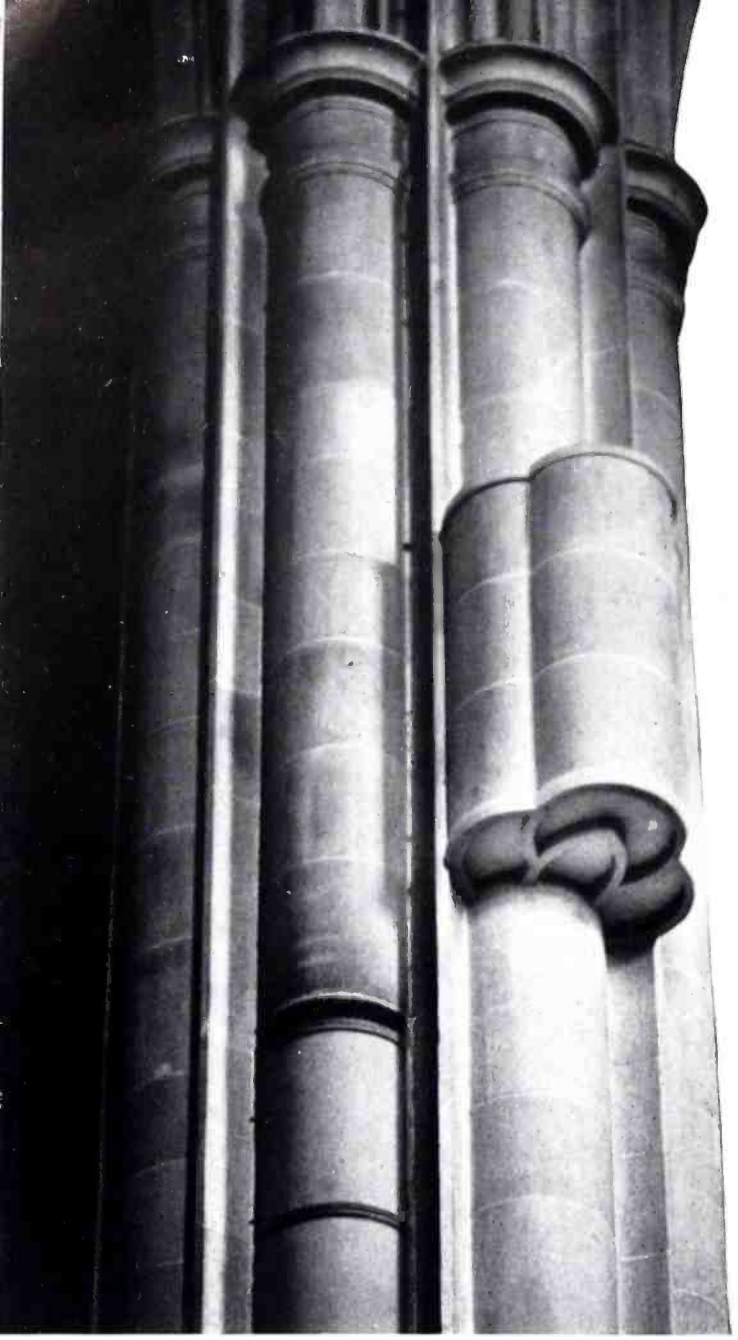
When La Guardia brought him to WNYC, the station was near the lowest ebb in its history. There was considerable pressure in favor of its abandonment, but the new

(Continued on page 37)

Director Siegel; Major E. H. Armstrong, and F. R. Lack, V. Pres. Western Electric watch Deputy Mayor Bennett of New York put 10 kw FM on air.

New 10 kw FM transmitter at WNYC-FM is adjusted by Chief Engineer W. H. Pitkin. Municipal station got full power on FM February 11, 1948.





Now the service can be heard

Specially engineered Western Electric sound system solves difficult church acoustic problem.

by C. W. Reynolds
Superintendent of Manufacturing Engineering,
Western Electric Radio Shops

and R. N. Marshall
Asst. Supt., Cost Reduction Engineering
Western Electric Radio Shops

IMAGINE a modern church, of soaring cathedral-like architecture, impressively beautiful, in which the Minister speaking from the pulpit cannot be understood by a third of the congregation, so that members have even adjourned to their cars outside to pick up a broadcast of his sermon on their car radios. The Centenary Methodist Church of Winston-Salem, N. C., had been plagued with this situation since the fine million-dollar stone edifice was completed in 1931.

The church is on a cruciform plan, as shown on page 35. The dimensions—165 feet long, 52 feet wide, and 68 feet high—are such that the acoustic conditions are very unfavorable to intelligibility of speech originating in the pulpit, seriously impairing the function of the church for a large part of the congregation.

Some attempts were made to improve the acoustic characteristics before installation of the system described in this article. The original architectural plan specified an acoustic covering about one inch thick concealed behind a patterned fabric to be applied to the side walls of the nave and ceiling. This did not remedy the situation as the fabric was far too thin to be effective. Later a conventional loudspeaker reinforcement system was installed with six speakers mounted on the columns in the nave and facing the congregation from a height of 12 feet. Still there was no improvement in the intelligibility of the spoken service for a large percentage of the congregation.

In 1947, the Western Electric Company was called in for consultation. Mr. C. C. Randolph, Manager of the newly opened Western Electric Radio Shops in Winston-Salem, made available all the engineering personnel necessary to solve this difficult problem.

It was possible to analyze the situation by experienced listening without resorting to actual reverberation time measurements. Low frequency sounds were obviously absorbed very little, while high frequencies were dissipated by the too-thin acoustical wall treatment. This caused the carrier vowel sounds to be re-echoed, while the consonant sounds necessary to intelligibility were rapidly removed from circulation.

Direct Sound Brings Intelligibility

The conventional sound system which had been installed did not take into account the frequency unbalance of the reverberation characteristic nor the low ratio of direct to reverberant sound reaching the listener. Thus, diagnosis indicated two alternate courses: complete re-engineering of acoustical treatment on interior surfaces or creation of a sound system which would produce the sound pattern required for intelligible hearing. The first was evidently a very costly major undertaking in a completed church of this size even without efforts to preserve the architectural

concept of the interior. The second course was selected as showing more promise, although the exact solution was not immediately apparent from previous practice in the art.

A few exploratory operations soon pointed the way. The first step was to increase the ratio of direct to reverberant sound reaching the listener. This type of problem had been solved during the war by the Western Electric announcing system for the highly reverberant hangar decks of aircraft carriers. In the church an experimental system was constructed with 10 speakers in the nave 15 feet overhead and 15 feet apart in two rows over the center of the two main rows of pews.

The second step was to equalize the frequency characteristic of the sound system to accentuate the consonant speech sounds, and thus restore the balance needed for good articulation, yet without producing distracting and unnatural accentuation of sibilants. These two steps were quite successful acoustically, but architecturally embarrassing. The church had been deliberately planned to emphasize the vertical expanse of the pillars and arches. A hexagonal chandelier-type speaker housing was designed for the new loudspeakers but this did not satisfy the requirements of harmony with the style of the building.

An experimental installation with six speaker boxes fastened to the six main pillars was compared with the system of 10 speakers hung directly over the pews. Completely satisfactory results were obtained. It is true that the system with six speakers mounted on the pillars produced a little less direct sound in ratio to reverberant, but not enough to be noticeable except to the trained ear.

Disguised Loudspeakers Mounted on Pillars

As a permanent mounting for the six speakers, a hollow blister housing was erected which carried out the cylindrical lines of the fluted pillars, as shown at the top of page 34. It was made three times as long as required for proper action of the loudspeaker, in order to achieve an adequate balance of mass and vertical line. The bottom grille was made of a few thick functional lines similar to those used in organ grilles.

The box is constructed of wooden frame with plywood ends cut to shape. The sides are three pieces of cylindrically formed aluminum sheet 1/16 inch thick, welded at the two inverse seams and screwed to the frame. The speaker baffle is above the bottom grille and set at a 15° angle towards the center aisle. The finish was worked out to simulate the sandstone block of which the pillars are constructed.

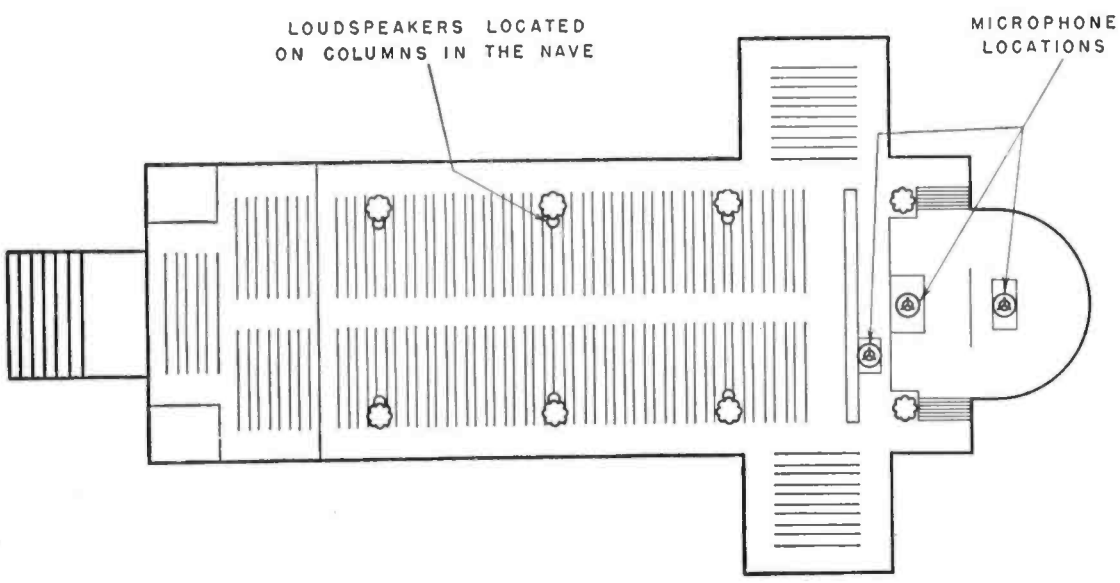
Audio Components Used in the System

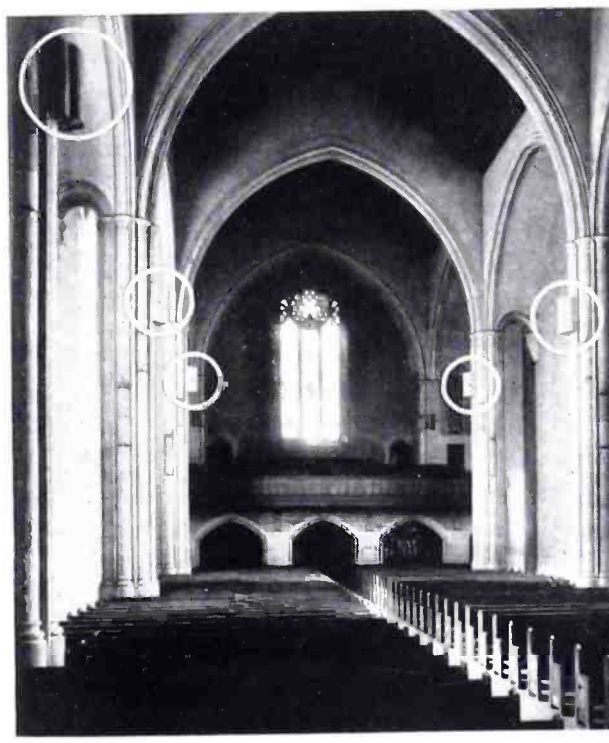
The sound pickup is accomplished with three microphones, one on the lectern, one in the center of the choir section, and one on the communion bench between the lectern and front pews. Western Electric 633A "Saltshaker" microphones were used with 8B Baffles, which acoustically accentuate the consonant sounds.

This combination was picked over directional types such as the 639A Cardioid because ample gain is obtained before feedback, input is close enough to disregard the reverberant mixture with direct sound, and the rising frequency characteristic of the 633A made electrical equalization unnecessary. The over-all sound system frequency response finally selected was almost a straight-line, rising characteristic of 5 db per octave from 100 to 5000 cycles. This can be obtained without electrical equalization by using the 633A mike and baffle with a 728B Loudspeaker in a 1½ cu. ft. box. The wide range single-unit 728B speakers were chosen as ideal for this installation since they achieve high fidelity with more than ample power capacity.

The amplifiers used are two 124G's of 12 watt power output each, with the grids of the second stages bridged together. First stages are 116B's with remote bias control. Each amplifier drives a speaker group down the side of the church. This unusual arrangement was chosen because of the very low hum level of the 124G. The 24 watts of power available covers requirements nicely, and four mixing in-

(Continued on page 38)





Floor plan above and photograph to right show positions of microphones and loudspeakers in the Winston-Salem Methodist Church. Production of proper sound pattern with speakers, correction of frequency characteristic made service intelligible to every member of congregation.

Mutual-Don Lee

(Continued from page 11)

programs this greatly facilitates mixing. For example: the multi-microphone pickup of an orchestra, controlled by one hand can be balanced against the instrumental solos or vocal microphones controlled by the other hand. The sound microphones can be balanced against the cast microphone in the case of the dramatic program.

Through the continual exchange of ideas with the Western Electric Company, there emerged a control desk with design beauty, which in one year of trial installation, has proven very satisfactory and seemingly the answer to our need. The readily accessible plug-in amplifiers have made our occasional service requirements very simple.

In addition to the consoles for the eight large studios, six electrical transcription desks were required, three of one type for the small studios, and three of another type for the announce booths.

Consoles for Discussion, Disc-Jockey Programs

The first of these has been designated "Studio Type Transcription Console." It allows for: (1) commentary and round table discussion type of programs, (2) preparation and playback of delayed broadcasts with facility for cut-in announcements and (3) assembly of record shows with the announcer (disc jockey) working in the control room, or in the studio with a technician at the controls. Discussions with Western Electric's engineers emphasized the design philosophy of simplicity, ease of operation, and dependability.

With an intent to minimize operational errors resulting from poorly placed and excessive numbers of controls and switches, a careful study was made to determine the most frequently used controls and the most convenient location for each with the least hazard to smooth operation. It was desired to satisfy program production demands with a minimum number of controls in order to facilitate fast and accurate operation. To insure greater dependability, each part was studied as a potential trouble maker. For ease of operation, the two turntables were built into one side of the desk and a third was placed in a separate cabinet on the other side of the operator as optional equipment. The mixer panel is shown in the left-hand photograph reproduced below.

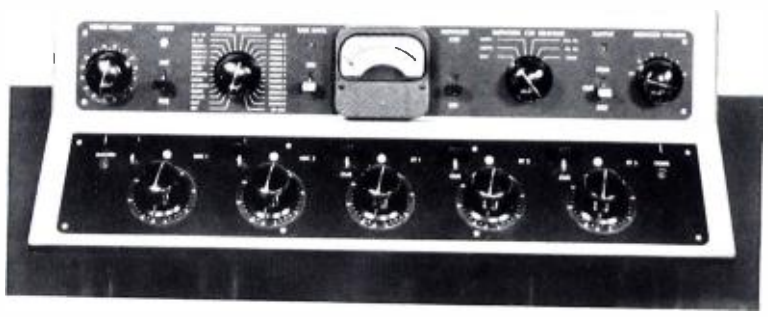
The physical shape and color of the control desk were worked out with Western Electric designers to give eye appeal and modern lines rather than just the "technical look," as can be seen in the photograph on page 11.

Control Desks for Announce Booths

The second type of transcription desk is known as the "Announce" type and allows the announce booth operator to: (1) fade live or transcribed announcements into or out of programs; (2) give identification and spot announcements; (3) play transcribed commercial spots or recorded fills in case of program failure; and (4) cue and monitor as necessary.

The number of controls appearing on the equipment was held to a minimum to avoid confusion and the placement was based on frequency of use. This resulted from a study made with the Don Lee production department and announcing staff. Consideration was given to the slope of the control panel and the location of the volume indicator to further facilitate operation. In a series of conferences with Western Electric engineers it was decided that a control desk similar in shape to that developed for the small studios would be ideal, with circuit and control modification for use in the announce booths. The finished unit includes space for two integrally mounted transcription tables. The mixer panel resulting from the considerations outlined, can be seen in the photograph below.

Mutual-Don Lee is thoroughly convinced that the care and effort expended in the design and construction of this network center have produced the ideal home for its operations in Hollywood. The acoustic characteristics of the studios will, we feel sure, add measurably to the enjoyment of our listeners. The provisions in the building for technical services and the careful planning of the layout for storage, for entrance and exit of the public, and for the managerial functions of the networks will be of the greatest value in our operations, and finally, the audio system will bring marvelous simplicity and efficiency to our program production and dispatching.



The two types of electrical transcription desks are similar in appearance, but have slightly different circuits and controls. Above is the control panel for the "studio" type and at right are the controls for the type used in the three announce booths.

Gotham Speaks Through WNYC

(Continued from page 33)

Director of Programs believed with La Guardia that the station had an important part to play in the city's life.

As developed by Mr. Siegel in his fourteen years as Director of Programs and Director of the station, this role includes four main types of programming: (1) regular and emergency service to the various departments of the City Government; (2) special events; (3) cultural and entertainment broadcasts; (4) political broadcasts.

In its direct public service to the city, WNYC has developed and is developing many programming techniques for this specialized field. There are a large number of more obvious services which the station must and does provide regularly, such as Police Department missing persons alarm; news; weather information; emergency instructions during crises such as major strikes, fires, epidemics or other dislocations to the life of the city; concerts by numerous bands, glee clubs, etc., of the city departments; information on city civil service examinations; graduation exercises and other ceremonies in the public schools; and on and on for a formidable list.

But the station does much more than merely transfer municipal activities onto the air waves. For the Department of Correction, for instance, it produced a series of programs entitled "Toward Return to Society", a use of dramatic continuity to deal with the readjustment problems of persons released from the city's penal institutions. For the Board of Education, the most persuasive radio techniques are used to enliven specific educational topics. "Bill Scott: Forest Ranger", for example, was a mythical character who through a series of dramatic adventures in the woods made exceptionally clear and vivid an important course in forestry. For the Department of Health, there are programs attacking every regular and emergency health problem in the city. Every new mother, for instance, receives a cheerful printed "welcome" to her baby from the Department of Health, pointing out the services provided for her; with it is a program schedule and invitation to listen to "Bringing Up Baby", a WNYC series that treats infant care in an intimate, expert and appealing manner.

Using the Radio Art in the Public Service

Director Siegel expresses the philosophy motivating WNYC's ever growing activity in this field:

"Our premier responsibility is to bring to every citizen of the city an ever greater understanding of and participation in his city government. Radio broadcasting, the most democratic of all mass communication techniques, can do an unparalleled job in this field.

"In order to be successful, however, we must learn the art of mass persuasion like any other broadcast station—getting our material across with maximum effectiveness is a problem in presentation technique, in which we draw heavily on the twenty-five year old experience of the industry as a whole. With this experience as a basis, we are trying to push forward and do a pioneering job in our own specialized field, a job which we hope will have value for public service broadcasting everywhere in the United States."

In developing special events programming, WNYC's principal problem is one of selection, of choosing from the staggering number of "events" in the city those that it believes are due its listeners because of their intrinsic importance or entertainment value. Technically, a large number of special events entails a corresponding number of remotes. Nothing is more characteristic of the station on its operational side than its ability and habit of being prepared at a moment's notice to go on the air from just about anywhere in the city. New Yorkers are pleasantly accustomed to this omnipresence of the WNYC microphone.

One particular type of event that has a special New York flavor is the welcoming of distinguished guests to the city, a ceremony that has become standardized with the visitor riding up lower Broadway to City Hall, to be met on the City Hall steps by the Mayor. From long experience with a horde of the great and near-great, this procedure has been perfected so that it goes off like a well-rehearsed football play, every participant knowing his role to the last detail. But oddly enough, this standardization of external details seems to free all of those concerned so that in the actual words of welcome, the short speeches made and answered, there is a spontaneity, a human reality, missing from many formal ceremonies. These events are invariably broadcast by WNYC, and offer a fascinating series of brief personality studies for the interested listener.

Fine Music From the City's Rich Fare

In the entertainment field, fine music is given special importance, and the great concentration of music in the city provides the station with many programs of the highest quality. Philharmonic Symphony concerts from the Lewisohn Stadium, Carnegie Hall "Pops" Concerts, Goldman Band Concerts in the parks, the Frick Collection Chamber Music series, Brooklyn Museum Concerts, Julliard School of Music recitals, "Nights at the Ballet" from the Metropolitan Opera, Ballet Russe from the City Center, New York City Symphony, New York Little Symphony, National Orchestral Association—the regular programs of these and many other organizations are put on the air by the municipal station.

Recorded music of the serious variety is also a staple in the program fare. WNYC was one of the earliest users of regular symphonic programs from records. Not only are there several hours each day devoted to such music, but there are weekly record review and discussion programs. David Randolph, for instance, with his "Music for the Connoisseur", attracts a large audience to hear discussion of matters of style in fine music with examples played from records. A single recent program brought Randolph more than 800 pieces of mail, including among the correspondents such public characters as Clifton Fadiman and Vladimir Horowitz.

But the station is not content merely to put on the air what it can find in the music field, any more than it is in the public service field. Its American Music Festival, which had its ninth annual production in 1948, gathers together the greatest quantity of American musical talent, both of creation and performance, that has ever been concentrated in any single short period. The music includes folk songs and spirituals, Sousa marches, the newest and most esoteric chamber music by "advanced" composers—there were 69

premieres during the 1948 production. The performers include practically all the leading professional groups in the city, who donate their time for this non-commercial project, as well as a large group of younger artists drawn from the schools and conservatories of the city. During the eleven days of the Festival, from four to six hours of air time daily are devoted to it. The whole project is produced by Herman Neumann, WNYC's fast-moving Musical Director who is responsible for much of the station's maturity and enterprise in the musical field.

Political broadcasts are presented on WNYC on a strictly non-partisan basis, with equal time offered to all recognized groups. During actual campaigns, each party is invited to name a speaker or speakers to present the party candidate's message to the city. A remarkably entertaining and enlightening broadcast was the Transit Hearing conducted by Mayor O'Dwyer in 1947, in which for three whole days the city had its say on the nickel fare, which is just about the hottest subject in New York politics. Citizen after citizen rose in the open meeting to have a go at it, and with the New Yorker's known ability to express himself pungently and forcefully, the broadcast set a high mark in aliveness and human interest.

Most important of the station's presentations of political material are its "gavel to gavel" broadcasts of the United Nations Meetings, a service of which the station is deeply proud, and one which has drawn the greatest volume of appreciative mail of any of its "public service" programs. In these broadcasts WNYC is entering a field that points beyond "public service", as now understood, toward a direct role for broadcasting in opening parliamentary councils to the peoples of the world.

KDTH-FM, Dubuque

(Continued from page 29)

built upon the *Telegraph-Herald's* own coverage in Dubuque and the surrounding territory plus the Associated Press wire services. Local on-the-spot broadcasts have long been popular thanks to a 1½-ton mobile truck unit. A daily feature this year will be the Chicago Cubs baseball games via direct wire from Chicago, which will be a KDTH-FM exclusive in the Dubuque area. Mutual Network shows will augment this "balanced diet."

It is anticipated that KDTH-FM programs will eventually be heard at the maximum distance possible for FM due to the station's 50,000 watts and the unusually fine location of the antenna. Full provisions have been made in the transmitter building to take care of the increase in power output which will be carried forward as rapidly as possible this year.

Today's business-like building which has been constructed in the center of a 77½ acre treeless tract on the Mississippi bluff, is only the initial step in the creation of a commodious two-story structure, the second floor of which will be completely turned over to living accommodations for engineering personnel. The first floor now contains living quarters for an engineer, consisting of a combination living room-dining room, bedroom, kitchenette and bath.

In the largest room in the building are the transmitter, speech input equipment, turntables, console, and other operating equipment. A large workroom is situated to the right of the transmitter room. Back of the transmitter is a large room to house rectifying units and high voltage equipment, and outside the building a 12,000 volt power line is terminated. Under the entire building is a finished basement which houses the heating plant.

Completion of the transmitter building, the increase to 50,000 watts, and the steady growth of an enthusiastic FM audience in "Dubuqueland," all promise an attractive and profitable future for KDTH-FM. In the opening minutes of the new station's career on the air KDTH-FM expressed its hopes in this way:

"Keep your dials tuned to this station," the announcer advised, "for the latest in news, in sports, and the best in radio entertainment. It is our honest hope to serve our listeners with the best at our command, and we sincerely hope that you, our listeners, and KDTH-FM will become and remain very good friends."

Now the Service Can Be Heard

(Continued from page 35)

puts are obtained, since each main amplifier accommodates two 116B preamplifiers.

Final results have been most enthusiastically received by the congregation. After sixteen years of discouraging experience, every pew is provided with clear, natural speech which can be understood without straining. The choir sounds twice its size with much clearer projection of the soloists. In the past, congregational singing has been half-hearted because of the inability of the crowd to fill the church with sufficient volume to encourage the bashful singer. Projection of the choir into the audience by the new system has greatly improved this situation.

The illusion as to the source of the sound is helped by lighting the lectern in a manner to draw the eye to the person speaking. That the system blends architecturally is shown by the fact that many members, after learning that new sound apparatus was installed, have been unable to spot its location without informed assistance.

WFMY, Greensboro

(Continued from page 27)

Carolinians a pre-opening broadcast of the Southern Conference Basketball Games at Duke University, March 3 to 6. It gave regular coverage to the Greater Greensboro Open Golf Tournament March 19, 20, and 21, an event in which many national leaders of professional and amateur golf participated. WFMY had the only FM coverage of this event, and parts of the broadcasts were fed to other members of the Dixie network, inaugurating the kind of reciprocal origination which will be fundamental in the network operations.

In another place in this issue, 1948 is discussed as a most tremendous "growing up" year for radio, and in particular as the year in which FM jumped to full size almost overnight. WFMY shows what this means in a particular example . . . broadcasting is pushing down a vast number of new roots into the life of America.

A Big Step Ahead for WDNC

(Continued from page 31)

of Station WRAM from Wilmington, and have been in service as long as 20 years. New records of interest are added as fast as they come on the market.

A growing and highly significant class of programs are those which WDNC originates in its own area for distribution on a national scale by the Columbia network. Here is a kind of reciprocity that can have only the most beneficial results for WDNC, and for broadcasting in general. The station with its enlarged service area covering some 37 counties in North Carolina and Virginia has become the distributor of "national" programs for one of the major networks, to a section which is large, prosperous, full of beauty, and local pride, with an admirable balance between industry and agriculture. At the same time, the station can act in the reverse role by letting this fine section of America speak in its "local" voice to the rest of the country. As examples, the 45-voice chorus of North Carolina College, and the Fayetteville State Teachers College Chorus, two local musical organizations of which the community is proud, are both going on network shows through WDNC. As every part of the country "speaks up" more and more in this way, radio broadcasting will be correspondingly enriched.

Telling the Community About FM

When the FM operation, the AM increase to 5 kw, and the shift of frequency from 1490 to 620 kilocycles on AM, were all approved, the promotion department took on its biggest job. The station had to tell its old listeners that a change in dial position was coming, and had to alert its vast number of potential new listeners to the new voice they would soon find at "620". In addition, the FM operation required an educational campaign, in line with the experience of many stations opening on FM, that a majority of listeners will not understand the necessity for an FM receiver in order to tune in the FM broadcasts. Further promotion was built on the special qualities of FM as a medium for broadcasting.

To carry these messages to its potential audience, WDNC used the widest variety of media: billboards placed on state highways; car cards in the Durham and Raleigh buses, which carried a "teaser" caption such as "Soon . . . You'll Tune . . . 620"; match books which had the word "Soon" on the outside, and a brief story about the new transmitters on the inside; as well as regular advertising in the daily papers throughout the area, and a whole barrage of special announcements, growing in number, as the new operation approached, over the old 250 watt channel itself. For advertising agencies and clients, a weekly mailing campaign carried such devices as a card with a miniature golf tee and the caption "Soon WDNC will tee off at 5,000 watts", or a miniature pair of dice showing seven points with the message "It's a natural . . . WDNC and 5,000 watts".

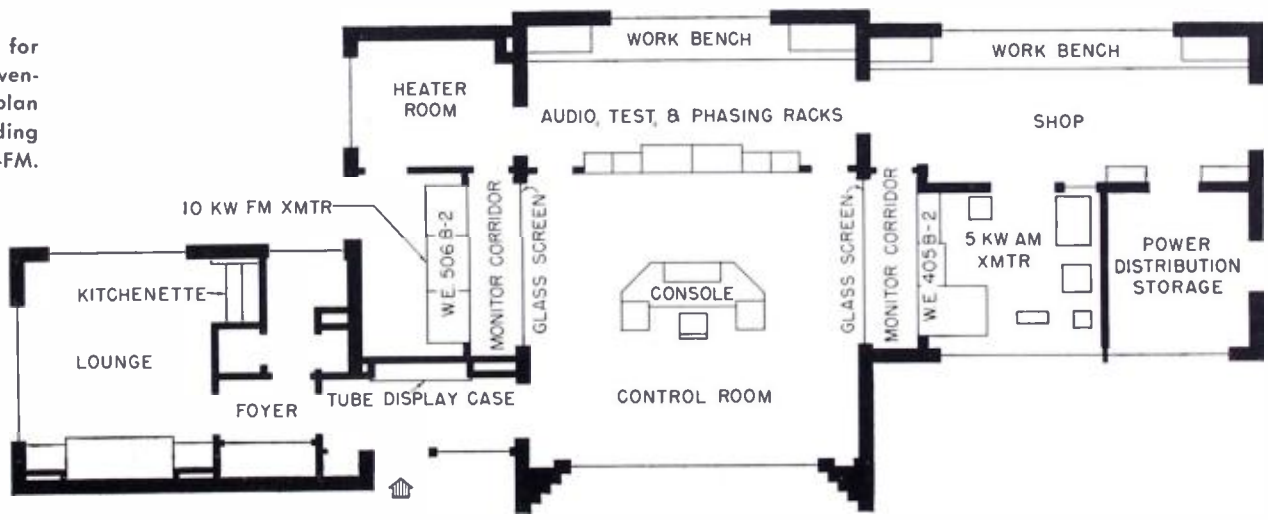
Technical Planning Pays Off in New Building

WDNC's remarkably fine new transmitting plant, six miles from the center of Durham, is an excellent example of the efficient installation that can be made for dual AM-FM operation, with thorough planning for that purpose from the very beginning. Technical planning of the installation, as carried out by Mr. Wilmotte, Mr. De Mars, and their engineers, included not only designing down to the last detail, but seeing it through from the first shovelful of ground to the final "proof of performance" that officially put the new transmitters on the air. In the architectural design of the building itself, the Wilmotte engineers had associated with them the firm of Deigert and Yerkes of Washington, communications architects who are known to readers of the *Oscillator* by the "Transmitter Buildings with a Future" featured in the September 1947 issue.

The floor plan of the new building is shown below. The two transmitters face each other from opposite ends of the control room, each having a monitor corridor and glass screen in front of it. With the audio, test, and phasing equipment across the back of the room, a single operator at the transmitter console in the center is conveniently situated to watch the whole plant in action.

The specially constructed console itself is novel in that it puts in front of the operator all essential meters for monitoring both transmitters. This scheme was worked out by the Wilmotte engineers in close collaboration with Western Electric audio and transmitter specialists, and represents a fairly simple revamping of the standard Western Electric 5 kw AM console to fit it to the new dual role.

On the console are the controls and meters for the two Western Electric 1126C limiter amplifiers; modulation



Careful, direct layout for greatest operating convenience is apparent in plan of new transmitter building for WDNC and WDNC-FM.

meters for both AM and FM transmitters; a VU meter which can be switched to the incoming program line for either transmitter; and input switching facilities for audio lines, microphone, and transcription equipment. In addition, the usual master switches for both transmitters are included.

The convenience and efficiency of the operator have been considered not only in the control console, but in every feature of the technical installation and the building itself. The control room has been designed for a minimum noise level so that accurate aural monitoring is facilitated, and the operator does not suffer from "noise fatigue". The two Western Electric 728B speakers used as monitors, one for the program on each transmitter, are mounted directly over the control console. Because of the excellent acoustic conditions in the room, it is ordinarily possible by "selective listening" to monitor the transmitters individually, even with both speakers in operation. If the operator desires, however, he can use individual controls mounted on the console to fade out one speaker while listening to the other.

No Afterthoughts on the Audio System

The complete advance planning of the audio system in the building produced the highly desirable low audio noise level and operating convenience, *without* any necessity for rearrangement or "improvements" after the system was installed. As explained by Mr. Wilmotte:

"In the ordinary course of events, when a transmitter plant is expanded, the audio system is expanded to match by throwing in an amplifier here, a new conduit there, with frequent trials and almost invariably a lengthy, sometimes desperate cut-and-try process to get the noise and cross-talk down to tolerable levels. At WDNC, under the able direction of Paul De Mars, we were able to do the whole job for the two transmitters in the ideal way. We made a complete system design in advance which will take care of the plant as far as we or the management can see, with noise, cross-talk, distortion, all 'designed out' to levels substantially better than FCC requirements."

A single-wire and ground system connects all audio equipment, with the ground to the building at only one point for the whole system. All conduit was positioned accurately on the plans, with electrical and mechanical characteristics in mind.

The antenna system comprises a three-element array for AM, with the Clover-Leaf antenna for the FM transmitter mounted on top of one of the AM towers.

The building, as can be seen on the floor plan, has ample shop and storage space in addition to the actual operating areas for the two transmitters, and a lounge and kitchenette for the operating staff. In its efficient layout and its long, sweeping modern exterior, it represents the very finest in contemporary transmitter building architecture.

From the very beginning of its plans for expansion, the management of WDNC was determined that it would have the finest transmitter plant that the most careful planning could produce. Western Electric is proud that its transmitting equipment not only served WDNC throughout its period as a 250-watter, but was chosen for the central role in such a superb modern transmitting plant.

How to Boost FM

(Continued from page 25)

on Wheels", a weekly dramatic program written and produced by Ira Walsh in cooperation with the D. C. Traffic Safety Department; and many others.

WWDC is also known as the "Sports Station" of the Capital city. Coverage has been given Washington Senators baseball, ice hockey, basketball and football. There is a daily All Sports Parade program. A number of highly popular disc jockey shows have been developed, with such record-ing-and-comment personalities as Jackson Lowe, the "Mayor of Connecticut Avenue," Milton Q. Ford, who calls himself the "Capital Crackpot"; Les Sand, known as the "Yawn Patrol Man"; Norman Gladney, Mark Austad, Willis Conover, and Bill Cox.

Helen K. Mobberly, National Sales Manager, who directed the "Mr. FM" contest so tellingly, started in radio in 1931 with NBC in Washington, as Secretary to the Sales Manager. She advanced to Assistant Sales Manager for the NBC outlet, then in 1940 went to WINX as Sales Manager, performing the feat of opening that station on the air with $150,000 of time sales already on the books. She has been with WWDC since it opened, and has been National Sales Manager since 1943.

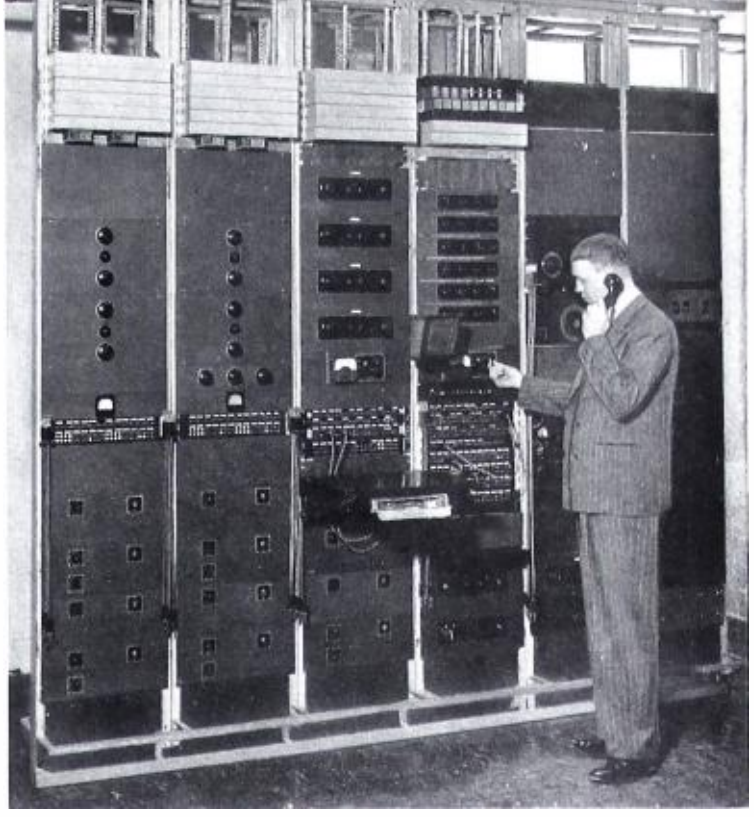
It was appropriate that Chief Engineer Ross Beville should open this story, because he and C. R. Shaffer, Transmitter Supervisor, along with the Western Electric engineers, put intense effort and skill into the problems of installing and testing the 10 kw transmitter, the 3⅛-inch, 400-foot transmission line, and the six-bay Clover-Leaf with its new tower.

Ross Beville was born in Texas, but 1935 saw him in Washington at the Capitol Radio Engineering Institute, after his infection with radio by the "ham" virus. After graduation he held a progression of jobs in broadcasting and in the electronics industry: transmitter engineer, WIBG, Philadelphia; Engineer, Philco Radio Corp.; design engineer, Globe Manufacturing Company; Ass't. Chief Engineer, WINX, Washington; Senior Industrial Specialist with WPB during the war; Chief Engineer of WWDC and WWDC-FM since 1943.

One of his most important interests has been the development of "satellite transmitters", and WWDC's AM booster on 250 watts reflects his belief that boosters are the answer to low-power coverage on AM. He helped install the first "satellite transmitter" authorized by the F.C.C. . . . that for WINX, which went into operation in 1940. He has written extensively on this subject and served on the RMA Committee on Satellite Transmitters, and on the NAB Engineering Executive Committee.

With three transmitters in regular operation, and two of them—the two AM transmitters—on for 24 hours every day, Ross Beville has the kind of job he likes. "I enjoy keeping WWDC and WWDC-FM at the peak of performance," he says, "we have fine equipment. Most important, however, is the fact that with our booster on AM and our 20 kilowatt FM signal, we have an assured basis for our operation as a leading independent station in the Washington area. We are all 'bullish' on the future of our station."

Main Corridor of new WHAM-WHFM studio building from entrance lobby.



Rack in central apparatus room with main, monitor, line amplifiers.

Radio City for Rochester

(Continued from page 21)

The connection of any console output to any one of the six trunks is accomplished by a d-c relay system, which is operated by keys mounted in the upper right of the mixer panel on each console, with the relays in the central apparatus room. With this arrangement, all amplifying equipment actually in the console is of the small, preamplifier type. Two Western Electric Type 129A amplifiers (each of which consists of four two-tube low level amplifiers) supply the eight amplifiers used in each console, six as preamplifiers and two as boosters. The signal leaves the console at about −10 VU for normal program levels, and the additional amplification required is furnished by the main and line amplifiers in the central apparatus room.

This simplification of the audio control system was worked out by Kenneth Gardner, Chief Engineer of WHAM and WHFM, in collaboration with Western Electric's audio facilities engineers. Mr. Gardner has been in broadcasting for 25 years, 20 of which have been spent at the Stromberg-Carlson Co. He describes the operation of his new audio equipment as follows:

"Our scheme of putting all of our large amplifiers in a single line of racks resulted from long and careful consideration of the operating problems inherent in our studio setup. We are delighted with the efficiency and ease of operation of our centralized system. The simplified consoles perform in the effective manner that we had planned."

Rx for Long Transmitter Life

(Continued from page 20)

position. The fact that it has been moved is almost sure to escape attention, indeed cannot be determined in many cases without a retuning, and resetting of a major section—or all—of the transmitter.

There are two principal ways to avoid thus losing your control settings and *both* should be employed, as they supplement each other. The first consists of putting a small dot of the polish at each setting after the transmitter is completely and properly tuned up. The advantages are apparent. Not only can you make a rapid visual check of all control settings when trouble develops; you have a quick and simple, but valuable aid to maintenance. A regular inspection of all the marked control settings requires only a few minutes each time and gives an excellent check on the proper operating condition of the transmitter.

The fingernail polish method of holding on to control settings is an effective and quick visual maintenance aid, but it must be supplemented by a second and more comprehensive maintenance tool—a complete tuning chart for the transmitter. Such a tuning chart should be carefully and completely prepared on a single sheet of paper and posted next to the transmitter after the tune-up is completed, showing not only all control settings, but in addition all meter readings covering normal operation of the transmitter in the tuned condition.

In the panel on page 20 is reproduced a section of the tuning chart which is completely filled in and supplied with every Western Electric 442A or 443A, 500 watt or 1 kw AM transmitter. Similar charts are supplied with every other model of Western Electric transmitter. Every variable quantity or control setting of any significance, covering well over a hundred items for the 1 kw transmitter, is included on the chart, giving a most comprehensive and detailed picture of what "normal operation" means for that particular transmitter, and that particular antenna, operating on the assigned frequency and power.

Keep the Tuning Chart on Tap!

Intelligent use of such a chart will uncover nearly any conceivable type of failure, at least to the extent of showing what section of the transmitter is affected and how the abnormal condition has upset operation. In addition, the tuning chart is a powerful maintenance tool, often enabling the engineer to forecast and forestall trouble, while it is in an early stage of development. For instance, tubes

beginning to lose emission are readily spotted. And yet there have been stations discovered with the tuning chart filed away in some unknown drawer, completely lost to the engineering staff. If not posted next to the transmitter, it should have a fixed place where it is always kept, near the transmitter, for constant and ready use by the operating personnel.

The tuning chart should be a stabilizing influence on the dial grabber, that trigger-happy operator who can cover the distance from anywhere in the transmitter building to the transmitter panel in one and a half seconds. The most important rule, when trouble develops, is *not* to jump to the transmitter and attempt a split-second retuning job—it can't be done that way. The "emergency" will become more serious, the transmitter hopelessly fouled up, if you try to retune without (1) a thorough knowledge of the transmitter and its normal action and (2) a careful analysis of any particular situation, to determine just what is wrong and what should be done about it. For this analysis, you should make it a rule to *take time for a tuning chart check,* at least of the principal meter readings and control settings, before touching the transmitter. Unless the automatic cut-off fails and something is burning up, of course; then you knock off the power in a hurry!

A Dummy Antenna Is Smart Business

For isolating a misadjustment, a dummy antenna is one of the most useful repair tools. If a transmitter's signal drops below normal, and the final stage is not operating in a normal fashion, it will generally be impossible to tell whether the antenna or the transmitter is out of adjustment without time-consuming measurements with an accurate r-f bridge, particularly with antenna arrays. A misadjusted antenna can of itself upset the action of the final stages of *any* transmitter. An attempt to correct such an *antenna* fault by corrective adjustments on the *transmitter* can result in an endless snarl and the transmitter may be damaged.

On the other hand, if a simple and ready means of connection has been provided, in a matter of minutes the dummy antenna can be connected and the transmitter fired up. If the output stages now behave normally, the trouble has been identified as antenna misadjustment or failure, and a great deal of going around in circles avoided. Conversely, if the output stages are misadjusted, a quick realignment can be made with the dummy antenna in place. Various types of dummy antennas are available, the characteristic of all acceptable types being that they present a non-reactive—pure resistive—load of the proper value to the transmitter output, and are capable of taking the full modulated r-f power output of the transmitter without going up in smoke.

Don't Let Your Blower Loaf

There are a number of operating habits that come under the heading of "maintenance", since they help keep the transmitter in good condition. One questionable practice common in some low power stations is the cutting off of the blower temporarily while announcements are made from the transmitter control room. No possible good can come from thus allowing the power tubes to overheat, even for relatively short periods. Some form of isolation for the microphone, for reducing any noise that may be created by the blower, is more economical in the long run than turning off the blower for announcement periods.

When a transmitter has been cut off, the blower should be allowed to run for another few minutes to clear all the hot air out of the cabinet. Cutting the power and the blower at the same instant produces a temporary rise in temperature in the power tubes which is similar to that occurring when an automobile motor is switched off and the cooling system stops operating. Repeated temperature rises of this kind may cause deterioration or damage to the tubes or other components.

Don't Keep Tube Records on Tube Cartons

In keeping track of the condition of spare tubes, it does not pay to write "n.g." or "fair" on the tube carton, because it has been found that tubes will invariably get into different cartons than those intended. Once a switch of this kind occurs, that "good" tube on the shelf that has given you a nice comfortable feeling for several months and that you need in a big hurry some cold night, often turns out to be the "n.g." tube that was supposed to be thrown out the back door weeks or months before. Mark the bases of the tubes themselves, another use for that nail polish—or you can keep a card file on which the tubes are positively identified, by serial number, tearing up the card when any tube is finally junked.

A ten to fifteen minute filament warm up, when the transmitter is turned on, has proved itself as a tube-stretcher. This also gives you a chance to inspect all the tubes in the transmitter before the plate voltage is applied, so that you don't attempt to go on the air with an open filament or heater somewhere in the equipment.

Knowledge Is Your Strongest Maintenance Tool

The most important "maintenance" procedure of all is implied in much that has been said above, but it needs to be emphasized as strongly as possible. It is for every member of the engineering staff to acquire a complete knowledge of your transmitter, of its theory of operation, of the normal function of each section and part, of what happens when different controls are misadjusted. Study the instruction book prepared by the manufacturer, if possible before your transmitter goes on the air, and keep it in an accessible place for use by the engineering staff. The manufacturer has spent a large sum of money and considerable time in getting down on paper all the things you need to know for top-efficiency operation of the transmitter.

There is no substitute for this kind of knowledge. It will pay big dividends to you personally, and to the station management, in the operation of *any* make or model of transmitter. After all, you are going to spend a heck of a lot of time with that transmitter—you are going to live with it day in and day out. The really smart engineer will get a satisfaction out of knowing accurately what happens on the inside—and will not overlook the advantage that comes from being in real control of the transmitter's "health", with quick, positive and accurate action prepared for all events in the transmitter's career.

Contributors to this issue

W. W. CARRUTHERS, author of *Mutual-Don Lee's New Hollywood Home,* (page 4) is Chief Engineer, Studio Division, Don Lee Broadcasting System. In this position he has been responsible for the vast amount of engineering planning that has gone into their new network center. Not content with taking his acoustical information out of the text books, he carried out his own original research on the subject and incorporated his findings in the acoustical design of the new studios. The results—better acoustic quality for Mutual-Don Lee's Hollywood programs. Mr. Carruthers specialized in acoustical and electrical engineering at the University of California and then joined Mutual-Don Lee as a program technician in 1938. From 1942 to 1945 he was a project supervisor for the University of California's Division of War Research. In 1945 he returned to Don Lee as Director of Research and immediately waded into the task of determining the acoustical and equipment needs of the future building. In 1947-48, as Chief Studio Engineer, he has carried out these plans as technical coordinator for the new building. Mr. Carruthers is a member of the Acoustical Society of America.

C. W. REYNOLDS, co-author with R. N. Marshall of the story of church acoustics, *Now the Service Can Be Heard,* (page 34) was graduated from the University of Delaware in 1923 in mechanical engineering and went to work for Westinghouse. He came to Western Electric in 1930 to work on coil development. Two years later he transferred to the Radio Shops Division in Kearny, N. J., to handle manufacturing planning for all types of radio transmitting and receiving equipment. From this, Mr. Reynolds went into sales in 1939 when he was given the job of promoting the sales of microphones, loudspeakers, airborne radio and similar apparatus. In 1941 he was placed in charge of the Engineering Division of Radio Shops. During the war years he was assigned to several of Western Electric's war-born plants to organize them from an engineering standpoint. In 1944, he was promoted to Operating Superintendent of one of the units of Radio Shops, and when the radio manufacturing activities were transferred to North Carolina in 1946, he moved to the South as head of the Burlington Unit. Later that year he was made Superintendent of Manufacturing Engineering for all of the Radio Shops.

R. N. MARSHALL, co-author of *Now the Service Can Be Heard,* received a cosmopolitan education at schools in China, the Philippines and the United States before entering Princeton University, where he was graduated with a B.S. in Physics in 1930. His next stop was Columbia University, where he did work in the Graduate School. From there he went to Bell Telephone Laboratories to work in acoustical research and development. In 1937 he was a Department Chief in microphone development, and three years later moved to Western Electric to work in sound instrument engineering. During the war he was engaged in radio and airborne radar engineering, and in 1944 he was made a Division Chief. When the Radio Shops moved to North Carolina, he was transferred to the Winston-Salem Plant. Mr. Marshall holds five patents on microphone construction and two on microphone styling, and is the author of a number of technical articles which have appeared in various engineering magazines. At various times he has been a lecturer on microphones and an instructor on technical subjects. He is a member of the Acoustical Society of America.

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