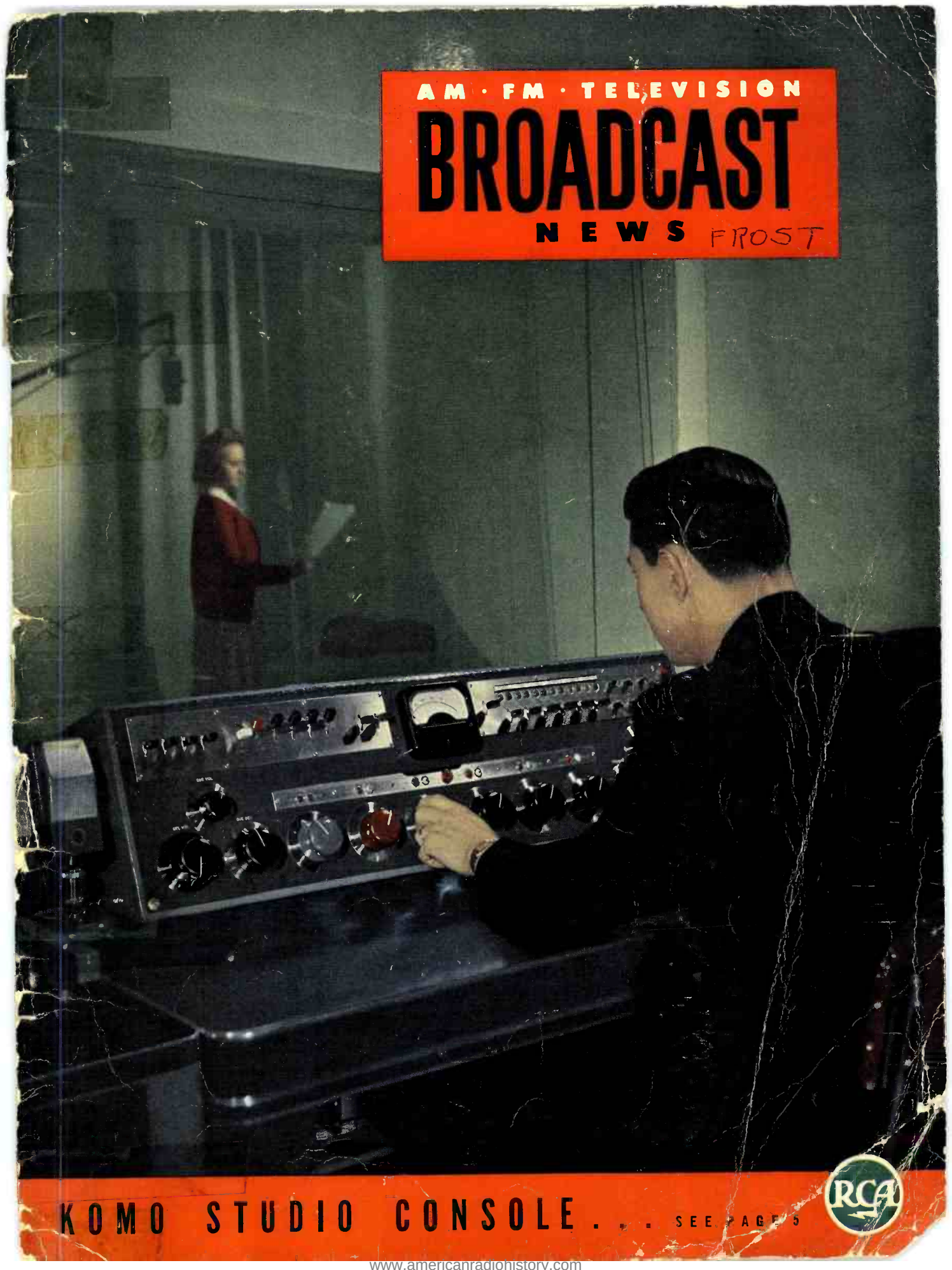


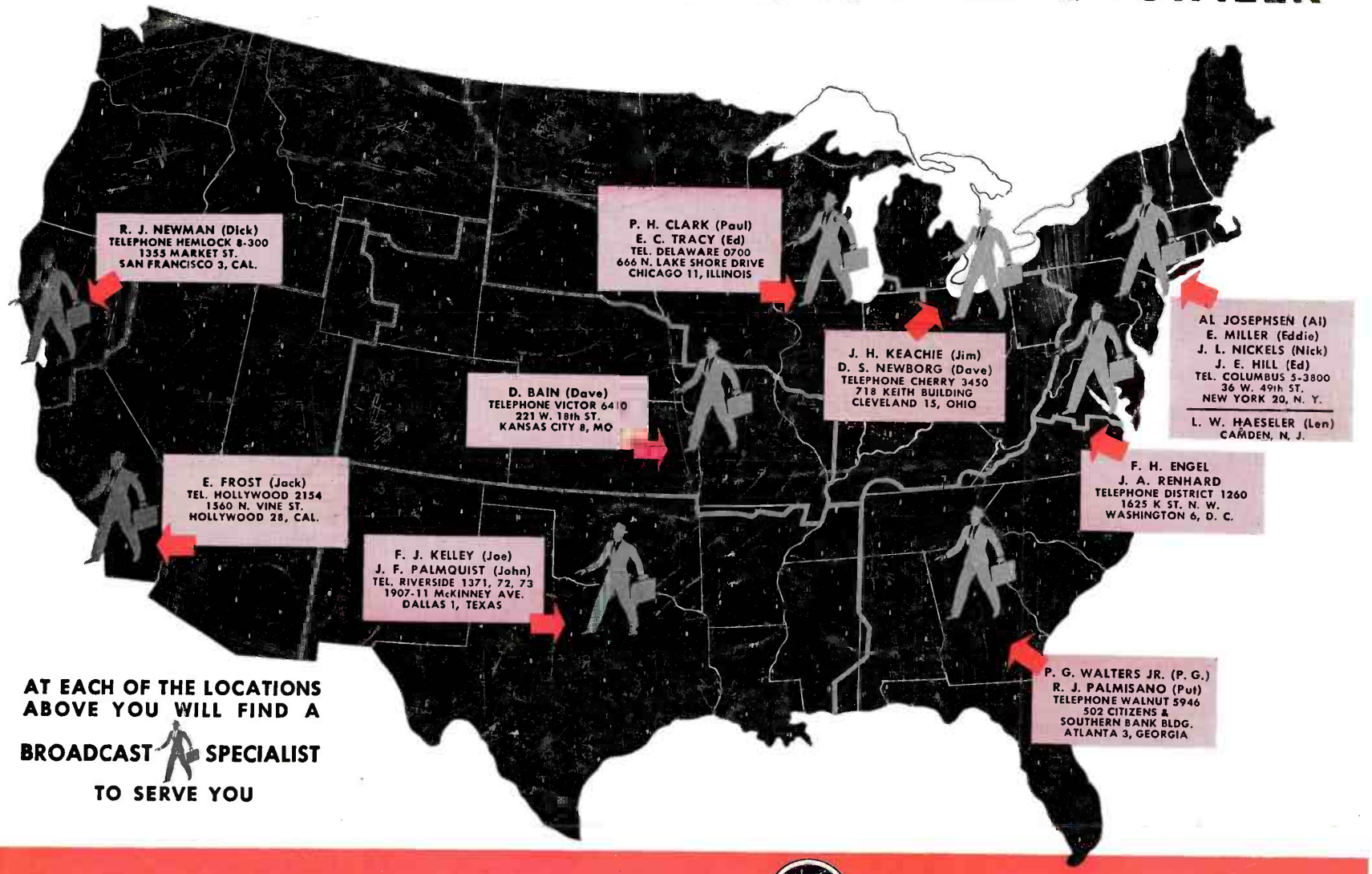
AM · FM · TELEVISION

BROADCAST NEWS

FROST

KOMO STUDIO CONSOLE . . . SEE PAGE 5

FOR QUICK ACTION ON EQUIPMENT PROBLEMS CONTACT YOUR NEAREST RCA FIELD ENGINEER



AT EACH OF THE LOCATIONS ABOVE YOU WILL FIND A BROADCAST SPECIALIST TO SERVE YOU

WHERE EXPERIENCE COUNTS MOST RCA **AM · FM · TELEVISION**

Broadcast News

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Published by the

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JOHN P. TAYLOR, Editor — JUDY J. ALESI, Ass't Editor

W. O. HADLOCK, M. L. GASKILL, Associate Editors

Contents

OUR COVER shows one of the special studio control consoles which was a part of the equipment our custom audio group supplied for the new KOMO installation. The Kodachrome was made by Rod Allen of our photographic department at the time these units were being tested in our engineering laboratory.

COLOR PHOTOS for use on our cover are always welcome. If you have any Kodachromes you think might be suitable, send them along. We'll take good care of them and return them (whether or not we use them). There are several things to keep in mind in judging suitability. For one thing we like to use transparencies not smaller than 4″ x 5″ in size. In theory, 35mm shots can be blown up to our cover size—in practice we have not had much success doing it. Another requirement is that the illustrations have vertical proportions—i.e., be 4″ wide by 5″ high, rather than the other way around. Of course, we can "crop" the picture to get our desired ratio of height to width. However, this is only practical if the subject matter is in roughly the same proportions—and there is enough margin available. Another thing to remember is that we have to get the BROADCAST NEWS title cut in somewhere—preferably at the right or left top of the picture. Finally, there's the little matter of appropriate subjects. Naturally we like shots of RCA equipment or installations. However, that's not an absolute requirement. If it's good enough—and if it's sufficiently interesting to broadcasters—we'll do our best to be unbiased.

KOMO, KOMO, KOMO, KOMO, KOMO, KOMO, KOMO, KOMO; This issue is full of it. Why? Well, first, because it's one of the newest and finest installations in the country—with many unusual features in which other station engineers will certainly be interested. Second, because it is a particularly well-engineered job—so much so that the manner in which the KOMO engineering staff went about planning it is in itself an interesting story. And, third, because it's all RCA equipment—a fact of which we are naturally very proud.

Most of the KOMO story is pretty well told in the several articles beginning on Pg. 5. However, there is one interesting angle which (probably because of the modesty of the men involved) is only hinted at. This is the high degree of importance which KOMO attaches to the engineering part of its operations, and the esteem in which its engineering staff is held. Much of this, no doubt, is due to the fact that Mr. O. W. Fisher, President and General Manager of KOMO, is himself an engineer—or maybe we should say, an "engineer-turned-manager"—and he is always much interested in the engineering plans.

KOMO's engineering staff is headed by Francis Brott, Chief Engineer, Stan Bennett, Studio Supervisor and Cliff Miller, Transmitter Supervisor. These men can boast, between them, of as much experience as any station anywhere. Nevertheless, when KOMO decided to build a new plant, the first thing these men did was to make a survey of all recent station installations. Many of them they visited in person. They also collected all the available information from network and manufacturers engineering staffs. When they thought they had every bit of up-to-date information they sat down to plan their "dream" station. This procedure is typical of the KOMO operation. And the new KOMO plant bespeaks the success of it.

The material contained in this issue is the contribution of many members of the KOMO staff. However, we are especially indebted to Stan Bennett for acting as our KOMO liaison and for patiently answering all our queries and carefully collecting all the photos, drawings and other information we wanted—not to speak of writing much of the copy himself. Thanks, Stan.

Broadcasting's favorite

DELIVERY NOW

Now sold! Over 1,000 consolettes of this series

The Features

- Four pre-amplifiers.
- Over-ride facilities for all remote lines. Permits engineer or announcer on remote broadcast to "call-in" by over-ride on control room speaker.
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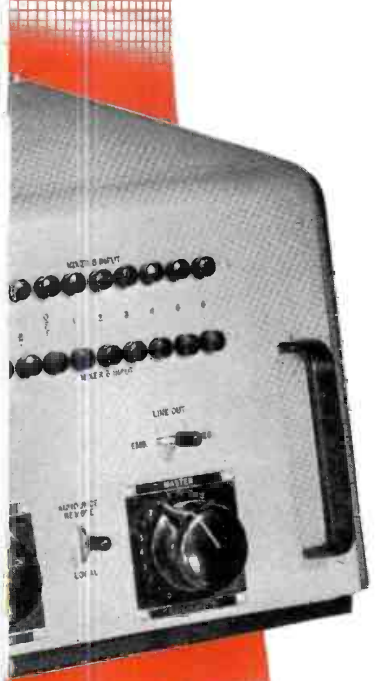
- No lost time due to possible failures of amplifiers or power supplies. Emergency operation may be obtained quickly by means of switches.
- Headphone monitoring across output line, monitor and external source, such as network.
- Recorder feed.
- Low-noise, low-microphonic type-1620 tubes.
- Built-in isolation coils for remote lines and turntable booster amplifiers.

Consolette . . .

for AM, FM and TV



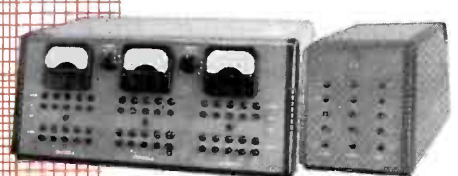
NOTHING like the 76-B5 Consolette to keep studio programs and rehearsals in motion. Because there's nothing like it for flexibility and easy operation. It provides program quality that meets FM requirements. It has full facilities for simultaneous auditioning and broadcasting . . . for practically any combination of studios, turntables, or remote lines. It performs all the amplifying, monitoring, and control functions of most large and small stations—AM, FM, and TV sound.

Here's where you use it

- For two-studio operation, using two microphones in each—one announce booth microphone, and one control-room microphone.
- For two transcription turntables using external booster amplifiers.
- For single-studio operation . . . using four microphones, one announce booth microphone, and one control-room microphone.
- For remote lines—up to six! With independent control of each.

For complete technical information on the 76-B5, the consolette that's backed by more than 20 years of broadcast engineering experience *in the field*—call your RCA Broadcast Sales Engineer. Or write Dept. 19GB.

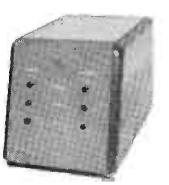
NOW . . . Switching Systems for RCA Consolettes



Master Control Sub-Control

Type BCS-1A—Handles the output of as many as five control consolettes. Feeds three outgoing lines. Enables you to monitor studio, network, recording room, remote inputs. Switches these inputs into transmitter or network lines.

Type BCS-2A—For the smaller station requiring only two RCA consolettes. Handles up to four studios and two announce booths. Routes your program to two outgoing lines (AM, FM, or either transmitter and a network lines).



Sub-Control

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RADIO CORPORATION of AMERICA

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The HIGH-FIDELITY RECORDER...

...for The Studio Professionalist

RCA Type 73-B

RCA 73-B RECORDER, with its optional cabinet type MI-11827

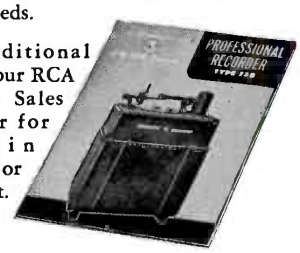
DESIGNED with almost every known device for cutting your high-fidelity reproductions, this professional recorder has everything you need for versatile control of cutting to meet any recording situation.

● For instance, a new improved cam-operated lowering device prevents stylus damage and overcutting . . . because it enables you to lower the flutter-proof cutting head gently with decreasing speed as the head approaches the spinning record.

● For instance, start and finish spiralling is controlled by a *separate* motor . . . push-button operated. Spiralling pitch: approximately 6 lines per inch at 78 rpm and 2.5 lines per inch at 33⅓ rpm.

● For instance, *you can change cutting from inside out to outside in* by the simple turn of a dial . . . without adjusting the lead screw or driving gears. The pitch is continuously variable, while recording, from 96 to 152 lines per inch to handle program overruns. During actual running, too, you can adjust the stylus cutting angle and cutting depth. Groove grouping is eliminated because the head rides smoothly along a tubular enclosure that protects the feed screw. An automatic equalizer . . . available on special order . . . compensates for recording-level variations due to changes in surface speeds.

For additional facts ask your RCA Broadcast Sales Engineer for Bulletin 1J3137 . . . or write Dept. 30-L.



CHECK THESE SPECIFICATIONS

Frequency response	30 to 10,000 cycles, ± 2 db
Head sensitivity (groove velocity 6.3 cm/sec., 0.00079" peak to peak at 1000 cps)	+30 dbm (1.0) watt
Turntable accuracy	± ½% 33⅓ or 78 rpm
Speed regulation (wows)	0.14% rms at 33⅓ rpm 0.07% rms at 78 rpm
Turntable drive	2 hysteresis type synchronous motors, using rim drive through rubber idler rollers
Type of stylus	Sapphire or Steel
Microscope	36 power Spencer

RCA

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Salute to

KOMO

SPECIAL SECTION
OF BROADCAST NEWS VOL. NO. 51

KOMO ARTICLES IN THIS SPECIAL SECTION

The KOMO studio building as it looks at night. An all-glass entryway provides a view of the main operations' corridor.

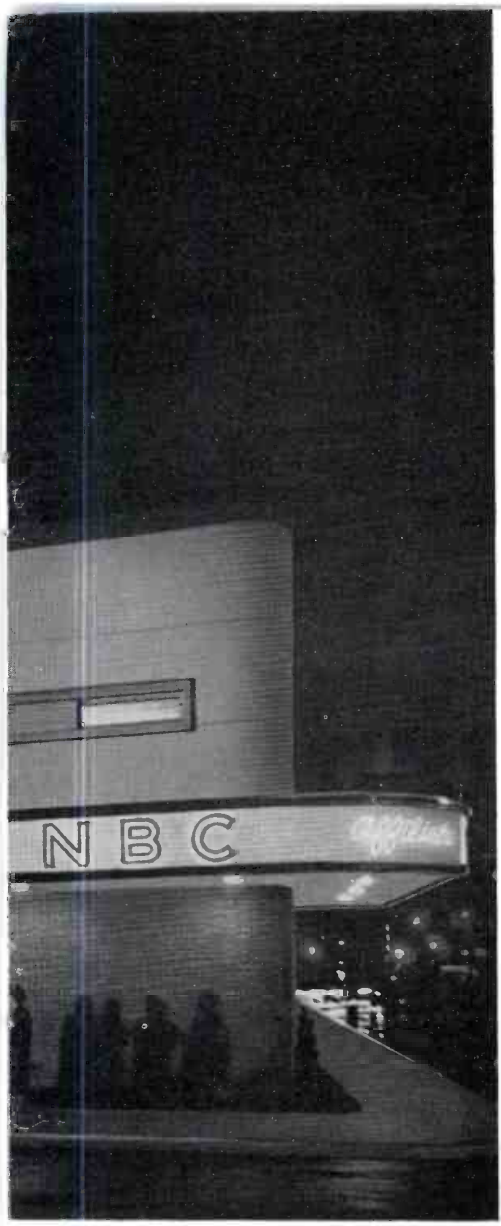
KOMO BUILDS A NEW PLANT

Seattle Stations New Studio Building, New 50,000 Watt Transmitter Building and All-New Studio and Transmitting Equipment Make It One of the Finest Anywhere - Full Details of Planning, Construction and Equipment In This Issue

KOMO has something every broadcast station engineer must have dreamed of—a completely new plant. And when we say complete, we mean complete; for KOMO's new setup includes (a) a new studio and office building at a new locaton, (b) a new transmitter building and antenna system at a new site, and (c) completely new equipment for both studio and transmitter.

The showiest part of the new layout—and the part which the public, of course, sees most—is the new studo building shown above. In this new broadcasting center, the largest and finest in the Great Northwest, the most advanced equipment and building techniques have been combined in a layout introducing new principles of studio design and operations.

Here, to an unprecedented degree, working radio has been placed on permanent public display. With five of KOMO's six broadcasting studios, plus its news room, grouped around a single operations control



center visible to pedestrians from the street, Seattleites can follow the comings and goings of announcers, celebrities and engineers without even crossing the threshold of the station.

Conceived by O. W. Fisher, the engineer-president of Fisher's Blend Station, Inc., NBC affiliate, which owns and operates the station, the studio building was designed in collaboration with station engineers, headed by F. J. Brott, Chief Engineer, and erected by the Austin Company, whose long experience and pioneering research in studio construction is reflected in many innovations.

Located at the head of Denny Way, along which the city's main business district is expanding, the two-story-and-basement reinforced concrete studio building occupies one-quarter of a block, which is ultimately to be developed by the addition of an FM and television tower adjacent to the studio building and additional broadcasting facilities. Provisions have been made in the present building for the addition of another floor.

Six studios, in addition to offices, news rooms, recording rooms, client's rooms, etc., are housed in this building. One of the studios is a large auditorium type for audience-participation show. Two medium-sized studios are provided for group-participation shows and three small studios for news, interviews and vocalists.

All of these studio units have been designed in accordance with the most advanced isolation practice, each being erected as a "room within a room" with floors, walls and ceilings completely separate from the surrounding structural elements. Floors, for instance, are "floated" on the structural concrete floor slabs by means of steel isolators, while ceilings are suspended in similar fashion. All walls and partitions are self-supporting and stand entirely free of the structural walls and columns, while glass panels, doors, and the like, have been mounted in special isolating materials which preclude the setting up of disturbing vibrations.

Acoustical treatment of the individual studios, control rooms, sound locks, as well as the auxiliary areas and air-conditioning system, was developed to assure maximum technical perfection for the full range of broadcasts originating from these studios. Perforated transite, backed up with rock wool, has been used with plywood to provide the combination of "live and dead" wall surfaces for effective acoustical control in the small studios, control booths and sound locks. The two larger group studios and the audience participation studio have been treated with a combination of polycylindrical and splayed wall and ceiling surfaces in design calculated to produce precise reverberation and sound values.

The same concern for functional efficiency which governed the design and layout of the operating facilities controlled the development of the architectural features, the lighting installation, the air conditioning system and the color scheme, as well as the selection of furnishings for the individual offices, public areas and studios.

The KOMO studio building, and the transmitter plant as well, are models of functional efficiency. Because of this, and because the KOMO plant represents one of the largest installations of modern broadcasting equipment, we have decided to present in this issue as much information as possible on the planning, construction, and equipment of this station. We are doing this because we feel that all station engineers contemplating the start of new installations will be interested in "the way KOMO did it."

BELOW. The beautiful wood-panelled lobby of the KOMO studio building is dominated by this mural "Across Horizons," by E. T. Grigware.

FIG. 1. The all-new KOMO was planned by Mr. O. W. Fisher, President and General Manager of KOMO and Mr. F. J. Brott, KOMO's Chief Engineer. Illustration above shows Mr. Fisher (right) and Mr. Brott (left) checking plans for the 542-foot FM/TV tower which is being erected adjacent to the new KOMO Studio Building. The tower will support a 4-section RCA Pylon for FM and a 3-section RCA Superturnstile for Television.

PLANNING THE NEW KOMO STUDIOS

FRANCIS J. BROTT
Chief Engineer, KOMO

STAN BENNETT
Assistant Engineer, KOMO

Foreword

More than three years ago, when the active planning and drafting of new studios for KOMO was begun, the drafting board contained only rough sketches, a collection of ideas accumulated over more than two decades of broadcast activity. When the first requirement was laid down by management—"Make this construction the most modern and completely functional broadcasting studio ever built"—serious thought was given as to just what a modern studio design should be.

Attempting to fulfill this requirement meant knowing what other leading stations and network centers were doing. KOMO executives and engineers and their architectural associates made trips throughout the country studying radio stations and motion picture sound stages. They drew from the experiences of men throughout the nation whose experience in radio broadcasting dates from the industry's infancy. Appreciation is here acknowledged to the many radio executives and engineers, whose invaluable contributions of ideas and suggestions were usually prefaced with, "Well, if we were doing it again, this is what we'd do . . ."

These experiences of others, plus KOMO's own background of 21 years as NBC Pacific Northwest outlet and affiliate, have been brought together in a building and studios that we're proud to describe for BROADCAST NEWS.

Traffic Flow Chart

Laying out a completely functional floor plan for studios and offices was at first more or less hit and miss doodling until the Traffic Flow Layout Diagram (Fig. 2) was developed. This block type diagram indicating the functioning of this particular

station gave a logical starting point for studio and office arrangement, minimizing steps and lost time, keeping artists, engineers and public all routed for minimum conflicting traffic and thus facilitating efficient operation.

A description of the overall building (Fig. 3) is probably in order before describing some of the reasons for its design. The structure is two stories, reinforced concrete, with design provisions for a third floor. It houses 6 modern studios including a small theatre type studio; 2 large studios, one for pipe organ and orchestra, the second for drama groups and general purpose use; 3 small studios for guest speakers and small groups; conference rooms; offices for 60 or more employees; an FM transmitting plant; shops; current expansion space and provisions for addition of two television studios, one by removing a temporary wall.

Functional Design

A study of the floor plans, Figs. 4 to 7, and the above mentioned Traffic Flow Chart reveals some functional design points:

(1) Five studios and four control booths are conveniently grouped about an Operations Supervisor's Headquarters which has full visual as well as electrically indicated supervision over studio operating entrances, master control room and recording room.

(2) Operations Headquarters commands a full view of the public entrance and an "operational corridor". The latter handles a large part of the staff traffic flow and minimizes personnel to handle guest speakers and special artists requiring assignment of studio space and announcers (see illustrations on Page 16).

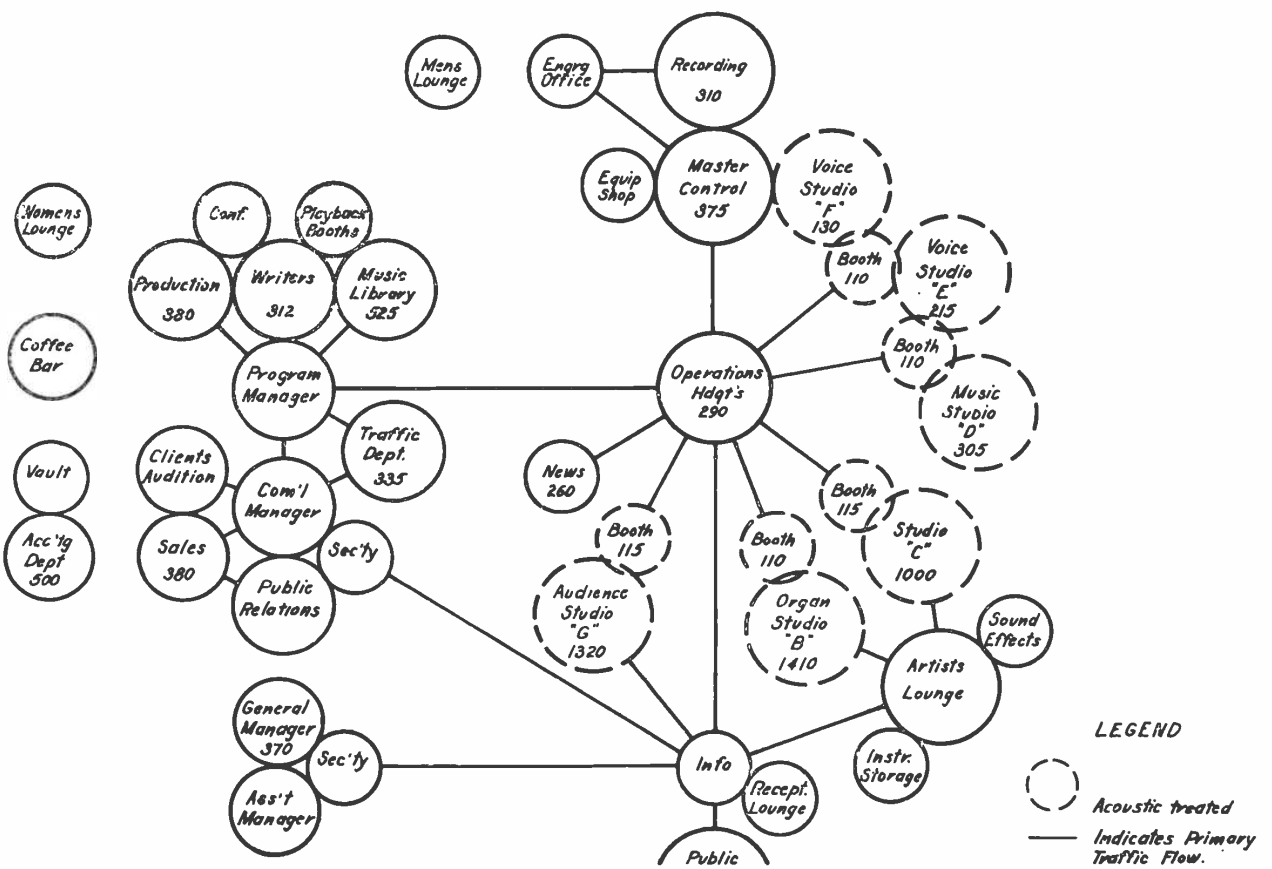
(3) Master control room has visual contact with two control booths, station supervisor's headquarters and the recording room. It is also available for alternative direct control of one studio (see illustrations on age 17).

(4) Two large studios that accommodate groups of artists each have an artist's entrance from the main floor separate from operating corridor and entrances. Sound Effects Storage, Instrument Storage and an Artists' Lounge are all logically entered off the artist's corridor (see illustrations on Page 16).

(5) A public entrance apart from operational corridors and entrances is set up for the audience studio located on the lower floor level.

(6) A gradation of studio sizes was designed physically and acoustically to accommodate the variety of programs originating from a station of 50 KW size. The range from 1000 cubic foot "F" to

FIG. 2 (below). First step in laying out the floor plans for KOMO's new studio building was to make up the "Traffic Flow" diagram shown below. By using this diagram as a guide it was possible to plan the various working areas so that the number of steps taken by engineers, artists and other staff members in performing their normal duties would be reduced to a minimum.



TRAFFIC FLOW AND PRELIMINARY LAYOUT DIAGRAM
RADIO STATION KOMO

FIG. 3. The complete KOMO studio building is shown above. Of reinforced concrete construction it presently houses six studios, is designed for the addition of another floor if future expansion for FM and TV require it.

26,000 cubic foot "B" studio was based largely on experience of requirements.

(7) Adequate storage space adjacent to each studio has been provided to house extra chairs, flats, and what-all that collects in the average studio.

(8) An interesting feature of the small studios is the location of control booths, so planned that any of the three studios can be controlled from either of two booths. In addition, one studio can be controlled from the master control position. This allows for flexibility in that one control engineer can handle two consecutive programs in different studios (see illustration on Page 20).

(9) All studio entrances are through sound-locks, a practical necessity even with the special 3-inch layer built "sound-proof" doors.

(10) Client's Viewing Rooms for studios "B" and "C" are both accessible without entering staff corridors or office area.

(11) The upper floor is devoted to the executive and business operations of the station. Each group is placed to facilitate business and programming operations. All are acoustically treated and carpeted.

(12) Convenience to both Program and Sales departments has been increased by making available separate conference rooms adjacent to each department. Two playback booths for checking and cueing transcriptions are adjacent to the Music and E.T. Library, while another playback booth is adjacent to the Clients Audition Room. The latter booth is for use of salesmen and clients in listening to "air check" and E.T. programs.

(13) Further interesting features on the first floor are the location of the news room adjoining the entrance lobby with its plate glass windows, allowing full public view; lounge areas for both musicians and station personnel off duty, and centralizing technical mobile units, storage and shops in logical area behind master control.

(14) In the lower floor area there is an auditorium-type studio complete with stage. The control booth for this studio is arranged to allow full view of audience and stage area—a valuable feature for audience participation programs (illustration on Page 21).

Air Conditioning—Lighting

A modern studio building is necessarily completely air conditioned. In the KOMO building air is carefully humidity controlled for consistent acoustic conditions. In addition the air is filtered for dust and odors. A 50-ton capacity refrigeration unit cools the air when necessary.

Lighting of studios was chosen on the basis of investigation into successful lighting in various studios throughout the country. Incandescent lamps in flush mounted Holophane controlens units are arranged in two intensity levels of lighting giving an average of 35 foot candles at script height. A lower intensity of light is used for studio set-ups and maintenance. A single lamp in the center of the ceiling is used as a passage lamp to save frequent turn-ons of the main lighting. Indirect cove lighting has been used for effect lighting in the Public Lounge and similar areas.

Studio Isolation

The location of the new studios is adjacent to an arterial street. A reasonable requirement, but difficult figure to realize in studio design is 100 decibels of sound isolation. This specification assured the loudest street noises, fire-engines and ambulances included, will be unheard inside the acoustic treated double-walled studios. Likewise the loudest orchestra will be in-

FIG. 4 (right). The entire street floor, except for the entrance lobby, reception lounge and a corner office, is devoted to studio activities. The arrangement of three intimate studios and two larger group accommodation studios—all of different sizes—along a central operations corridor has made it possible to hold the maximum distance between the master control console and the individual studio control booths to approximately fifty feet. The grouping of the three smaller studios, D, E, and F—side by side along an outer wall—has made it possible to serve all three by a pair of identical control booths, each of which serves two of the three studios.

The master control console is located at the head of this studio group at a point from which both of the control booths, and parts of the three studios, are visible. The engineer at the master control can handle broadcasts from Studio F without leaving his station, so that network broadcasts or recordings can be coordinated with live announcements and programs. The larger group accommodation studios, B and C, have been located parallel to each other, with a director's booth between them to permit the use of these facilities in combination. Combination broadcasts requiring the use of Studios B and C are controlled from a single booth in Studio B.

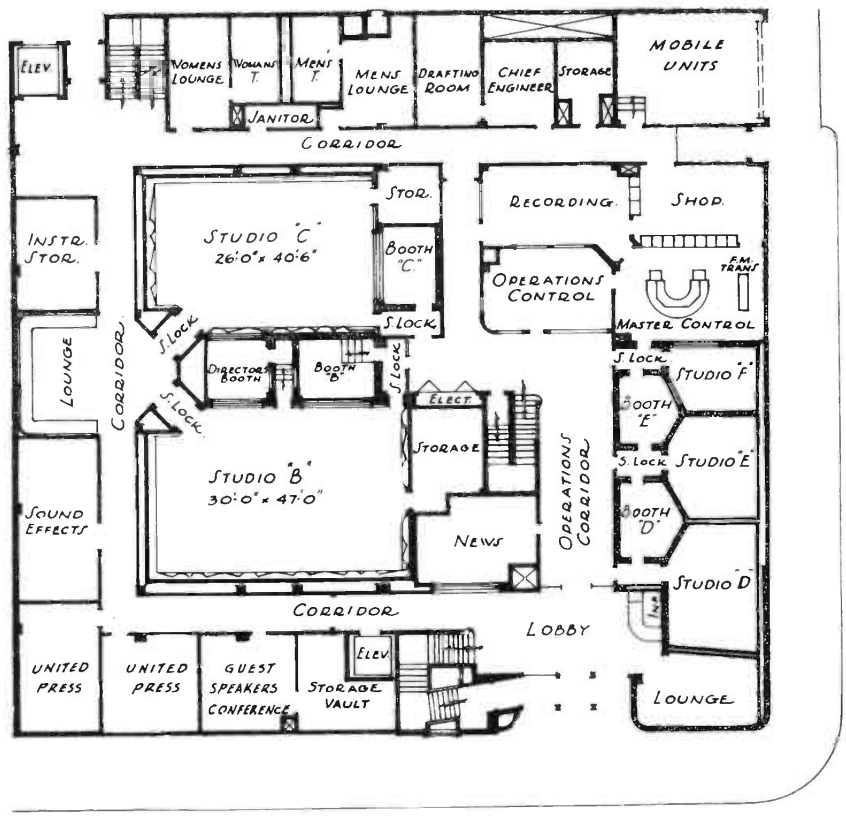
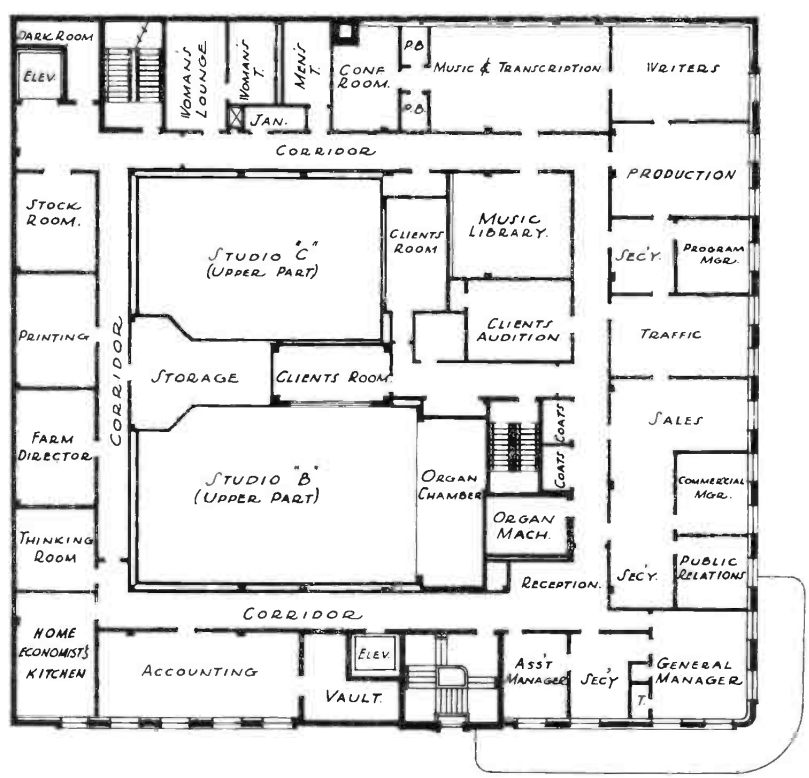


FIG. 5 (lower right). Clients' booths for the two larger studios have been strategically located on the second floor level at points from which broadcasts can be observed. The clients' audition room is also located on the second floor, where machinery for a large, modern organ and spacious organ chamber serving a movable console in the larger studio have also been installed. The executive and business offices, music and transcription libraries, script writing and program departments, a test kitchen and a "thinking" room occupy the balance of this floor.

audible in an adjacent studio. Isolation is achieved from street noise by: (1) 8-inch concrete wall, (2) 6-inch airspace, (3) 2-inch rock-wool blanket, (4) 4-inch pumice block floating wall built on 2-inch cork, and (5) a 2-inch rock-wool blanket and associated acoustic wall treatment supported on a floating floor.

The floating floor is a second concrete floor supported on spring and felt clips from the 6-inch floor slab. The ceilings of all studios are likewise suspended from the structure on acoustic isolators.

Air conditioning residual noise requirements and isolation were made especially rigid with a view to future FM broadcasting and improved minimum noise in equipment and studios. All air ducts are treated inside and out with 1-inch duct-liner and have a calculated minimum of 125 decibels attenuation between studios. The noise of air conditioning plus residual has been specified as equal or less than plus 20 decibels above ASA 0 level.



Acoustics

The acoustical excellence of radio studios designed for music broadcasts is determined largely by the degree of realistic reproduction. To achieve this realism the

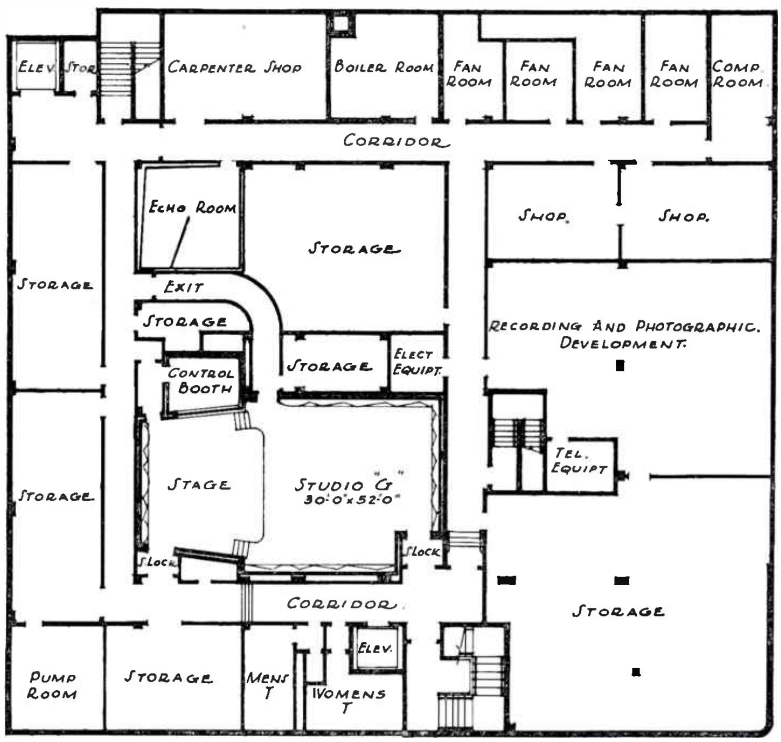


FIG 6 (left). The basement floor of the KOMO studio building provides space for Studio G, which is a large audience-participation type studio, and for all of the storage, maintenance, heating and ventilating facilities. The audience studio is provided with a large control booth fronting directly on the stage—so that it has a good view of both the stage and the audience. Folding chairs are used so that if occasion demands, the entire area may be used for artists.

An interesting feature of the KOMO layout is the fact that the traffic to and from the large audience participation studio on the lower level is handled over a stairway leading directly from the entrance vestibule to this studio, so that there is no occasion for these groups to enter the carpeted reception lobby.

FIG. 7 (opposite page). These three building "sections" show the vertical arrangement of the KOMO studio facilities. Studios B and C are two stories high, with the client's booth located directly over the control booth in each case. The floor level in the audience part of Studio G was made lower than the rest of the basement floor level in order to provide the necessary height in this studio.

music studios, "B", "C", and "G" combine wood paneling for concert hall resonance with polycylindrical construction to provide maximum dispersion of sound and increased life and brilliance to music broadcasts without objectionable echo or standing waves.

These studios contain a number of plywood cylindrical sections, approximately 1/3 of the wall and ceiling area, with the remaining area balanced by veed splays of Transite backed by 2 inches and 4 inches of rock-wool. An appropriate proportion of hard paneling gives studio acoustics proper reverberation. The Transite and rock-wool treatment offers an additional advantage besides its utility and durability in the ease with which the acoustics may be changed by adjusting the proportion of rock-wool backing.

All large, flat surface are broken either with convex cylindrical sections or splays of Transite. Absorbing areas are dispersed to achieve an approximate logarithmic decay of sound.

The degree of "liveness" of the studios is staggered according to the use for which they are designed. Studio "B", containing the organ, is designed to give a longer reverberation time of 1.2 seconds than is studio "C", a general purpose studio, with 0.6 seconds reverberation time. Studios primarily for speech as "E" and "F" are less live in proportion to their cubic volume than "B" or "C".

A general guide used in these calculations was NBC's "Optimum Reverberation Time for Radio Broadcasting", containing data which plots optimum reverberation time versus room volume and is based on practical experience in studio design and usage.

All studios are dimensioned on the cube root of two ratio of height, width and length, minimizing the possibility of standing waves.

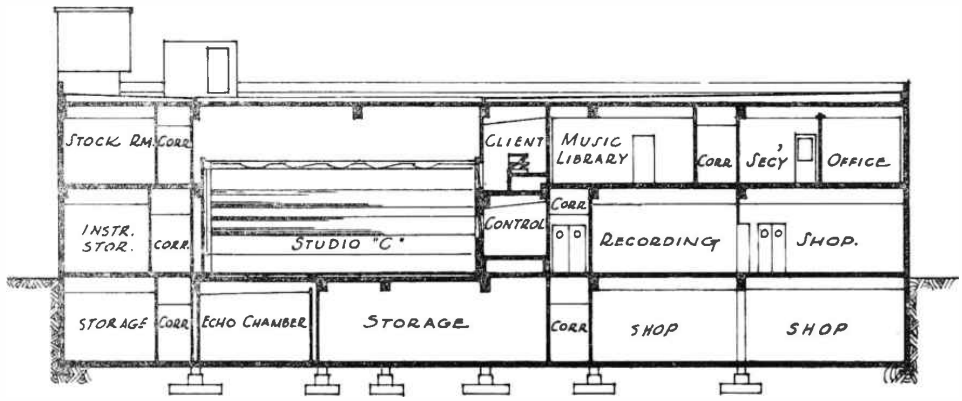
Technical Equipment

The special requirements of multi-studio operation and interlocked switching made it desirable to "custom build" the studio control consoles and the master control supervisory console. RCA speech input components were used throughout the technical equipment design, the custom-built equipment being built by RCA to KOMO specifications and design in close cooperation with RCA's Engineering Products Division. The studio consoles provide control of 8 microphones, 2 turntables, network, and choice of two remote inputs. Each booth has its own standard cabinet rack of equipment with monitor and program amplifiers, relays and controls.

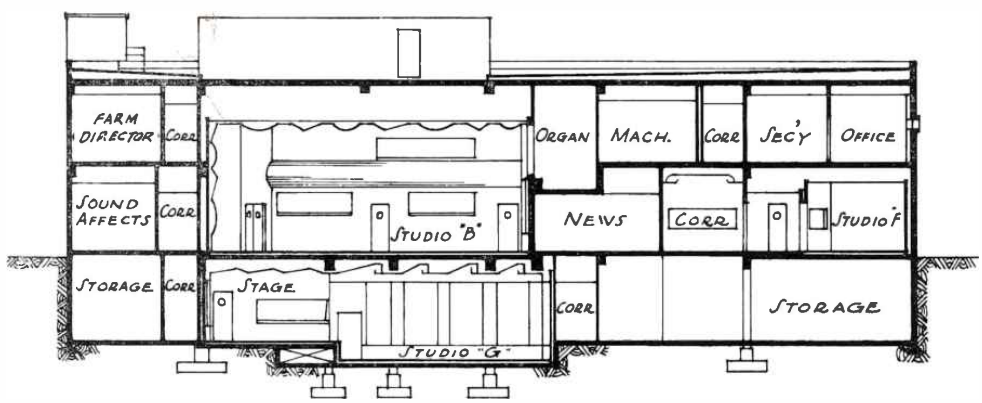
An extremely versatile master control switching system has been developed to permit selection of either a "pre-set" system of switching supervised by master control, or a selective interlock system leaving all switching functions to booth control and thus leaving master control unattended. Ten studio inputs are interlocked so they may feed one to six outgoing channels, but no two studios are permitted on the same channel.

The remaining equipment has been assembled from RCA standard speech input gear and consists of 17 RCA standard cabinet racks in which are housed line amplifiers, monitor amplifiers, network and remote line terminal equipment, and booth control program and monitor equipment.

The KOMO studio building was constructed by the Austin Company. Acoustics and isolation design are a compilation of suggestions from several consultants, RCA's M. Rettinger, NBC Engineering Department, Johns Manville Corporation, and the authors. Many unusual features of the building, includng a wall-panel heating system for the office areas, has been conceived and designed by Mr. O. W. Fisher, president and general manager of KOMO.



°LONGITUDINAL SECTION°



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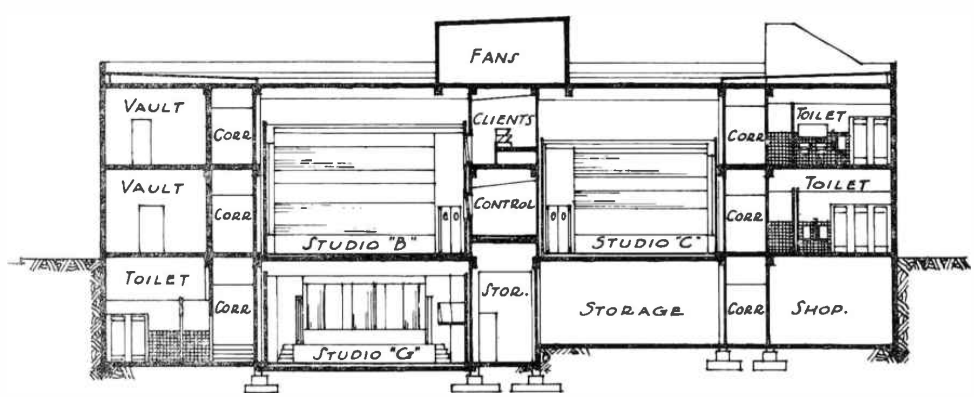


°CROSS SECTION°

KOMO - Entrance

The broad aluminum and glass entrance to the new KOMO studio building was designed "to place working radio on permanent public display." The view at the right shows the entryway as seen from the street at night. The larger illustration below shows how the lobby looks from the sidewalk just outside the center doorway. In this view a corner of the news room may be seen at the left, the "operations corridor" in the center and a corner of the reception desk at the right. Large glass doors are used not only for the front entrance, but also between the lobby and the operations corridor from which five of the studios, the news room and the operations center are entered. Thus the public can follow the comings and goings of announcers, celebrities and engineers without even crossing the threshold.

KOMO - Lobby

Location of the news room, adjacent to the main reception lobby, is one of the unusual features in the new KOMO studio building. Three "printers" record the news in full view of visitors who can see members of the station's news staff at work through the long, double-glazed window shown in the picture at the right. The steps at left lead to the offices on the second floor.

The reception desk and visitors' lounge are shown in the lobby view below. A colorful mural, "Across Horizons," by E. T. Grigware, depicting the personality and scope of radio, is the central decorative feature. The entrance to one of the smaller studios can be seen on the left, just beyond the all-glass doors which separate the main operations corridor from the reception lobby.

KOMO - Operations Center

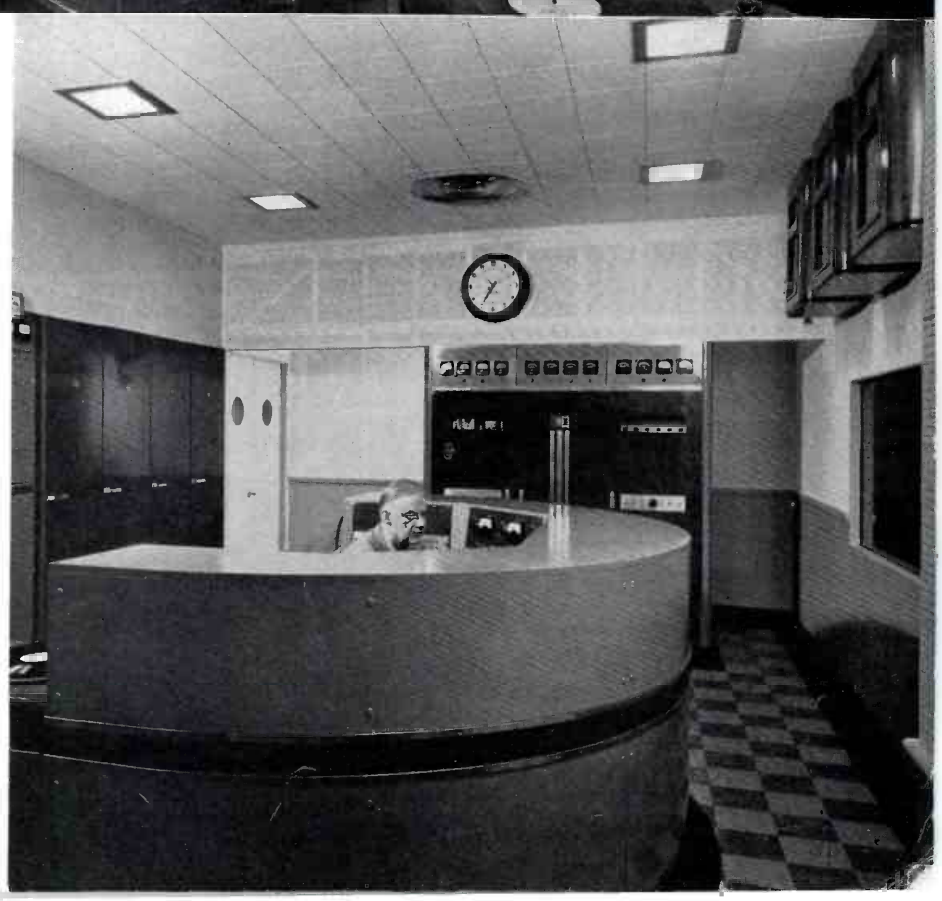
The key to operating efficiency in the new KOMO studios is in the arrangement of facilities around an operations control center and an operations corridor. The illustration above shows the operations corridor as seen from the lobby (with operations center at the far end).

The picture at the right is from inside the operations center looking out toward the corridor. The window on the extreme left affords a full view of the master control room where the master console, FM transmitter, and audio racks are located. The window in the center commands a view of the operations corridor where the entrances to Studios D, E and F can be seen on the left. Entrances to news room and Studios B and C—all adjoining the corridor at the right—can also be seen from this point.

KOMO - Control Room

Center of all KOMO technical operations is the master control room, shown above and at the right. Trunk lines from the five studio control booths, from the network, and from numerous remote pickup points, are brought into the custom-built-by-RCA master control console where all switching operations are performed. A panel on this console provides for direct control of Studio F operations.

The view above shows how the operator at the master control console can look into Studio F (at left), and on through this studio into the control booth and Studio E which is beyond it. He also has a good view of the operations headquarters, through the window at the right, and of the recording room (not visible in these illustrations).



KOMO - Studio B

Studio B, opposite ends of which are shown in the views above and at left, is a large "group-accommodation" studio with a floor area of 30 feet by 47 feet. The walls of this studio have been treated with a combination of polycylindrical and splayed wall and ceiling surfaces. Perforated transite has been used in the splayed sections, and wood in the cylindrical areas. The horizontal cylindrical surfaces are painted a soft blue which provides interesting contrast with the warm grey tones used in other wall area.

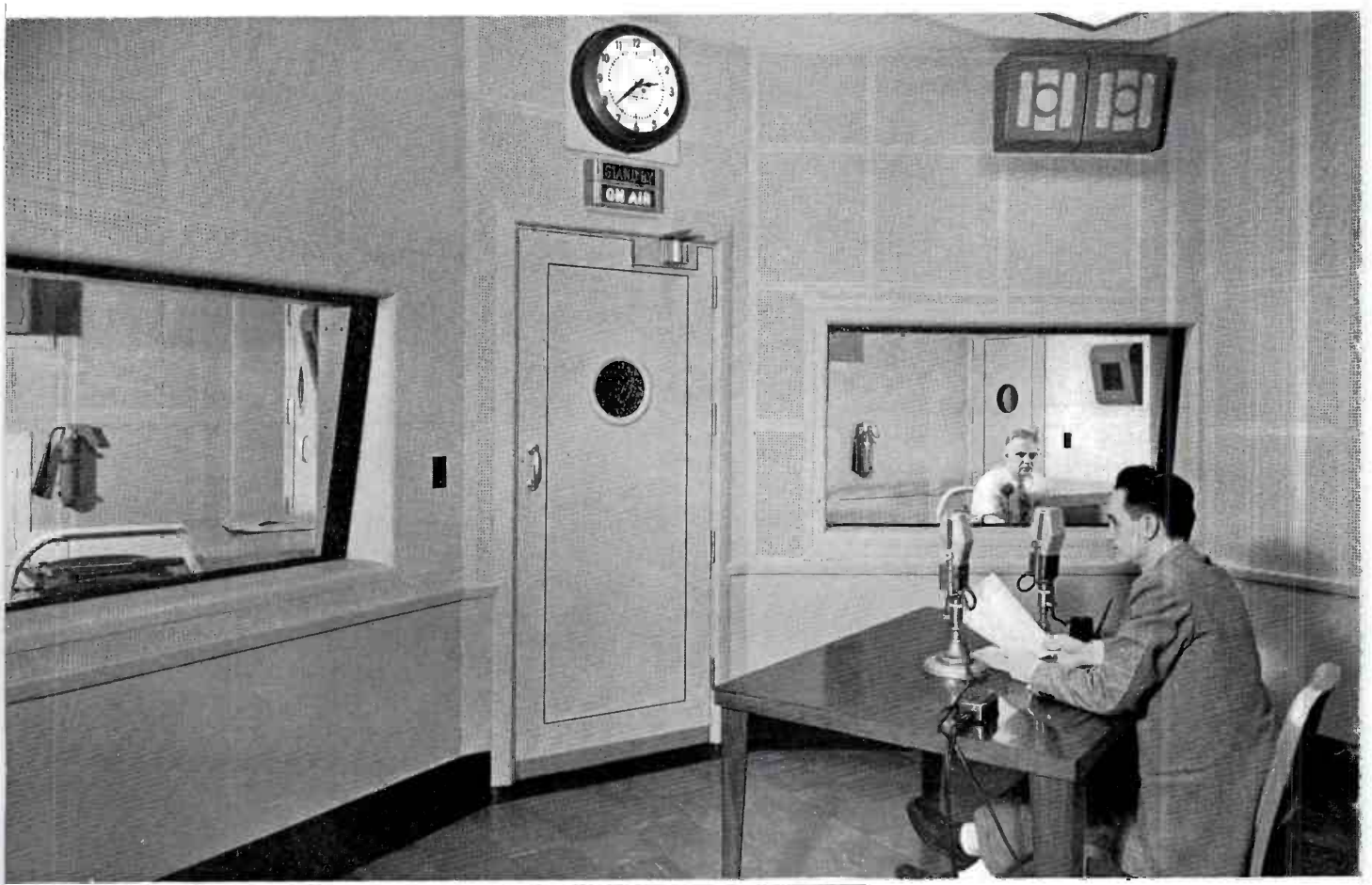
Between Studios B and C there is a special music director's booth, which can be seen on the extreme left in the view above. Studio B can be used in conjunction with studio "C," which is parallel to it behind the wall on the left, for broadcasts under the direction of a single musical conductor. When these studios are used in combination, as in programs requiring the location of a chorus in "C" and a symphony orchestra in "B," all the controls can be handled from control booth "B." The interior of the music director's booth is shown in the view at the bottom left of this page. The two sides of this booth have been fully glazed to afford an unobstructed view of activities in the two studios.

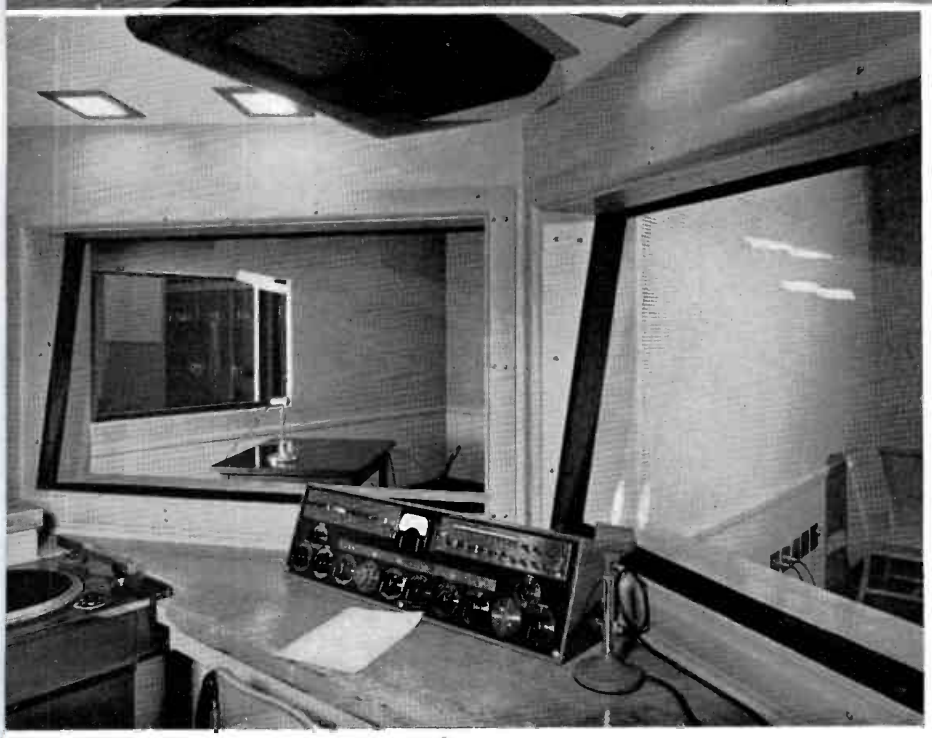
KOMO - Studio C

Studio C, several views of which are shown on this page, is 26 feet by 40 feet and is similar in construction and acoustical treatment to Studio B. Like the latter it is located on the ground floor directly adjacent to the central operations corridor. It is entered through the door in the right background. The door on the left affords access to a sizable storeroom used for storage of chairs, instruments or other equipment required for broadcasts in this unit.

The client's booth is located immediately above the studio control room and is reached by a stairway leading directly from the operations control corridor. The window shown here on the extreme right is located in the special musical director's booth between studios "B" and "C."

Perforated transite has been used throughout the flat and splayed wall and ceiling planes, while the cylindrical sections which form part of the design for effective acoustical control are of plywood. Holophane "controlens" incandescent fixtures installed in the ceiling are controlled by a combination of separate switches which permit lighting of various intensities according to the program requirements.





KOMO - Studios D, E and F

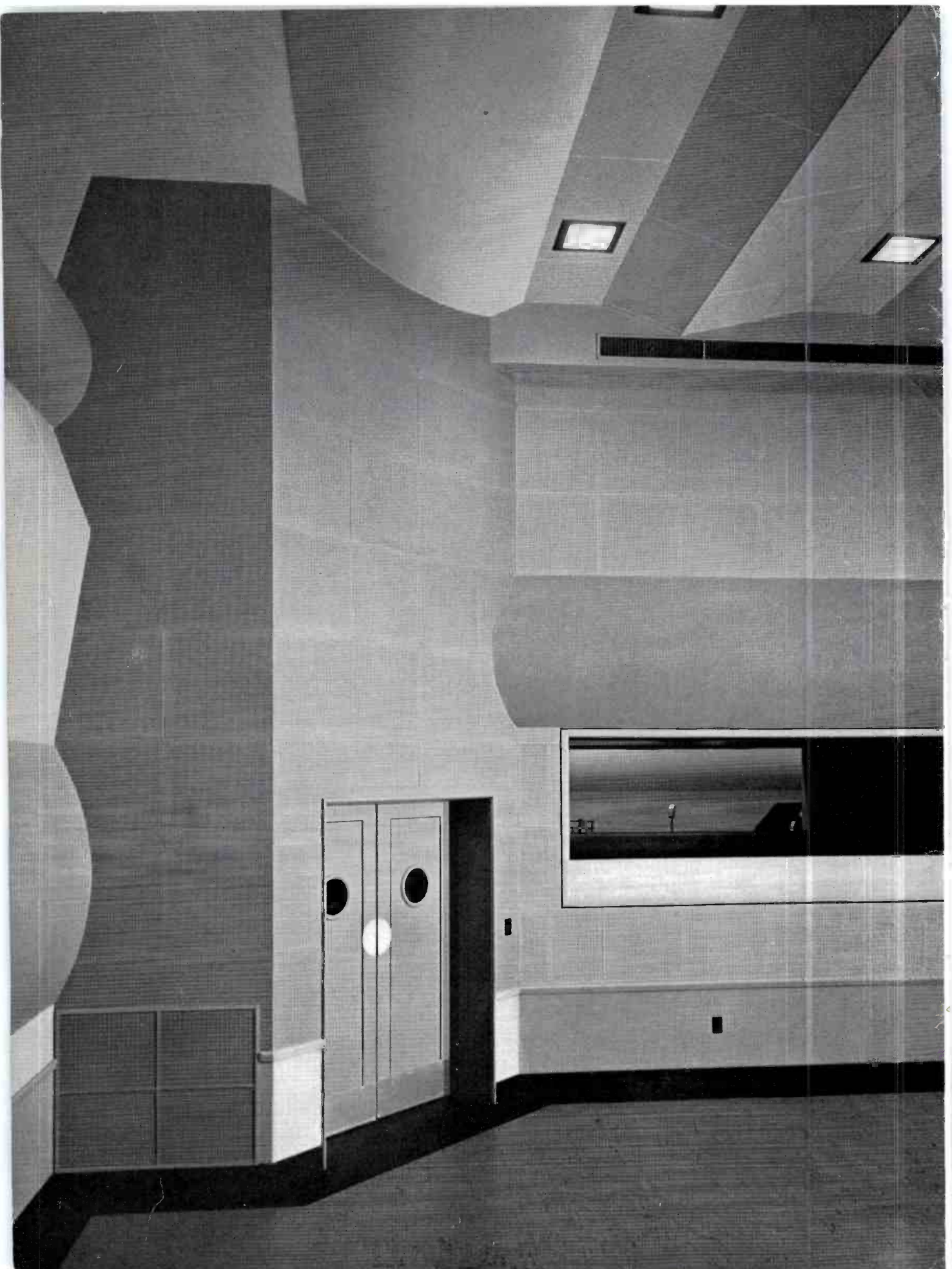
The arrangement of the three small KOMO studios (D, E and F) is unusual. Referring to the floor plan diagram (Page 11) it will be noted that these three studios are arranged along the right hand side of the operations corridor with two control booths in between them. Each control booth looks into two of the studios and microphone inputs are provided so that each can control either studio.

The view above shows the interior of Studio E. At the left is the window of Control Booth D, at the right windows of Control Booth E. The view at left is of Control Both E. Window at left looks into Studio F (and through it into Master Control) while the window at right looks into Studio E. The seven microphone inputs on the console are divided between studios. One engineer can handle two consecutive shows, allowing pre-show setup in one studio while the other is on the air. Cue positions allow check out of mikes of studio that is not on the air.

KOMO - Studio G

Studio G, shown in the two views on this page is a theatre-type studio designed for audience-participation type shows. It is located on the lower (basement) floor of the building and is reached by a stairway just inside the main entrance.

A large specially-designed control booth at the right of the stage provides a clear view of both the stage and the audience area. Combination splayed and polycylindrical wall surfaces have been used in this studio. Indirect lighting system is used over the audience portion and a direct system over the stage. The indirect lighting is furnished from a succession of incandescent coves which are directed away from the audience, while stage lighting is provided by flush Holophane fixtures on the splayed ceiling sections sloping away from the audience. The coved ceiling over the audience serves the double purpose of offering indirect lighting and dispersing sound when the entire area is used as a studio.



CONSTRUCTING THE KOMO STUDIOS

by STAN BENNETT

Assistant Chief Engineer, KOMO

There are few studio construction jobs on which architects, engineers and contractors have not learned something. These rambling notes on studio construction are here set down for either those who wish to read and heed or for veterans of studio construction who wish to read, sympathize or criticize.

Provide Holes Before Pouring

About the first request to engineers after construction has started is: "where do conduits go?" Seldom are engineering plans completely jelled at this stage. In the KOMO construction preliminary conduit layouts had been made and divided into two categories. A-C circuits were put in the slab. Radio circuit conduits were provided thimbals through walls and floors. Spare holes were plentifully provided for future conduits and unused holes filled with cinder cement easily punched out when needed. These provisions saved much tedious labor in going through 5 to 8 inches of concrete only to hit a reinforcing bar when the inevitable circuit changes appeared during construction.

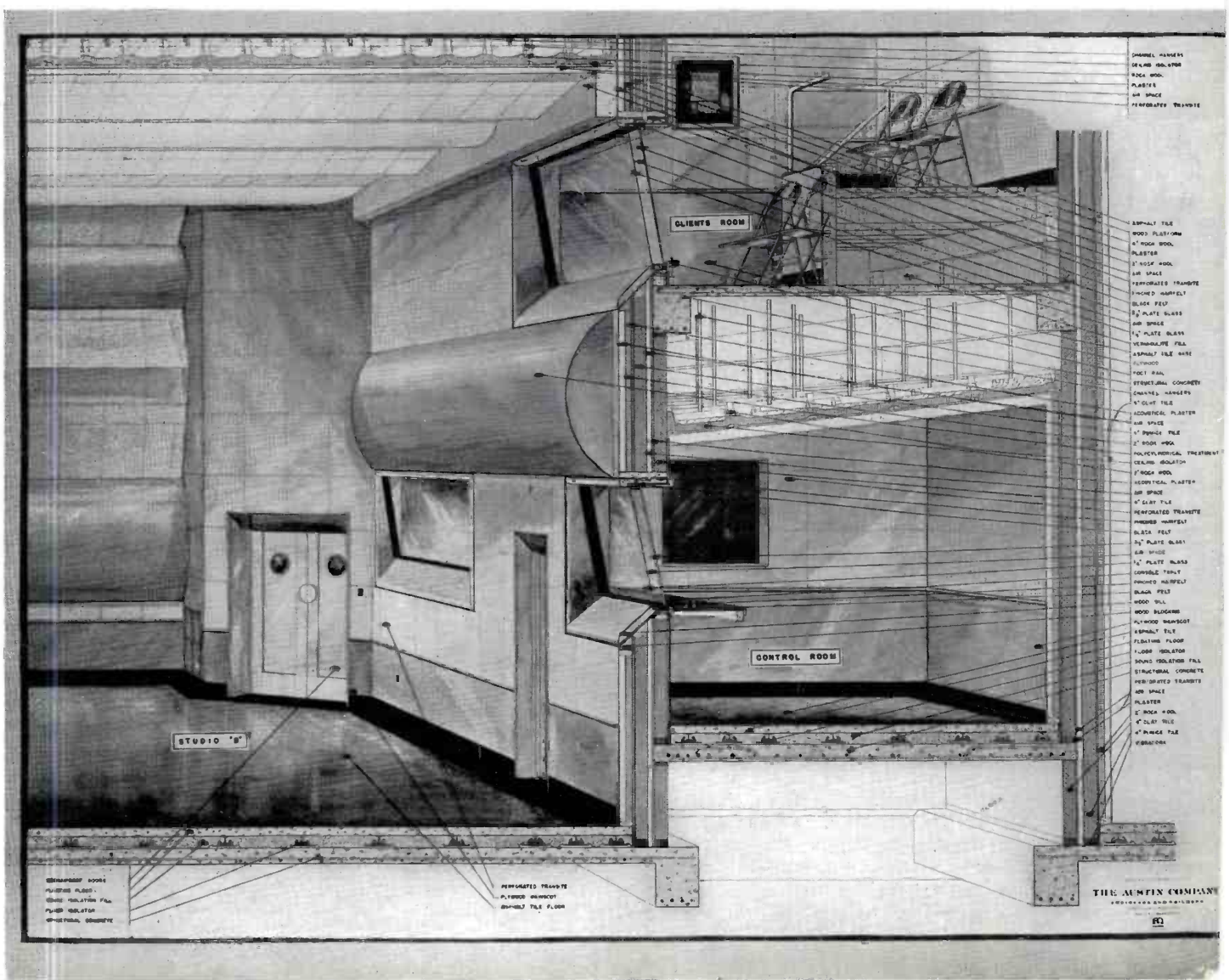
Sound Isolation

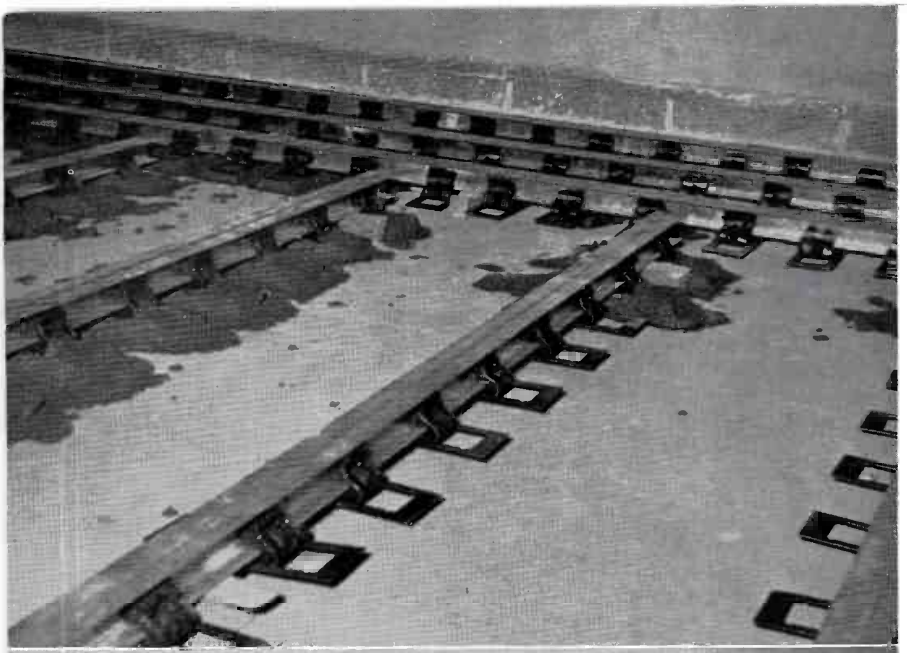
The requirements of sound isolation for these studios were determined by a few observations and measurements, but how to obtain it was only accomplished by investigation, consulting experts, and a few trials and errors.

A General Radio 759-B sound level meter soon told the intensity of noise likely encountered from the adjacent arterial street. Three airhammers of the street department busily replacing a section of pavement furnished what was thought might be the worst condition. The noise registered 130 decibels at 25 feet. A fire station two blocks away gave considerable fire engine traffic which registered near 120 decibels. It is known that a practical minimum of studio noise from air conditioning and other sources runs about 20 decibels above ASA 0 level. This 20 db residual

FIG. 1 (opposite page). A corner of KOMO's Studio B showing the combination of polycylindrical and splayed surfaces used to achieve the desired reverberation and frequency characteristics. Window at right looks into control booth and through it into Studio "C".

FIG. 2 (below). A cross section drawing of the corner of Studio B shown on the opposite page. Construction of the walls of this studio and of the associated control booth and client's room is indicated. Arrows identify type of isolating material used at each point.





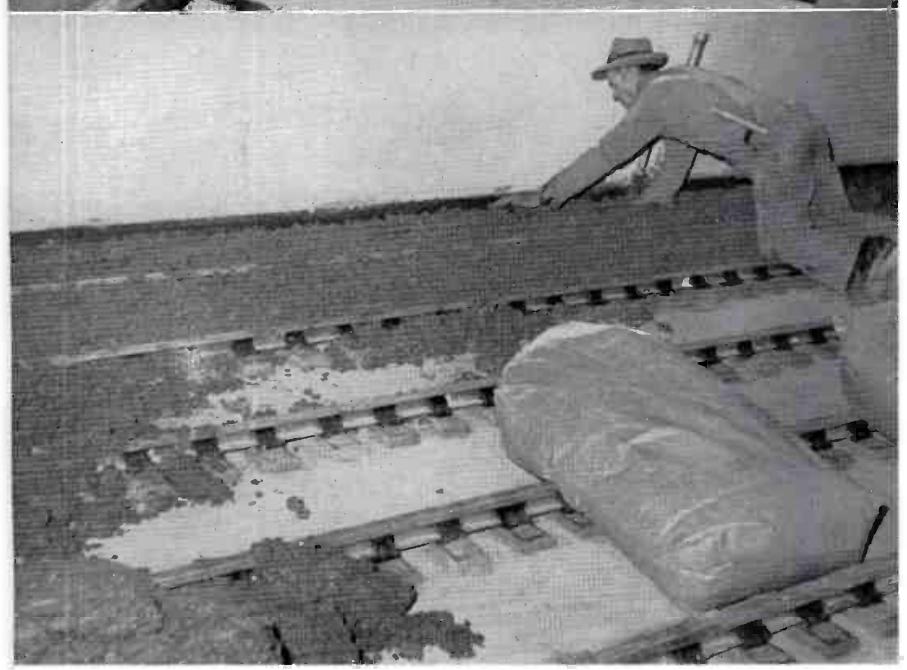


FIG. 3 (left, upper). Typical studio floor isolation system consisting of steel H sleepers and J. M. chairs with punched felt isolation. After leveling, chairs are grouted to structural floor.

FIG. 4 (left, center). Rock wool isolation fill is added between floating H sleepers. Heavy building paper, Hy-rib lath and wire mesh reinforcement supports 2½ inch studio floor slab on sleepers.

studio noise with any reasonable microphone placement would probably be undetectable even on the best FM home receivers. A subtraction gives an average 100 decibel isolation figure for which to strive.

Sound isolation of a studio breaks down into two problems, vibration isolation and airborne sound isolation. Standing on the sidewalk at the proposed site during passing of a ten-ton diesel truck convinced one that vibration isolation should start with a completely isolated studio, floating floors, walls and ceiling.

Investigation into wall materials for sound isolation properties resulted in choosing a 4-inch pumice building block. From the best available sources it was determined that this block when plastered both sides would have 40 to 45 decibels average attenuation. The 8-inch outside structural concrete wall, 2-inch rock wool blanket between walls, and the acoustic studio wall all add up to somewhat over 100 db sound attenuation. As an additional precaution the rock wool blanket of the studio acoustic wall was extended from floor to ceiling. Plywood plaques were nailed to studding in checkerboard pattern to obtain the desired reverberation. The acoustic wall was faced with perforated Transite. As a result of this sound isolation you cannot hear fire engines or street noise in any KOMO studio.

Isolation Double Checked and Tested

Isolation of walls, ceiling and floors required the closest of supervision to prevent accidental bridging by mortar, cement and nails. Inspection block holes were left between double walls to allow final check for mortar drippings.

A vibration pick-up (Piezo electric inertia type) for the G.R. sound meter and a small electric hammer and blunt star drill became standard vibration test equipment during construction. Each wall was tested as it neared completion and by comparison it was determined if any bridging detrimental to the isolation existed. Floating floors were similarly tested.

A refinement in the vibration source for checking double glass window isolation, known to the workmen as the "Schick test", was developed. It was an old Schick electric razor used as a vibration source on window sills and walls. Comparison of vibration between vibrated wall and floating wall quickly determined the extent of isolation. The "Schick test" paid off numerous times. The offending bridge of isolation was usually located within a few inches. A piece of flex tubing was found wedged between floating walls on one occasion. The vibration test determined that a certain grade of felt had been used which gave poor isolation between window frames. Another time paste had hardened the felt until it transmitted vibration nearly equal to a solid connection between structures.

Hunting Sound Leaks

Most sound leakage was prevented during construction by calking up anything that was not air-tight. Studio door closers were particularly critical in adjustment to get airtight seals to the sponge rubber stops. A few asbestos air ducts had to be deadened with extra amounts of RW blanket to prevent transmission of vibration. Teletypes had to be vibration isolated. An oscillator and loudspeaker operating at about 100 db level aided in locating sound leaks.

Studio Isolation Results

Both oscillator tone tests and program tests indicate approximately 100 decibel isolation between studios. The Seattle

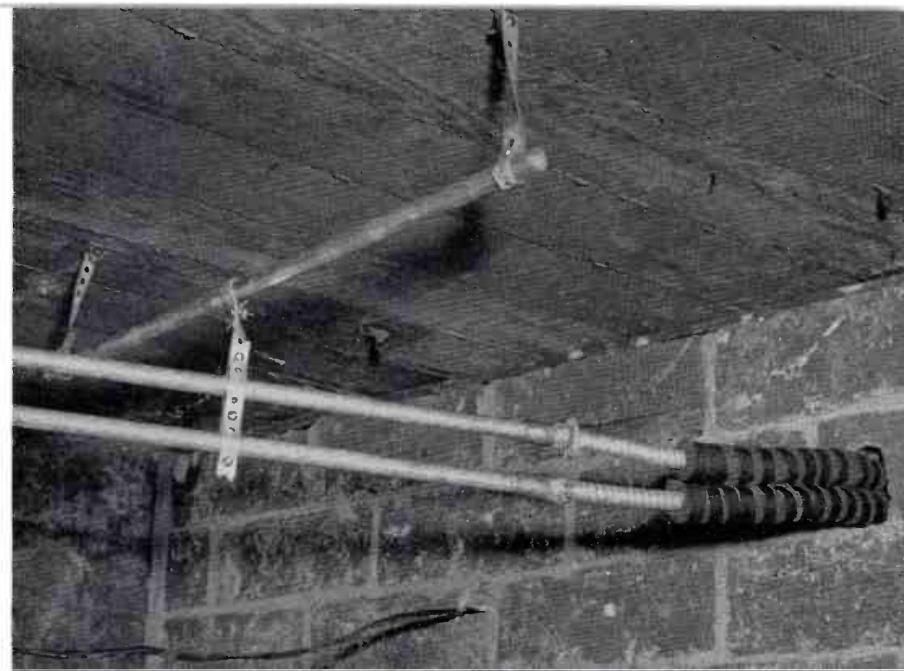


FIG. 5 (right, upper). One method of carrying electrical circuits through floating wall with felt wrapped flex tubing.

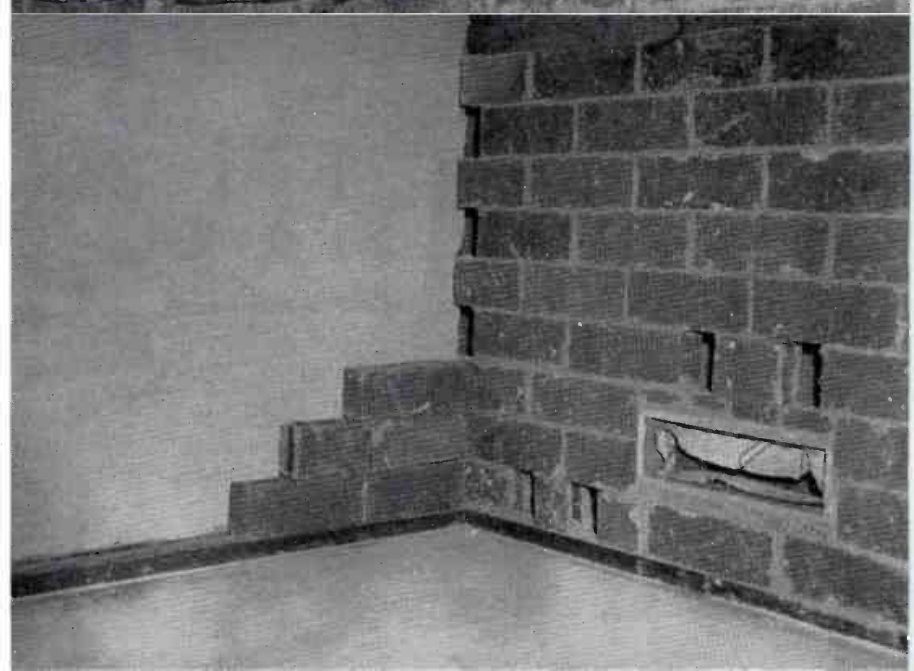


FIG. 6 (right, center). KOMO Studio Wall Isolation. Four-inch pumice block is built up on 2-inch vibra-cork. Where there are double walls between studios, one wall is plastered on two sides and second wall is plastered on the inside. (Note canvas boot to floating wall for isolation to ductwork.)

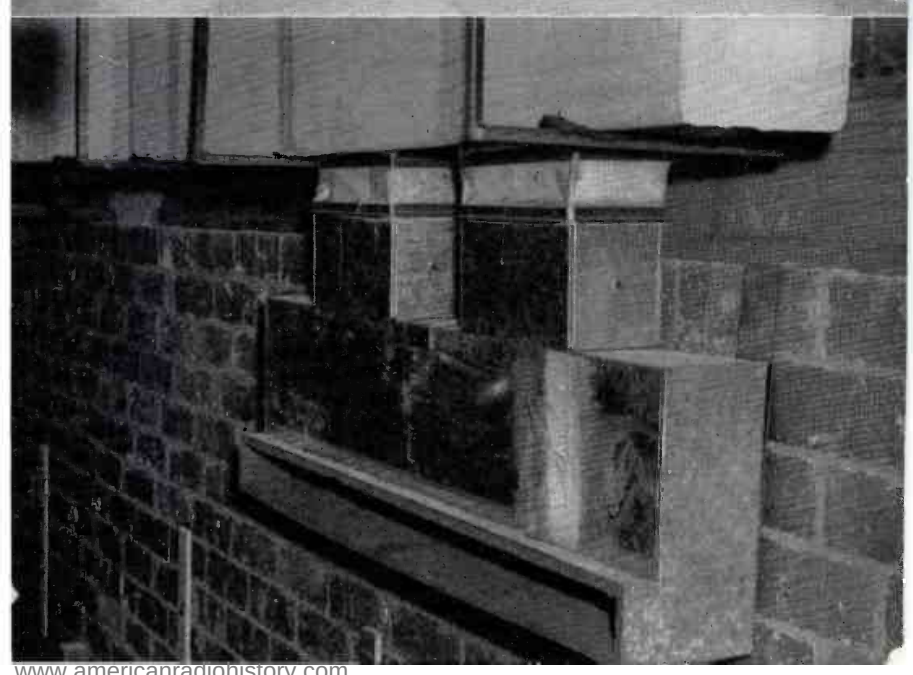


FIG. 7 (right, lower). Studio Air Conditioning duct showing 1-inch rock-wool duct liner and method of connecting from floating studio wall to ductwork. Note main "Carey Duct" is asbestos type having low sound transmission coefficient and is mounted on felt stripped hangers.

Symphony orchestra in studio "B" hitting forté fortissimo at 95 to 100 db peaks on the sound level meter was inaudible to meter and ear in adjacent studio "C". Average isolation between studio and control booth was limited to between 50 and 55 db by the large area double glass windows. Since only control work is done from the booth this isolation has proved adequate. Triple glass, each layer suspended in an isolated wall, was installed between master control and studio "F" after preliminary tests showed double glass insufficient to isolate high monitoring levels in master control.

Studio Acoustic Design

KOMO studio acoustics were designed around the theory of increasing brilliance by polycylindrical diffusion of sound, tempered by absorbing areas of perforated Transite and rock wool splayed into non-parallel walls. Since a total of six studios were planned, the acoustics of each was designed to best suit the purpose of the studio. The commonly used Eyring formula for reverberation was used in all calculations.

The cylindrical sections were formed in place with staggered dimensioned stud bracing on which was formed the ¼ inch plywood facing of the cylinders. One-half inch celotex backing was used between plywood and form. Cylinder radii were made several different dimensions. Stagger tuning the cylinders with random bracing was an additional precaution to give sufficient dispersion of modes of cylinder vibration at the lower audio frequencies. This latter point was well illustrated during construction by a "boner" that was caught just in time. An orchestra rehearsal was made from the first studio nearing completion, with all critics listening with great anticipation of the new acoustics. There was much chagrin when it was found that a particular bass fiddle note caused a boomy response out of proportion to other scale response. Investigation determined that the 30 inch high plywood wainscote was apparently producing vibration ex-

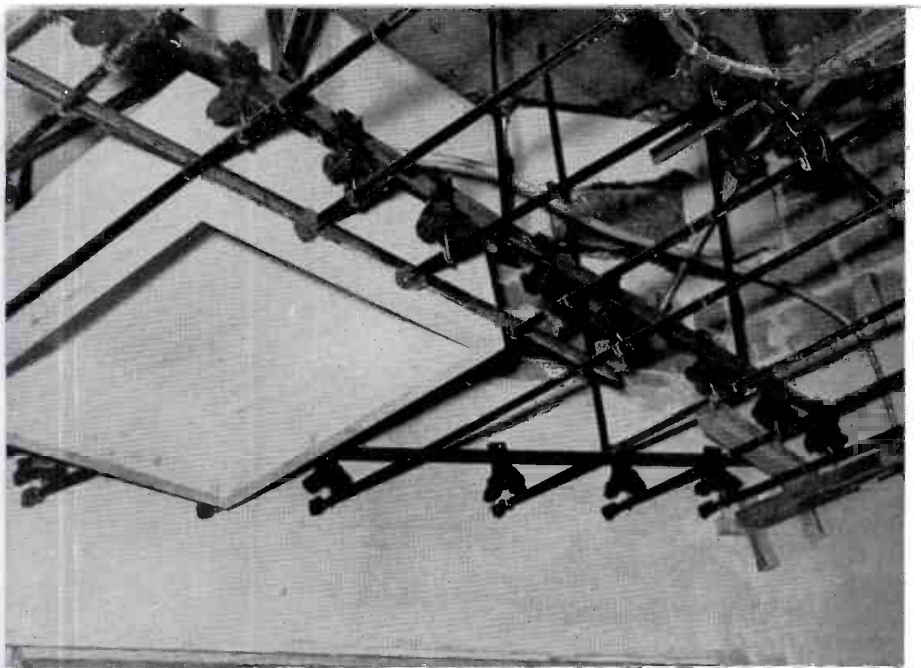


FIG. 8 (left, upper). Ceiling suspension system in typical studio control booth. J.M. ceiling isolators are used to support ribs on which is placed wire lath, plaster and acoustic tile. Box is for booth ceiling monitor loudspeaker.

FIG. 9 (left, lower). Studio floating ceiling which uses the Johns Manville system of ceiling isolation. Ceiling consists of wire lath and plaster with 2-inch rockwool blanket topside. Acoustic treatment of rock wool, transite splays and plywood cylinders is bottomside of ceiling.

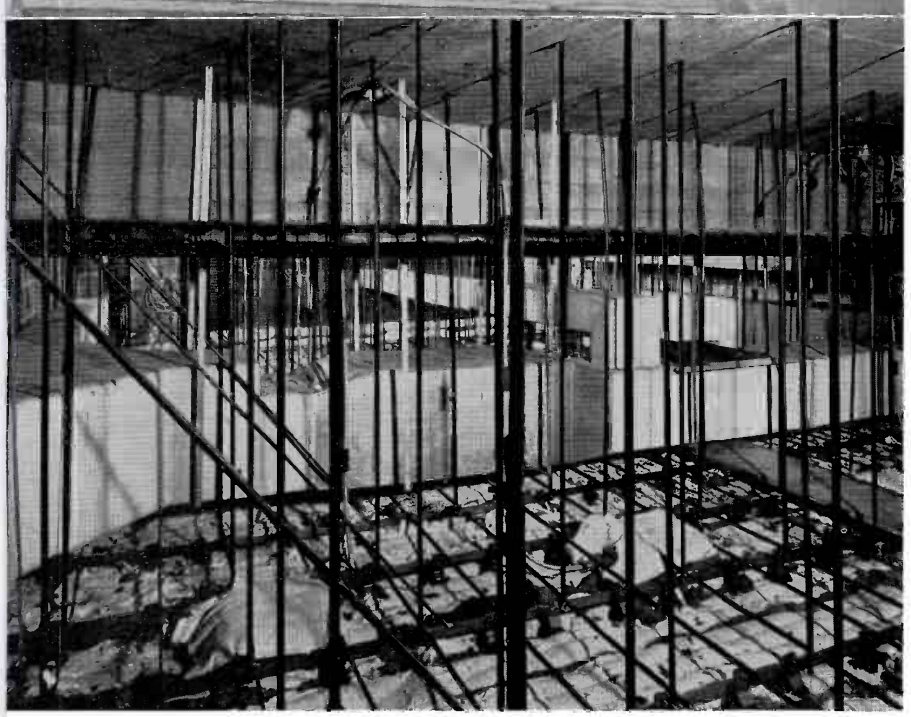


FIG. 10 (lefthand picture, opposite page). Studio wall construction showing staggered ribbed form for cylinder sections. Plywood wainscot is applied to first 30 inches, then alternate transite-rockwool treatment in veed splays.

FIG. 11 (righthand picture, opposite page). Small studios have acoustic treated wall setting on floating floor. Acoustic treatment is rock wool with perforated transite facing. Checkerboard arrangement of plywood squares gives proper reverberation time and distribution of absorption. Small studio walls are non-parallel.

cited by the particular bass fiddle note. The wainscot studding had all been carefully laid out with even spacing, in exact contrast with the random cylinder bracing. After replacing vertical studding with random and closer spaced bracing the excessive bass response disappeared.

Studio Performance Results

A good studio is the object of much subjective discussion. The results of good studio design should probably aim to achieve realistic reproduction of sound with simple microphone technique, and at the same time offer pleasing acoustics to the performers.

This seems to have been achieved to a high degree in the KOMO studio design. Performers in the Seattle Symphony took advantage of the newly designed studios for Spring rehearsals. Inquiries were made to many of the 75 members and the opinion of those asked was unanimous that studio "B" acoustics offered a pleasing reinforcement of sound without "echo" as in former auditoriums, and aided in good performance.

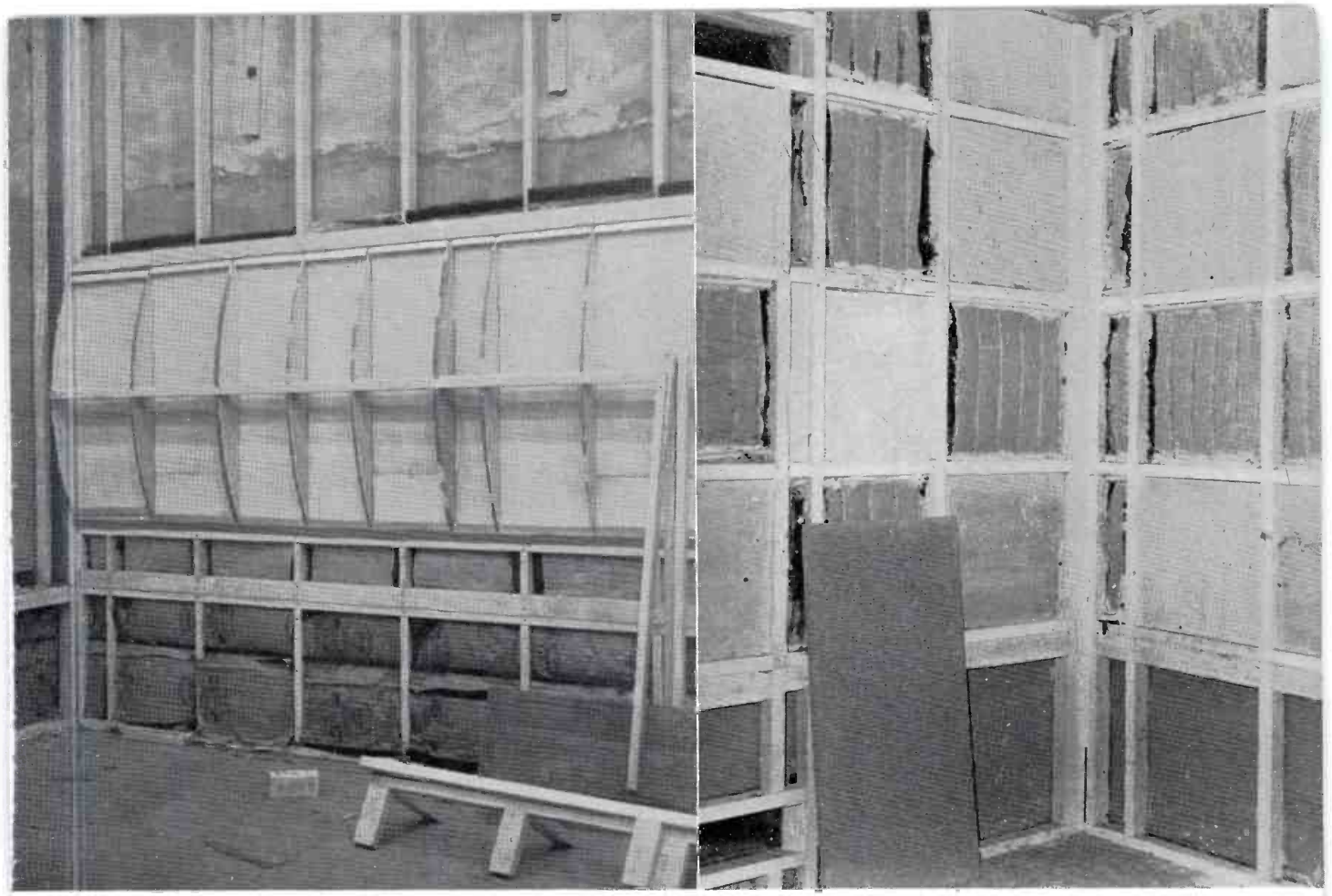
Measurements of studio acoustics that have been made to date seem to substantiate the operating experience. Microphone pickup has been much less critical than in the old highly absorbent "dead" studio. "Voicing" the organ for uniform response on the VI meter was a simple process with well dispersed sound treatment and special attention to low frequency absorption in "B" studio. Good sound diffusion prevents high standing wave (excessive sound pressure reinforcements and cancellations), an old bugaboo in organ voicing. Musical shows from this studio have had noticeably increased and pleasing "liveness".

Studio "C", designed for drama and general purpose usage, has performed equally well. This studio is sufficiently deadened for good dramatic "fade-outs". Sound diffusion is excellent and the studio has been found especially pleasing for single and twin piano broadcasts.

Reverberation Measurements

Preliminary reverberation measurements have been made of the studios which closely checked the calculated reverberation time at mid frequency and higher frequencies. Calculations at low frequency were not as accurate due to probable error of cylinder coefficients at 128 and 256 cycles.

Reverberation-frequency characteristics of studio "C" from 128 to 4096 cps in-



dicates a maximum variation of 0.2 seconds from an average of 0.60 at 1024 cps.

Studio "B" has a similarly flat decay time-frequency response characteristic with a measured 1.1 second reverberation at 1024 cps. An average of five measurements per frequency at 2 microphone positions have been made to date. The data is regarded as preliminary, however, until more microphone positions are taken.

The reverberation period was determined on a Sound Apparatus Co. high-speed-level recorder and warble tone oscillator in the conventional manner. The recorder is logarithmic so that true logarithmic decay of sound is recorded as a straight line decay.

The above photostats of typical chart recordings from studios "B" and "C" show only slight variation from the ruled straight line used in decay time extrapolation.

Decay curves for frequencies 128 to 5000 cycles were similar in having no ragged decay time. The charts would seem to confirm the achievement of an excellent degree of sound diffusion, good dispersion of acoustic treatment, and a properly proportioned room.

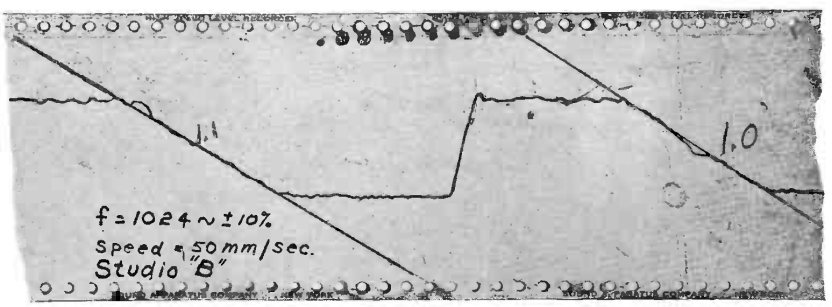


FIG. 12. Reverberation measurement chart showing typical tone decay characteristics of Studio "B". Measurements taken on high speed logarithmic recorder with warble oscillator at 1024 cps. Average of several chart runs and microphone positions gave 1.1 seconds reverberation time.

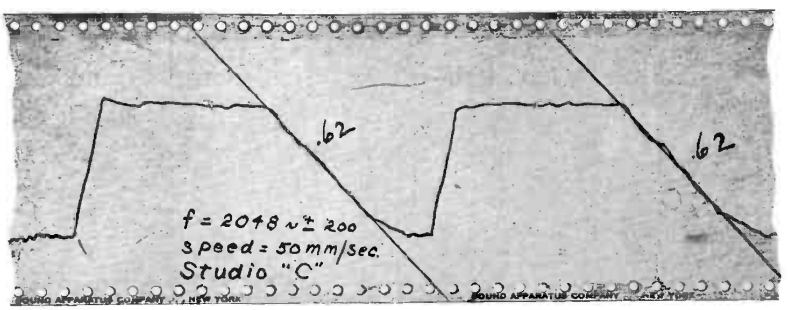


FIG. 13. Typical sound decay characteristics of Studio "C". Straight line decay of sound level would indicate ideal logarithmic decay of studio sound. Reverberation measures 0.6 seconds at 1024 cps and increases to maximum of 0.8 at 4096 cps.

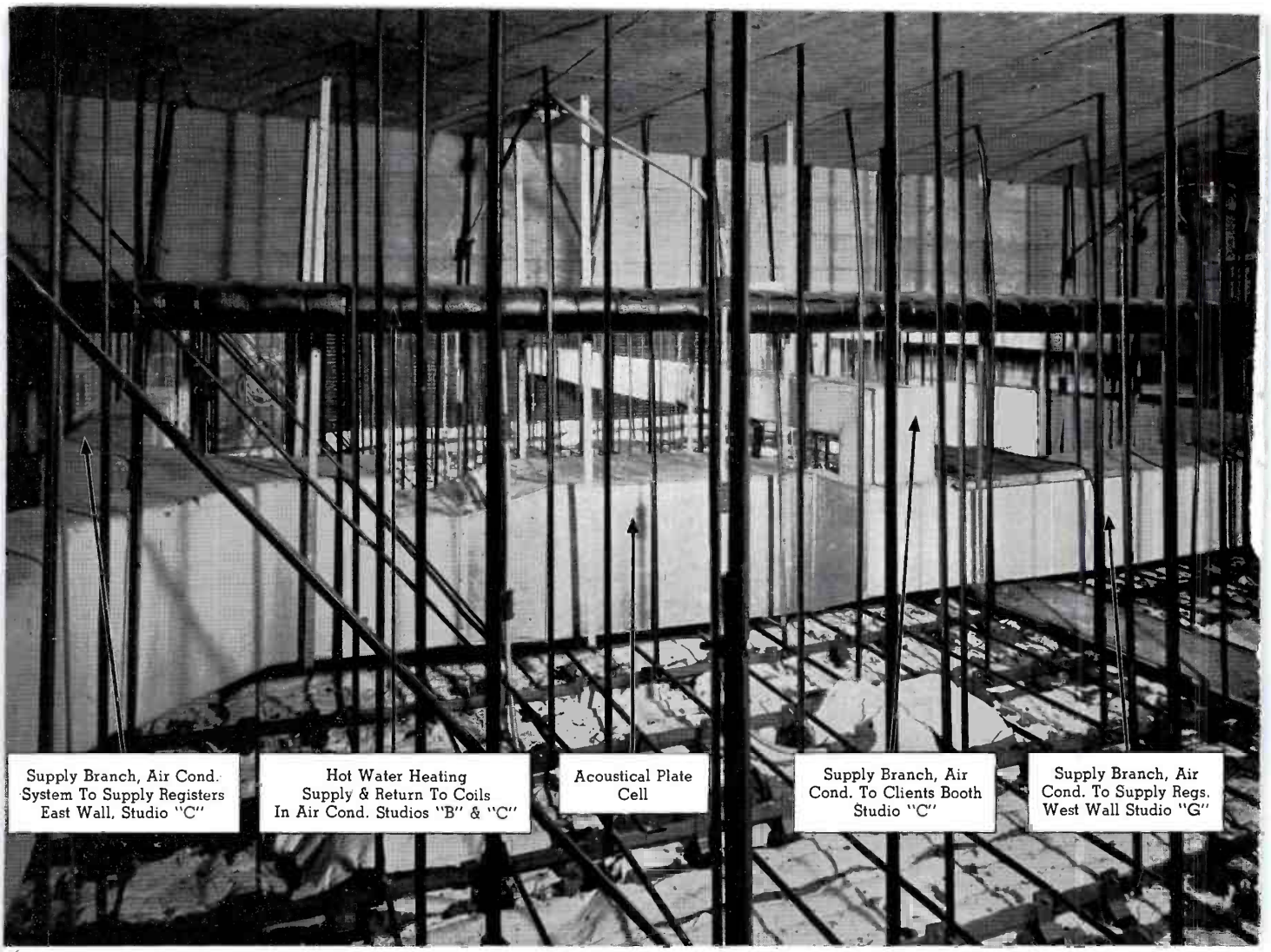


FIG. 1. This is a view of the area between the ceiling of Studio C and the roof of the building. The hangers from which the isolated ceiling is suspended are anchored in the concrete roof slab. Complete isolation of the ceiling has been obtained by the suspension of cork-insulated ceiling supports from horizontal members, which are connected directly to the bottom of these hangers. The entire ceiling has been blanketed with sound-absorbing felt, which has been fitted closely around electrical fixtures and all air-conditioning outlets as well.

HEATING AND VENTILATING THE NEW KOMO STUDIOS

by J. K. GANNETT
Vice President and Director of Engineering
The Austin Company, Engineers and Builders

The new two-story and basement home of KOMO, in Seattle, offers a unique solution of the problems in fully air conditioning a studio building that combines heavy acoustical treatment with an extreme light load much of the time and a widely variable occupancy.

The most serious problem encountered in the installation of the system for KOMO, and the one demanding the most engineering and research, was the elimination of both grille and fan noise and of any possible cross-talk between studios and between studios and booths.

The Austin Company has used a number of innovations in both air conditioning and ventilation to produce ideal working conditions in the KOMO building, where most of the acoustical treatment also provided high thermal insulation. Since the building is a "Controlled Conditions" plant, outside temperatures could be almost completely disregarded. With the light load a fixed condition, the main problem was the effect which the changing studio population would have on ventilation and outside air requirements.

An extremely low noise level is of paramount importance in the modern studio. High fidelity broadcasts demand the elimination of street noises, and it was therefore important that any noises introduced into the studio by the ventilation system be

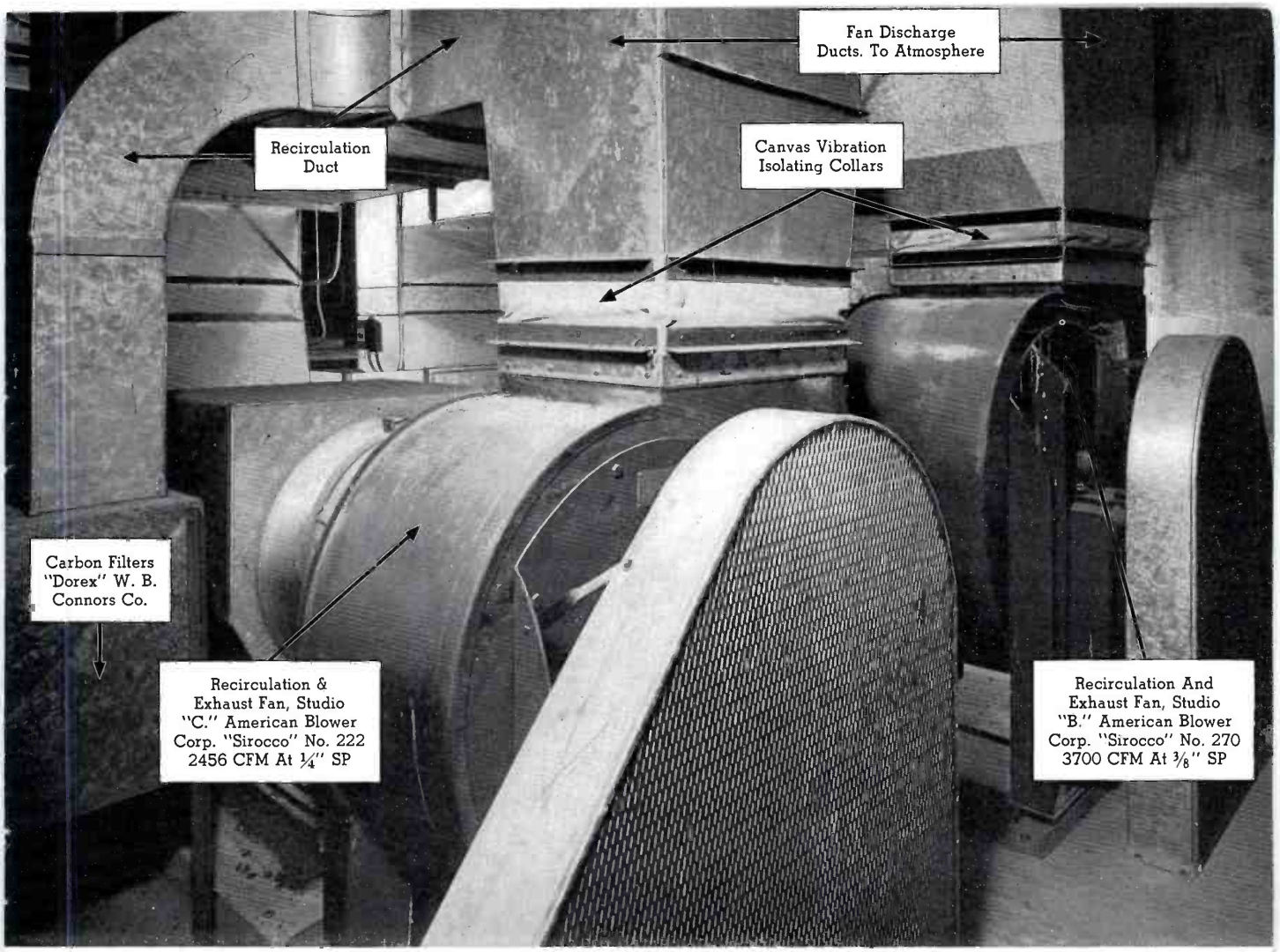


FIG. 2. This air-conditioning equipment, installed in a penthouse on the roof at KOMO, serves the two large group accommodation studios, B and C. The two fans shown here exhaust and recirculate air from the conditioning systems serving these studios. The flexible couplings, which separate distribution ducts from the duct directly at the head of the fan unit, form part of the system of baffles and sound absorbing cells which reduce the noise level of the air-conditioning equipment to a minimum.

held as near 10 db as possible, despite the fact that the KOMO studio building is located at a noisy and busy intersection.

Faced with these problems and with the exacting requirements set by O. W. Fisher, the station's owner-manager—himself an experienced engineer, our Seattle District developed a multiple zone conditioned air system which has proved entirely satisfactory.

In general, the building is divided into six major zones of complete air conditioning. Each of the three major studios is on a separate system; all control booths, the operations area, and three small studios are on a single system; the basement ventilation is on a single system; and the second-floor office area is provided with a single control air conditioning system which is in turn divided into five zones through the reheat coils.

This air conditioning system required plenty of room for the duct work. Experience has indicated that outside insulation, inner acoustical treatment, and low velocities will usually double the normal size of the duct work.

The systems serving the main studios, and the system serving the operations area, booths, and small studio, consist of a standard arrangement of supply and exhaust recirculation fans. All systems are equipped with both heating and cooling coils, filters and activated carbon deodorizing cannisters. Heat is provided through a forced hot water system, operating at a maximum water temperature of 190 degrees F. Cooling is accomplished through chilled water at approximately 35 degrees F. All control systems are electrical, with a central control panel in the main operations control room. The systems are generally operated by a capable maintenance engineer, but during night programs and any special off-hour operation, the system is in the hands of the regular station personnel, naturally familiar with electric controls.

The controls on all studios, operations area, and booths, are identical. Studio "B" is a typical example, and the system operates as follows: The system is set in operation by closing the switch marked "Studio B" at the master control panel in the operations control room. This starts the supply and exhaust fans and energizes the entire control circuit. Operating temperature in the studio is determined by a duct-type microtrol located in the return air duct; the setting of this instrument is generally 70 degrees F. The system is also equipped with a proportioning type minimum fresh air damper, with a manually-operated switch on the master control panel. The setting of this switch is left to the discretion of the operator, with 100% outside air being used for the peak occupancy of about 50 people.

EQUIPMENT FOR THE NEW KOMO STUDIOS

by M. E. GUNN
Audio Engineering Section
Engineering Products Department

Introduction

About four years ago KOMO executives and engineers began planning a new studio building which was to be the most modern and completely functional broadcasting plant ever built. To accomplish this end, KOMO molded together ideas from leading radio engineers and executives throughout the country. Then they combined these with their own background of 21 years in the broadcasting field and thereby developed outstanding plans for studios, offices and other facilities. One of the goals of this ambitious venture was efficient operation, therefore special emphasis was placed on building layout, air conditioning, lighting, studio isolation and acoustics.

The studio building was designed as a two-story structure of reinforced concrete with provisions for adding a third floor at some later date. This building houses six modern studios of the latest design, a master control room, conference rooms, offices, FM transmitting plant, shops with plenty of room for the later addition of two television studios.

The studios were planned as follows:

Studio B—A large organ studio also used for orchestra broadcasts.

Studio C—This studio is designed acoustically for drama and small musical groups.

Studio D—Small music studio.

Studio E—For interviewing and voice—for three to five people.

Studio F—News and announcing—this studio is controlled from a panel on the master control desk although it may alternately be controlled from the studio E booth console.

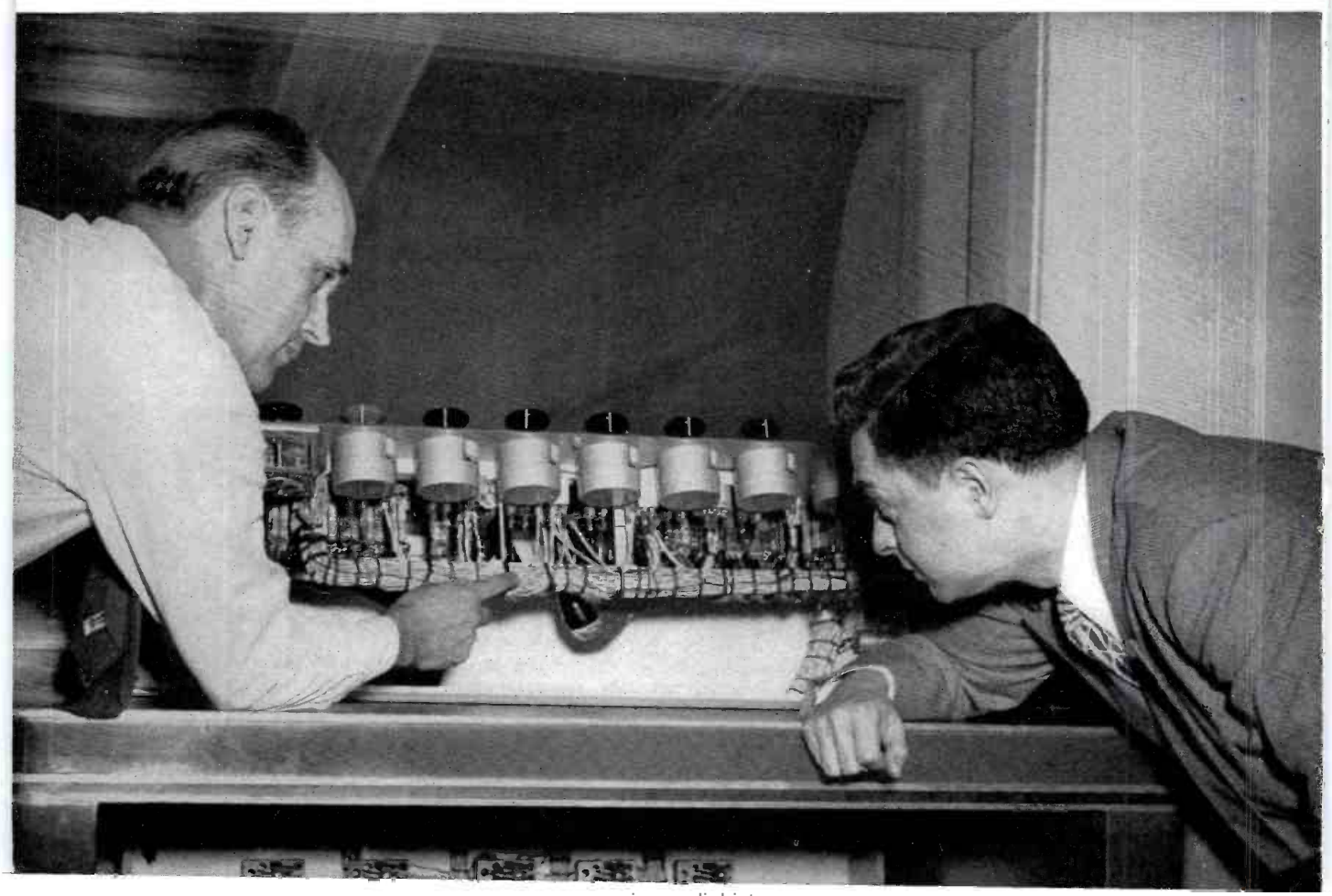
Studio G—Auditorium type with 20′ x 23′ stage. This may be used for programs utilizing audience participation.

Five of the studios and four control booths are grouped about an office appropriately designated as "Operations Supervisors Headquarters". This office has visual as well as electrically indicated supervision over studio entrances, master control room and recording room.

Equipment Design Plans

When plans for the studio layouts and construction were complete and agreed upon, it was only natural that to complete the installation the technical equipment would also have to be the finest in functional design.

The general design of the equipment was worked out by the KOMO engineering staff headed by F. C. Brott, who brought his plans and ideas to the RCA engineering department in Camden, N. J. For 15 years RCA has been equipping radio stations with custom built equipment and it was in several of these installations, like



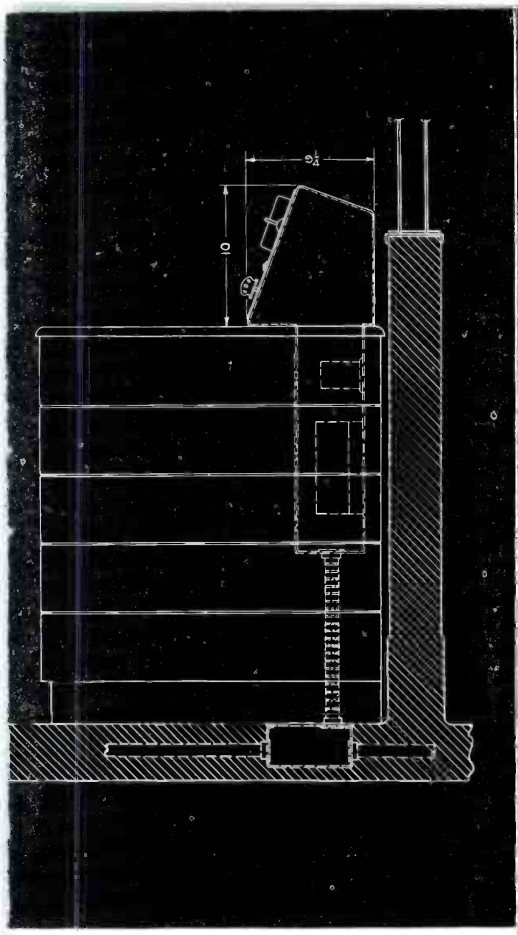


FIG. 1 (Above) Cross-sectional end view of KOMO's Studio Control Console showing how the "inset" design conserves space and permits components to be mounted below desk surfaces.

FIG. 2 (At Right). Painstaking mechanical and electrical design provides complete accessibility to all controls plus maximum visibility into the studio.

FIG. 3 (At Left). During inspection—Engineer M. E. Gunn (at left) raises the hinged front panel of a KOMO studio console to illustrate how wiring and components are easily and quickly reached.

WFAA's in Dallas, Texas that some of the ideas for KOMO were born.

After discussing the specifications it was evident that RCA was adequately equipped to handle just such a tailor-made custom-built job. It also was determined that consoles and a master control desk would be required. The studio equipment design incorporates a control console with a separate rack to house the associated amplifiers, relays, jacks, etc.

KOMO Studio Console

The studio consoles, which are described here, are of a special type of construction. The sketch of Fig. 1 shows a sectional end view which illustrates the general form of the console. Note that this design provides space below the desk top for mounting transformers and terminal blocks. This is a desirable feature which makes possible the use of a smaller turret thereby resulting in maximum visibility into the studio. All consoles are of steel construction with a baked enamel finish, and body styling is in a light umber gray with the panel in a contrasting dark umber gray. These color tones produce a pleasing and harmonizing blend with studio and control room decorating.

All dial plates and escutcheons are of nickel silver with machine engraved characters. Nickel silver was chosen because of its long wearing qualities and attractive appearance.

In some cases colored switch handles and specially molded mixer knobs of different colors are used to aid in selecting the proper controls for certain circuits. For example, the studio booth key switch handle is white and the associated mixer knob is white. Red is used to denote one of the other combinations while green handles make the turntable switches easily and quickly recognizable.

Figures 2, 3 and 4 show photographs of one of the completed units, as installed in the RCA's audio engineering studio. These pictures were obtained during engineering tests and inspection to illustrate the accessibility of parts and wiring for servicing (note in Figs. 3 and 4 that the

plate which covers the opening in the lower part has been removed to make wiring visible). The cabinet is drilled for the installation of extra terminal blocks or transformers that may be required at some later date. Cable conduits can be brought in either at the bottom or ends, as desired. Turntable receptacles are conveniently located at the left end of the lower section and two cannon receptacles are provided in the right-hand end of the upper section for talkback and announce microphones. Cabling from the panel to the main cabinet is formed into two large loops to provide long service and prevent failure due to breakage from strain.

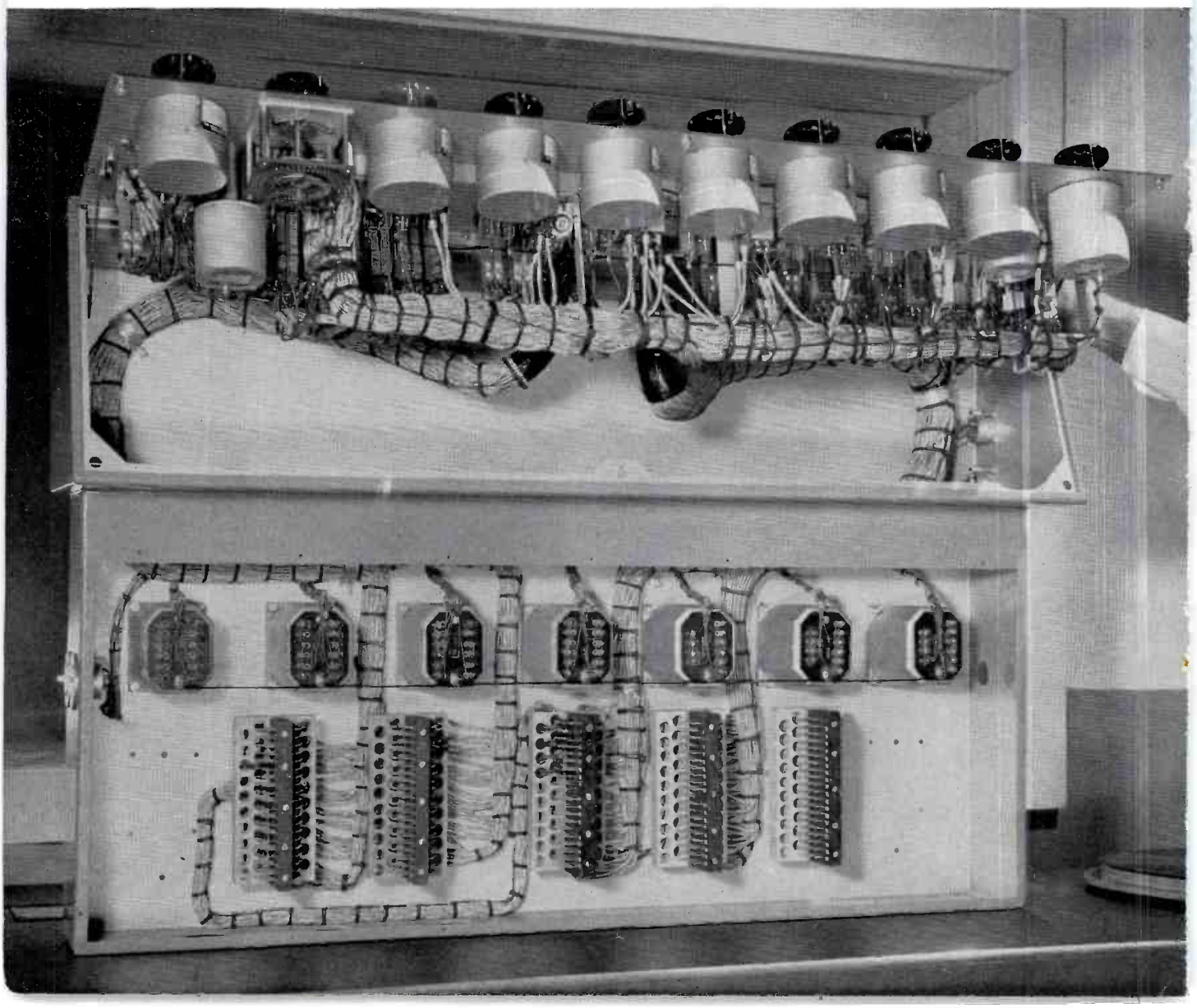
Fig. 5 is a photograph of one of the control consoles as it appears completely installed in studio "C" control booth at KOMO. A detailed account of the studio construction and acoustical treatment employed is given elsewhere in this series of KOMO articles. Therefore, the material which immediately follows is confined to a description of the technical equipment for this studio. The illustrations of Figs. 6 and 7, which are the block diagram and a close-up view of the control panel respectively, may prove helpful in following control features and circuit details.

The Studio Console Circuit

The circuit embodies six mixer positions and each mixer has associated with it a lever key. This provides a choice of two inputs to each mixer thus adding to the flexibility of the overall system. The six mixer controls are centrally located on the control panel with the selector keys grouped at the upper left part of the panel. Located directly above each mixer control, there are two supervisory lamps that indicate the input to which the mixer is switched. Both the "Studio-Booth" announce mixer and the "Remote-Net" mixer circuits are combined with the main channel following the program master gain control. This arrangement allows the group of four studio program microphones to be faded out simultaneously, while switching in or fading in the announce position or network programs. The network #2 equalizes the three circuit levels (net, announce and program) and matches the impedances for combining these three circuits.

The echo circuit is set up by patching a bridging transformer to the output multiple of one of the microphone or turntable

FIG. 4 (Below), This view shows one of the KOMO Studio Consoles prior to installation in desk top. The front panel is raised to make control parts and wiring visible. Transformers and terminal blocks are mounted below, as shown.



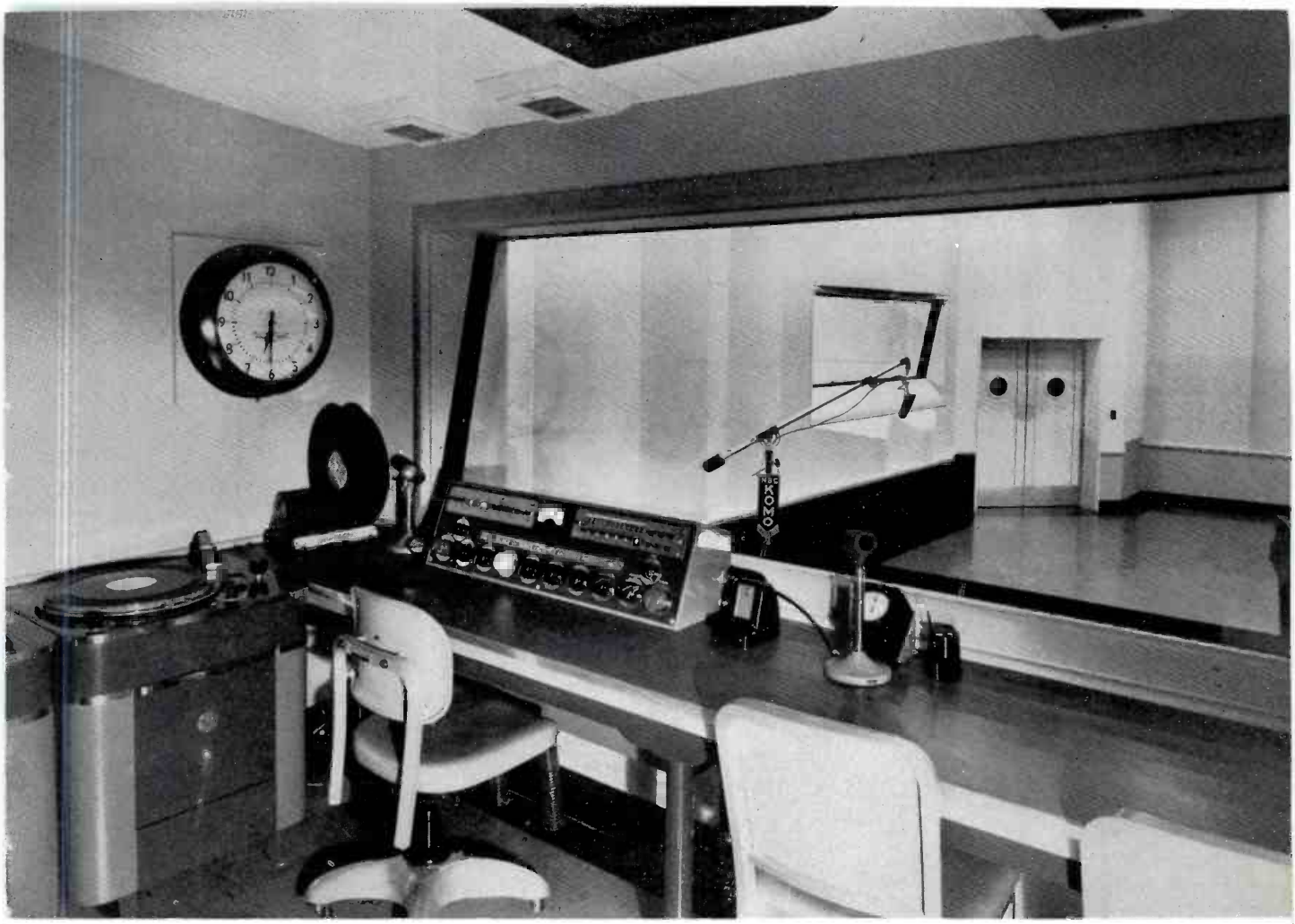


FIG. 5 (Above). Looking into Studio "C" from KOMO's "C" Studio Monitoring Booth. This same neat-appearing, custom arrangement is employed in each KOMO Studio Control Room. Two RCA (Type 70) Turntables are visible at the left.

pre-amps. The output of this bridging transformer appears on jacks on a rack in the master control room from which it can be patched into an RCA BA-4A Power Amplifier which drives a speaker located in the echo chamber. A microphone in the echo chamber picks up the output from the speaker and feeds it into an RCA BA-1A Pre-amplifier the output of which also appears on jacks in master control. This circuit is now patched back to the control booth where it can be connected into jacks labeled "echo return." This "echo return" overrides the program through a bridging transformer connected across the regular channel. The level and effect can be varied by adjustment of an echo attenuator located on the console control panel.

RCA Type BA-1A Amplifiers are used as microphone preamplifiers and in the booster circuit. The program amplifier is an RCA Type BA-3A. From this amplifier, a two-way branching network feeds the outgoing program line . . . and the VI circuit and monitor bus. An RCA Type BA-4A Monitor Amplifier bridges the monitor bus through a bridging volume control and feeds the client's speaker, studio speaker and booth speaker. Headphone facilities are provided for line monitoring and checking the regular monitor circuit in the event of failure. There is also another headphone circuit which provides a choice of either the regular monitor amplifier or the cue amplifier output. (A turn key located on the control panel is used to make the selection.)

The talkback and cue circuit uses a BA-1A and a BA-3A Amplifier with separate volume controls provided for talkback and cue—so that the proper level and balance can be obtained. A relay, which is provided to allow switching from cue to talkback, is operated by a push-button in the TB microphone stand. The BA-3A Amplifier feeds both the studio speaker and a separate cue speaker in the booth. The speaker relays are interlocked with the microphone keys in order to prevent feedback. Constant amplifier loading is always maintained by a system of back loading all relays. There is a relay in the booth monitor speaker line, which makes possible two separate operating levels for monitoring . . . thus providing maximum level for program monitoring or a decreased level for routine network monitoring (a switch on the console panel selects either the high or the low position).

Other facilities provided on the console are two utility keys, a sound effects filter key, two turntable motor keys and a spare key. The switch designated as "UTL 1" is a two-way key with connections appearing on rack jacks to permit line reversals. The switch "UTL 2", also has terminal connections on the rack and may be used for three-way switching.

The filter key is normalled through in the center position, but in the up position the sound effects filter is inserted in the microphone channel after it has been patched. This particular filter unit is used whenever special frequency characteristics are desired and can often be used in conjunction with the echo circuit to produce unusual effects.

There are two switches for control of the turntable motors. When in the up posi-

tion, they operate the motor-starting relays directly. In the down or "interlock" position, the relay circuit is interlocked through the turntable-mixer key. This allows the control room operator to start the motor and cut in the mixer with one operation.

The spare key switch mentioned above has several types of contacts wired to a terminal block. This switch is located to the right of the VU meter and may become useful at some later date.

The "Stand-By" pushbutton switch located on the panel energizes a relay which in turn operates a stand-by signal in the studio. This may be used at the operator's discretion or at some pre-determined period prior to "On-Air" time as a "get ready" signal.

Another useful feature is the "Flasher" button. This operates a photoflood lamp in the studio and is a means of getting the attention of announcers or other studio personnel while a program is on the air.

The utility volume control with 600 or 150 ohm input and output impedances is available and can be used as a spare or for arranging special program set-ups.

The cue selector is a special Daven Switch of 24 positions (non-shorting) with continuous rotation. Twenty-one cue circuits appear on this switch.

The output line key is a two position switch. When it is in the up or "On-Air" position, and program is being fed to master control . . . the studio speaker is interlocked and cannot be connected to the talkback circuit. When the output line key is in the "rehearse" position the booth program monitor and cue speakers are automatically locked out whenever the talkback microphone is operated. "Rehearsal" and "On-Air" door lights are also operated by this switch.

Operation of the six channel keys and associated lights is included in a later paragraph under the description of Master Control.

KOMO Master Control

Two views of the Master Control Room Console are shown in Figs. 8 and 9. The view in Fig. 8 shows the Master Control desk in its entirety, as installed at KOMO, except at the extreme right where one panel is not visible. This view is looking into studio "F" which may be controlled from the left panel of the master control desk.

The view as seen in Fig. 9 shows part of the nine RCA cabinet racks at the left. These racks contain all of the amplifiers, jack panels, equalizers, line coils, power supplies, etc., required for normal operation. The FM transmitter can be seen at the far side of the room.

A block diagram (Fig. 11) of the equipment in the Master Control Room is shown on the pages following. The Master Control Room is the dispatching center for six outgoing channels to feed KOMO-AM, KOMO-FM and network. This leaves three additional channels which may be used for such services as auditioning, recording or emergency. The switching system, which is completely relay operated, has a total of ten inputs. These inputs include studio programs, networks and any remotes which may be patched in. The relay system is composed of 72 relays, made up of six channels each having 10 input relays, a master relay and a studio interlock relay (a part of the circuit which under certain conditions, extends master switching to the studios). With the exception of the master and interlock all relays are of the double-coil type. The two windings serve as an operate winding and a hold winding. The master relay energizes the operate winding which in turn locks the relay in through the hold winding after the master relay has been released.

The master control relay switching is electrically interlocked so that one or all studio inputs may be switched to any one or all of the six outgoing channels, but does not permit two studios on the same channel. Each of the channels has a power switch (DC), a studio pre-set selector, a

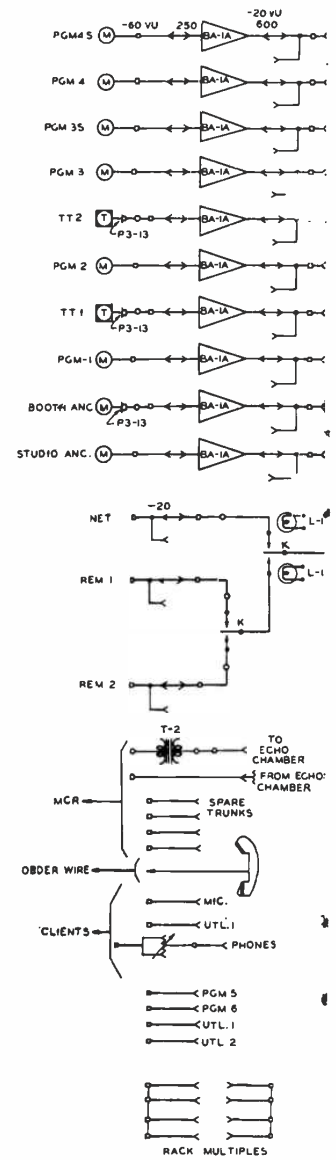
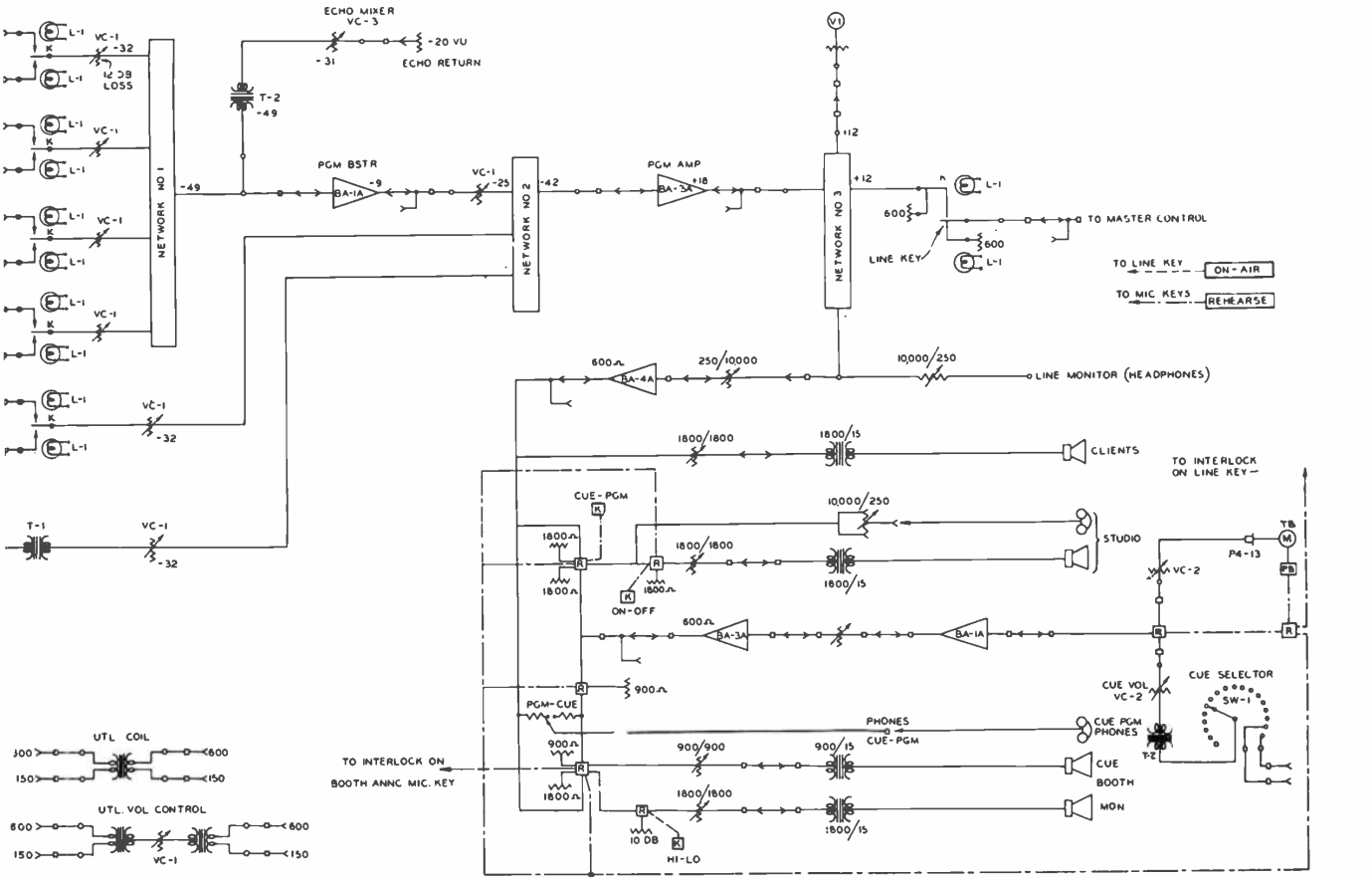


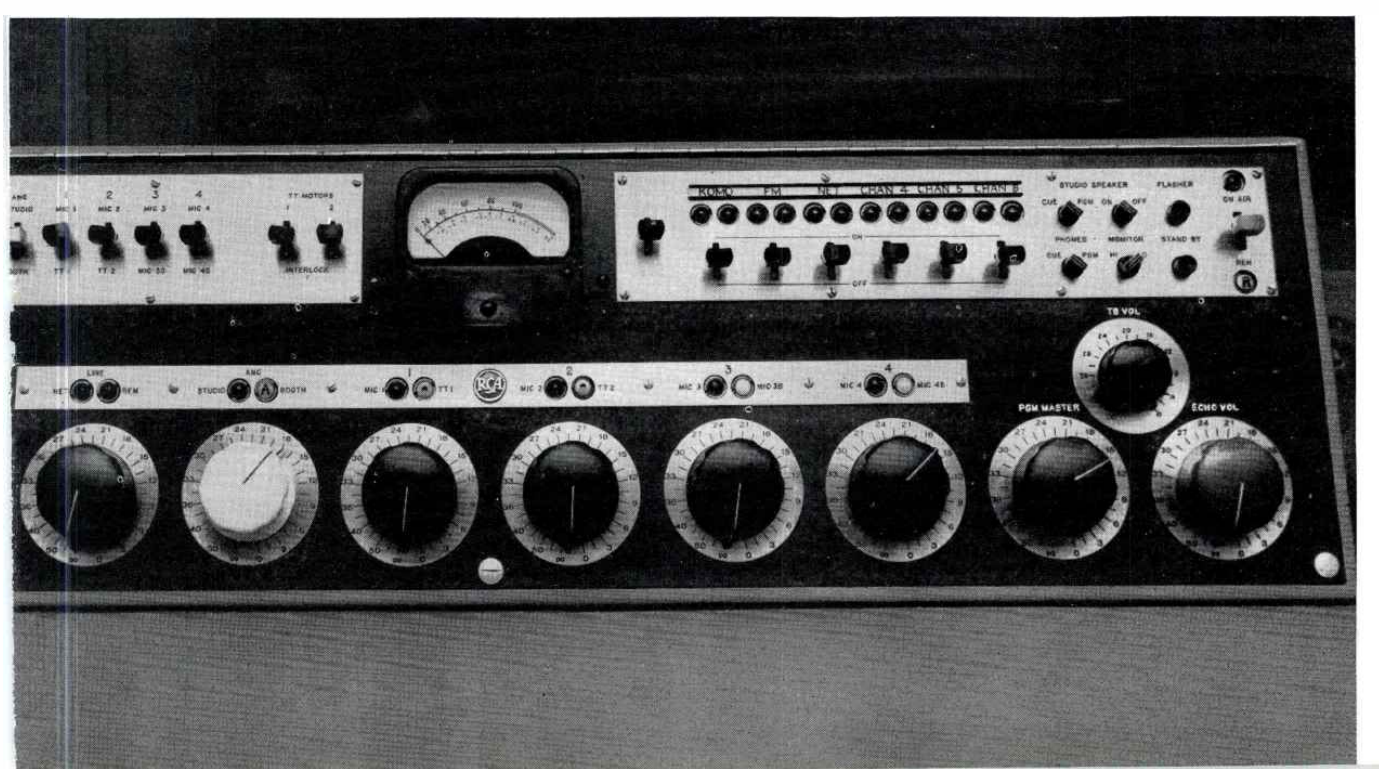
FIG. 6 (Top Right). Simplified Block Diagram of the KOMO Studio Console circuit which incorporates six mixers and provides complete selective switching for feeding AM, FM, Network plus channels 4, 5 and 6. The Console circuit design features include echo control, as well as elaborate monitoring, cue, talkback, turntable, sound effects and utility control facilities.

FIG. 7 (At Right). As shown in this closeup view, every facility needed for complete supervisory control of the companion studio is provided on the console front panel. Each switch, turn-key, indicator light and control knob has its associated circuit function, machine-engraved and clearly identified. Specially colored switch handles and mixer knobs (see front cover photo) denote certain circuits.



SYMBOLS

- ○— = RACK TERMINAL
- ○— = CONSOLE TERMINAL
- PB = PUSH BUTTON
- K = SWITCH
- R = RELAY
- T-1 = LINE COIL 600/600
- T-2 = BRIDGING COIL
- L-1 = SWITCH BOARD LAMP
- VC-1 = 250/250 BRIDGED T
- VC-2 = 250/250 BAL LADDER
- VC-3 = 600/600 BAL LADDER
- SW-1 = 21 POS NON-SHORTING SWITCH



master gain control, a VU meter, and a "Master-Operate" switch. Any pre-set studio may be switched to an outgoing channel by moving the "Master-Operate" switch to the operate position. This operates the master relay mentioned above and the key will return to normal as it is non-locking.

The condition may arise when it will be convenient and necessary to switch several channels simultaneously. This is accomplished by moving the "Master-Operate" key to the master position which transfers control to a master switch. The single master switch will then operate all channels over which it has control. After the switching function has taken place any pre-set selector may be moved to a new position without affecting operation of the system.

Referring back to the description of the studio console, mention was made of the six channel-operate keys which are incorporated in each equipment. Thus, in each studio there is a duplicate switching control arrangement available at the studio console. Also, there is a red and a green supervisory lamp associated with each channel. When the red lamp is energized it indicates that the channel is in use and that some program is feeding it. When the green lamp is on, it indicates that the channel is clear. Under this condition, when a certain studio is preset, the control room operator for this studio can put his program on the outgoing channel by simply operating the channel key switch to the "on" position. This is a spring-return lever key which will return to normal position after completing the operation. The studio control room operator may also take his program off the channel by operating the channel key to the "off" position. The interlock relay previously mentioned prevents channel switching in a studio control booth if the channel is already in use. This flexible switching arrangement makes it possible for an operator to preset a studio at the master control console and

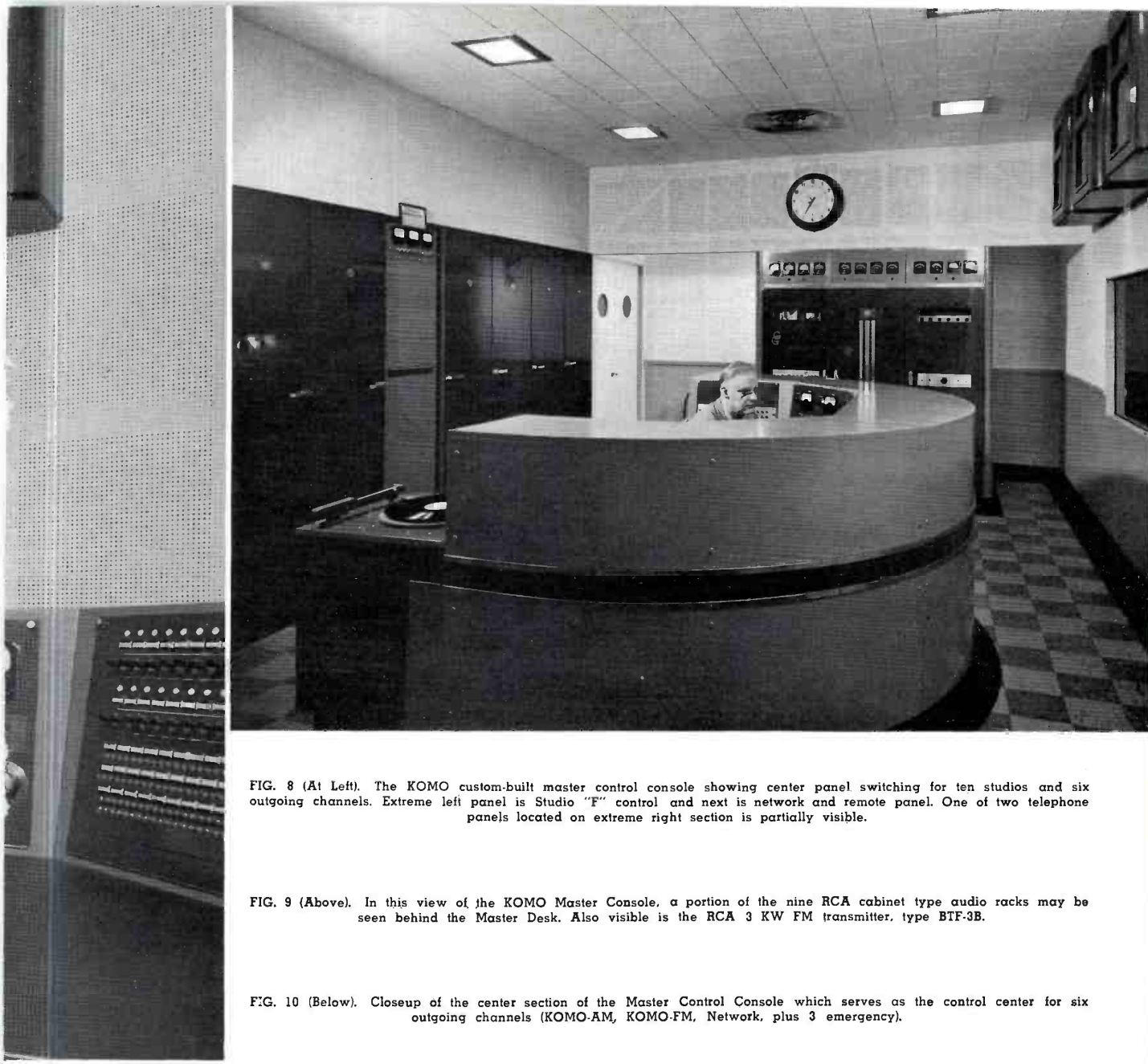
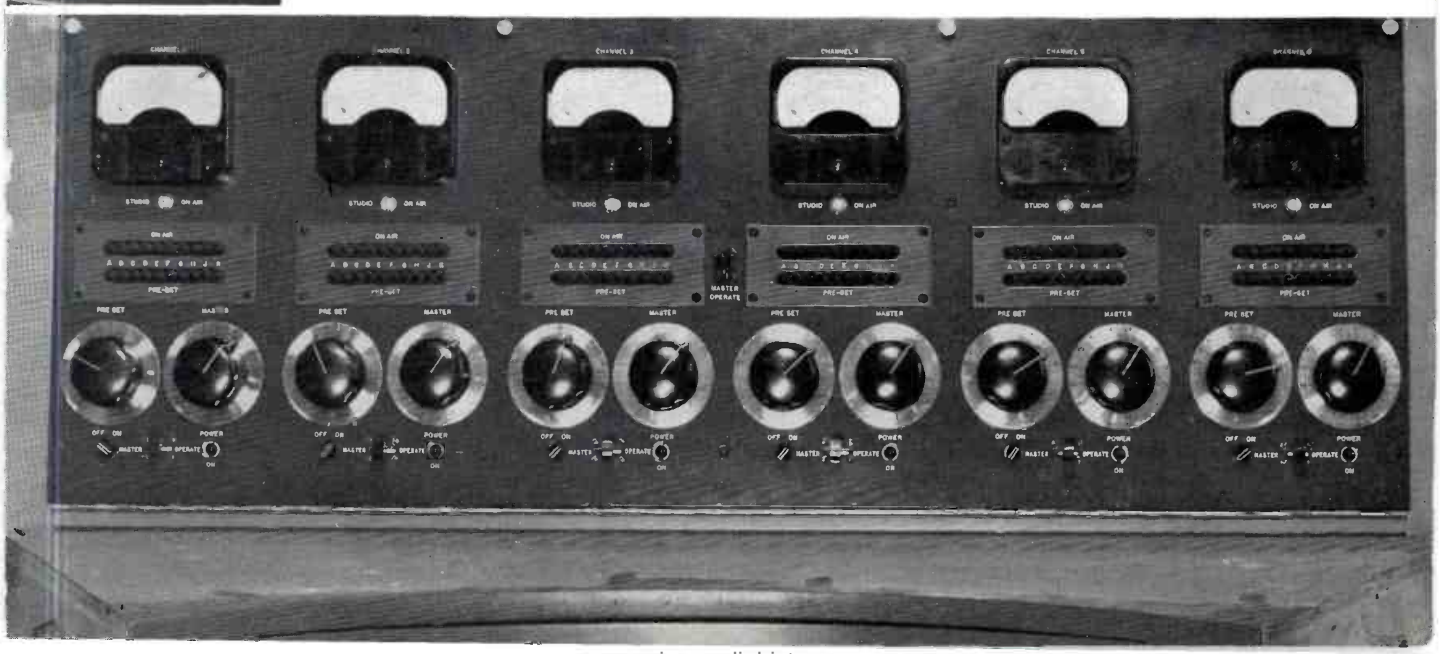


FIG. 8 (At Left). The KOMO custom-built master control console showing center panel switching for ten studios and six outgoing channels. Extreme left panel is Studio "F" control and next is network and remote panel. One of two telephone panels located on extreme right section is partially visible.

FIG. 9 (Above). In this view of the KOMO Master Console, a portion of the nine RCA cabinet type audio racks may be seen behind the Master Desk. Also visible is the RCA 3 KW FM transmitter, type BTF-3B.

FIG. 10 (Below). Closeup of the center section of the Master Control Console which serves as the control center for six outgoing channels (KOMO-AM, KOMO-FM, Network, plus 3 emergency).



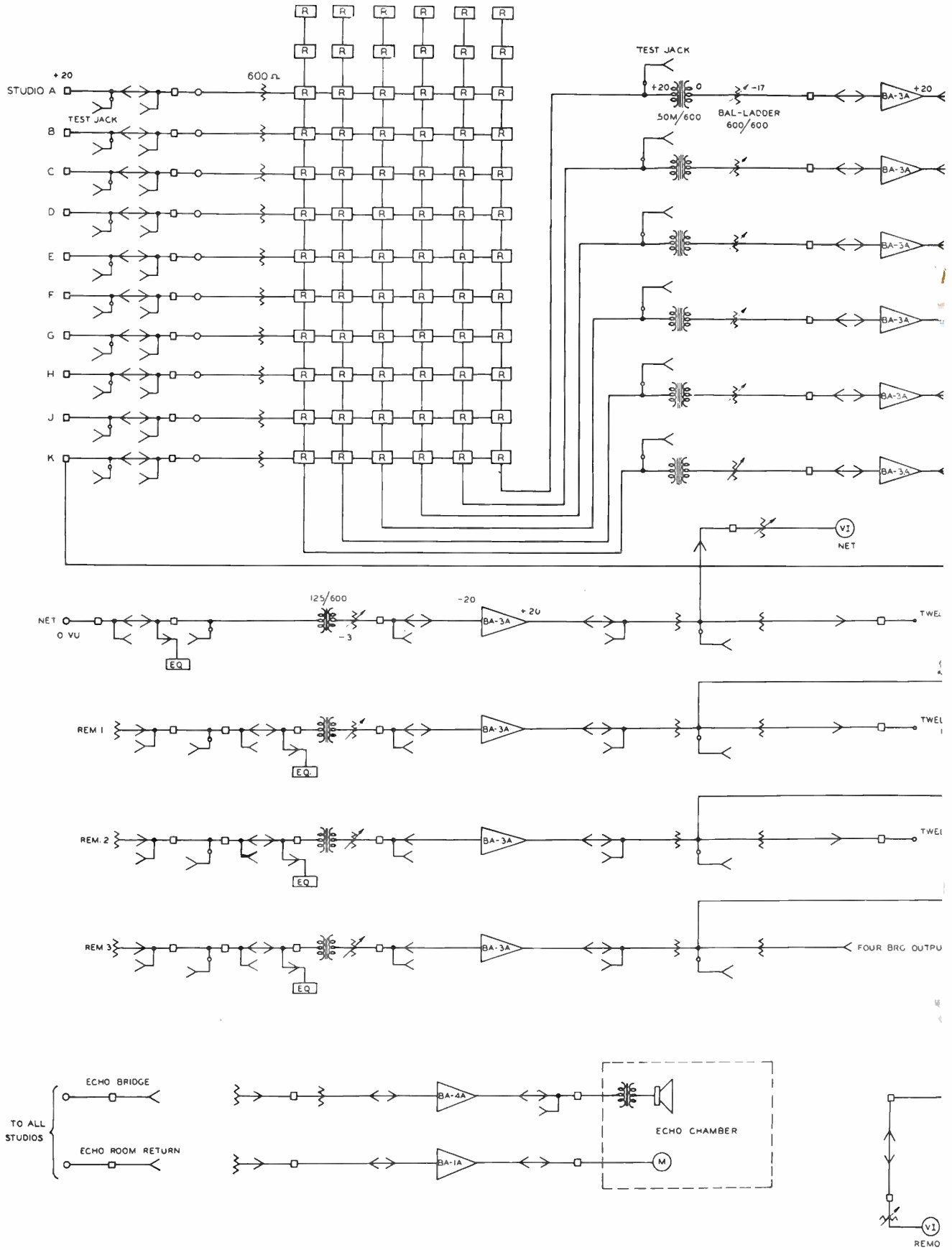
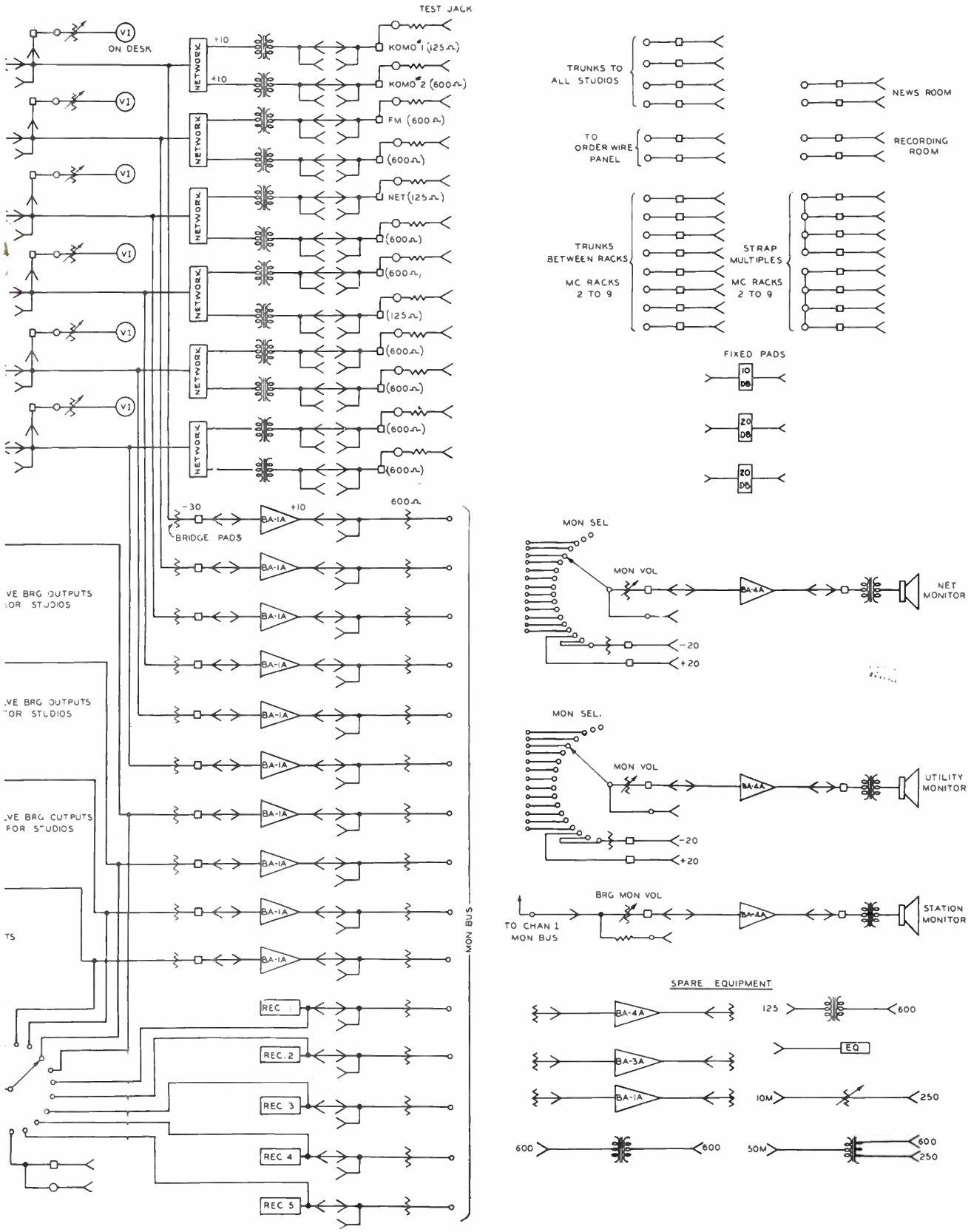


FIG. 11 (Above). SIMPLIFIED BLOCK DIAGRAM OF



THE KOMO MASTER CONTROL ROOM SYSTEM.

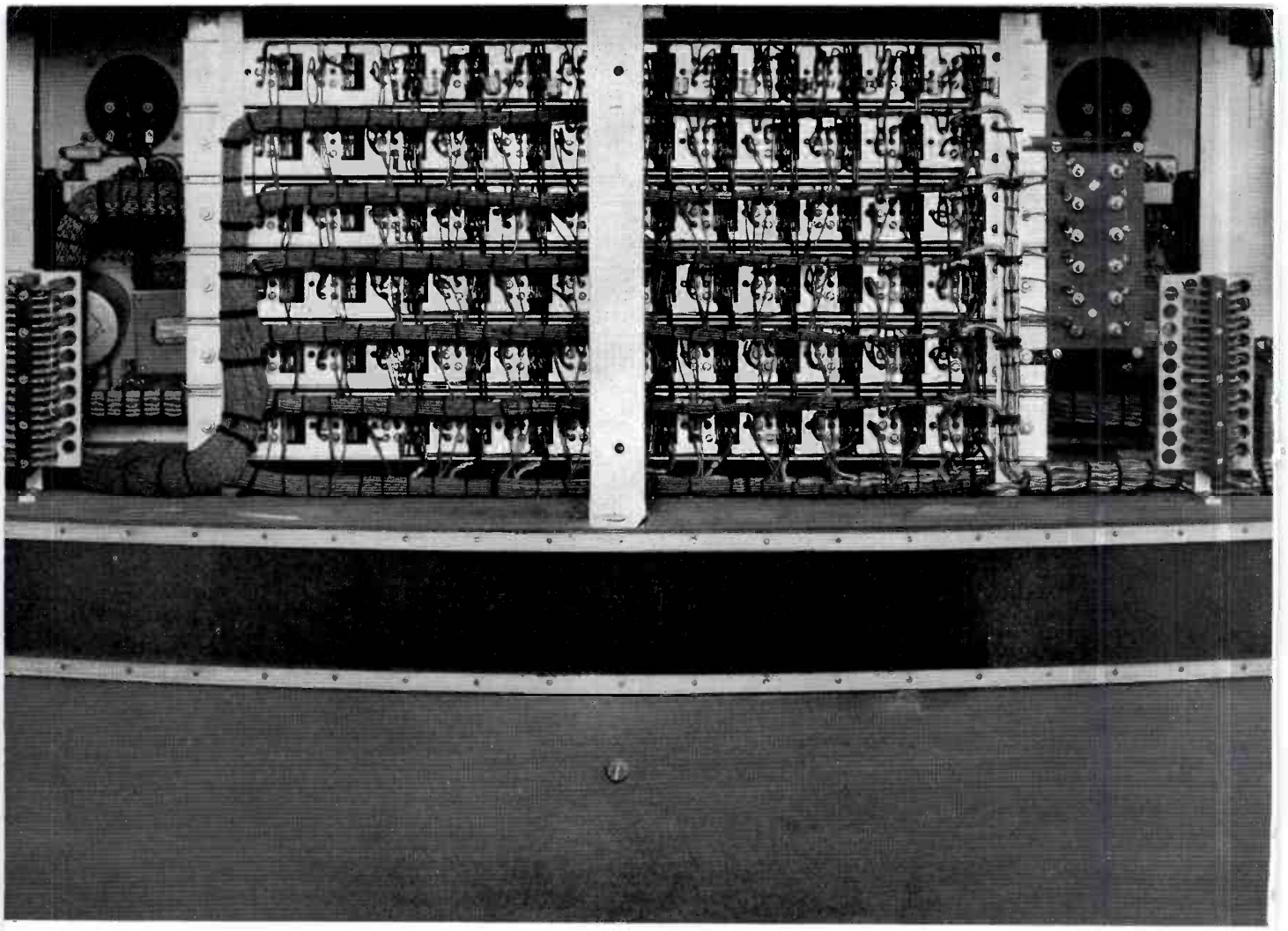
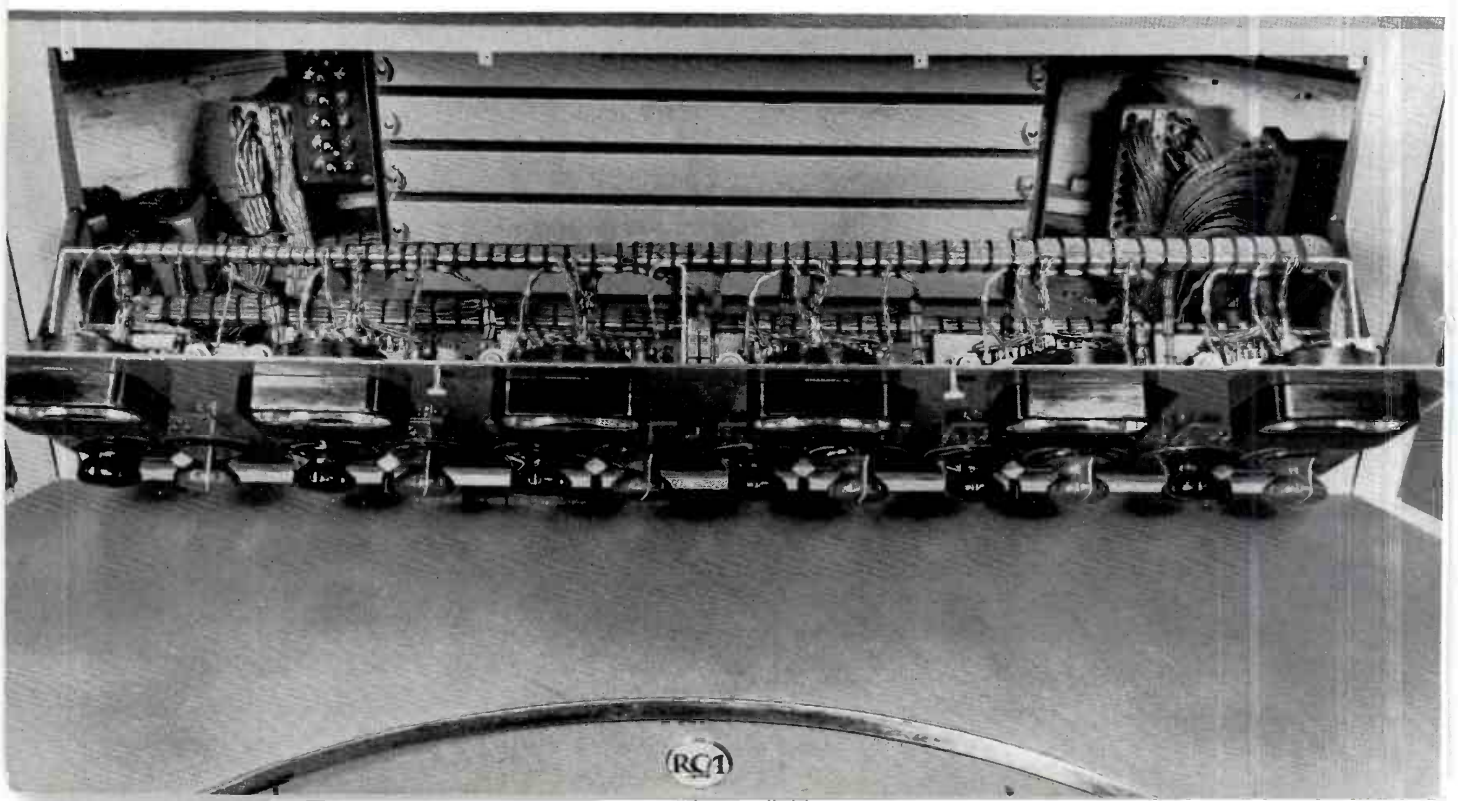


FIG. 12 (Above). Rear view of the Master Console center section, with panels removed to illustrate relays, wiring, terminal blocks, etc.

FIG. 13 (Below). The front panel of the master console showing how center section may be lowered to gain easy access to components, when desired.



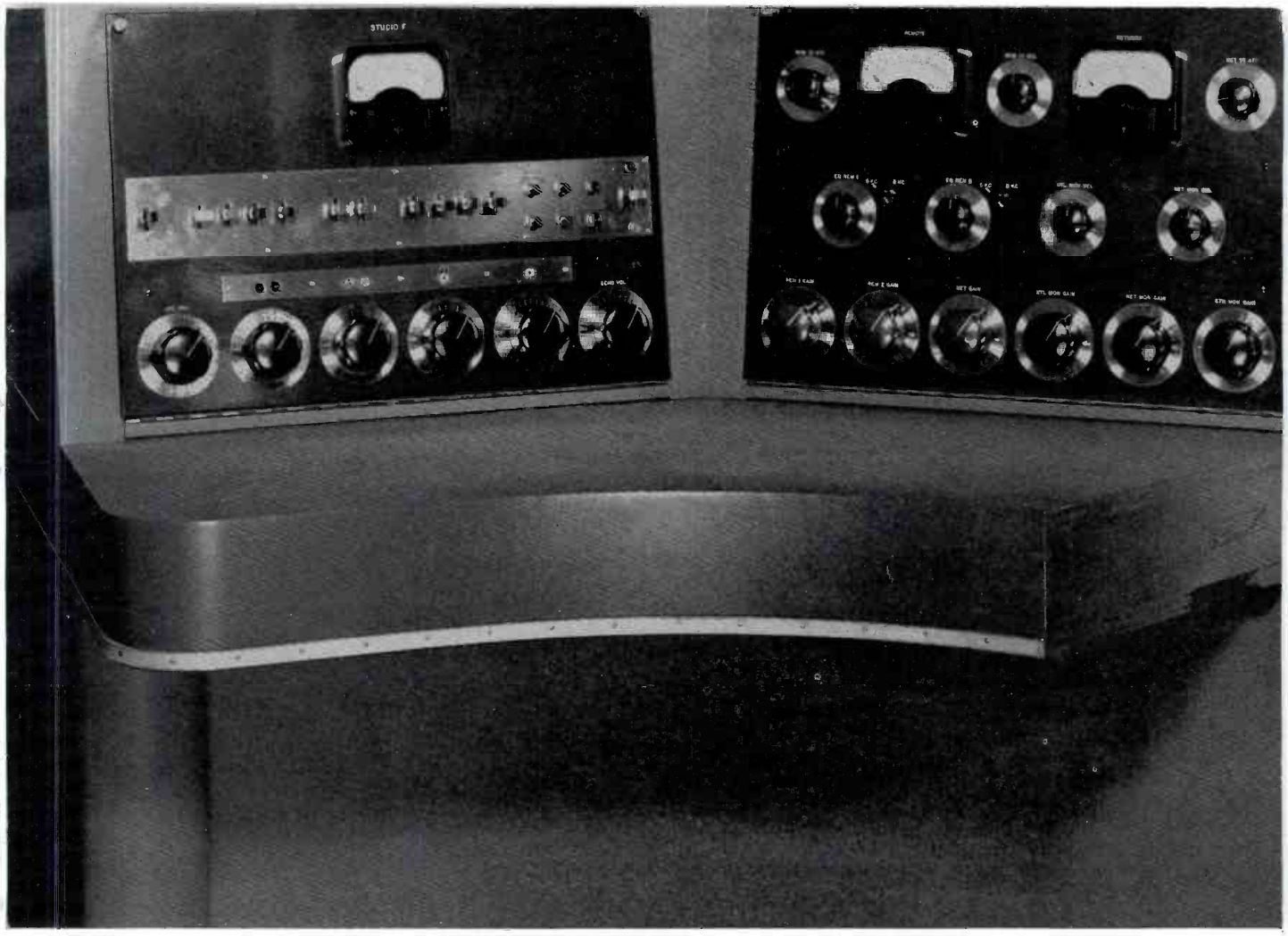


FIG. 14 (Above). In this partial view of the KOMO Master Console, the Studio "F" control panel, at left—and the remote, network and monitor controls at right are visible. Control of Studio "F" is provided for on the Master Console, as shown above.

then go to the studio control booth and put the program on the air. This would be desirable at certain hours when operating the studios with a reduced staff.

Each of the six program output channels is bridged across the outputs of the relay system through a 50M/600 bridging transformer. Each transformer feeds the program through a balanced master gain control to an RCA Type BA-3A Channel Amplifier whose output is bridged two ways to two outgoing lines. The bridging network used provides a 60 DB isolation between the two lines with a 10 DB transmission loss to each one.

Fig. 12, which is a back view of the center section of the control desk, shows the bank of relays required to perform the switching functions described above. The relay covers are removable from the front side of the desk. This provides easy access to the relays by merely opening up the front panel in the event adjustments are required. Fig. 13 illustrates how the center switching panel of the master control console may be opened to provide access to controls, relays and wiring.

Other services required in the master control operation are three incoming remote lines and a network trunk. The remotes may be bridged to the various studios or may be patched directly into the switching system by the master control operator. Variable equalizers and gain controls for the remotes are provided on the master control desk (the network line is equalized by the telephone company). The network is permanently normalled into one of the switching system inputs, although it too is bridged to the various studios where it is available for special program set-ups. RCA Type BA-3A Amplifiers are used as boosters in these remote lines to make up for the loss in level due to equalizing and to provide the exact level required for transmission to the studios or switching system. There is a VU meter connected to a selector switch with taps connected to the remote and network lines, thus provision is made for the accurate measurement of the program levels.

The monitor bus system consists of 10 RCA Type BA-1A Amplifiers with bridging volume controls connected to the six output channels, three remotes and one network. In addition, there are 5 monitor buses fed by receivers, the outputs of which appear on the VU selector switch so that they may be adjusted to the correct level in order to provide a balance with the output of the BA-1A Amplifiers.

There are three monitor systems, each using RCA BA-4A Power Amplifiers. A selector switch, which picks up the monitor buses, feeds a bridging volume control ahead of the amplifier in two of the monitor circuits. The third monitor is nor-

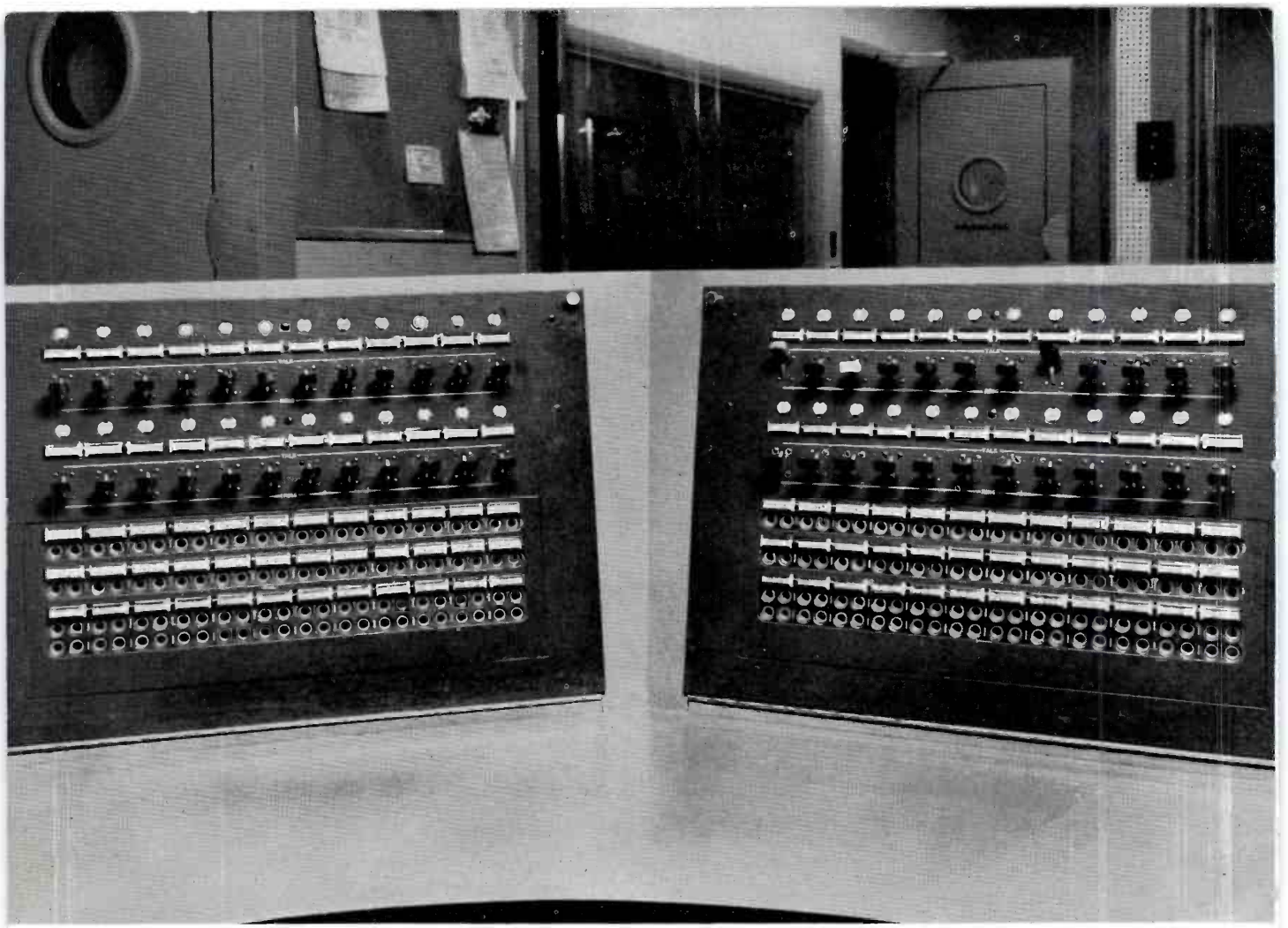


FIG. 15 (Above). Two panels at the extreme right-hand end of the console provide complete telephone ringdown and test-jack facilities, with each panel capable of accommodating 24 circuits.

malled directly to the Number 1 or KOMO-AM output channel to provide constant monitoring of that line.

The fact, that studio "F" may also be controlled from the master control desk when desired, was previously mentioned in the introduction. Control and switching facilities for this studio are incorporated on the left panel of the master control desk and include a remote-net mixer, and 3 mixers for one announce microphone and two turntables. A partial view (see Fig. 14 on preceding page) of the left section of the master control desk shows the studio "F" control panel. The panel containing remote and network controls and equalizers, and monitor selectors and controls (also visible in Fig. 14) is located to the right, adjacent to the studio "F" panel.

Both panels on the right-hand section of the desk are devoted to telephone ringdown circuits and test jacks (refer to Fig. 15). Panel #4 has keys and relays for 24 order wire circuits. Each ringdown circuit has a hold-in relay which operates a supervisory lamp associated with it. A buzzer also sounds when one of the relays has been locked up as a result of a remote ring. Operation of the line key to the "talk" position (which is locking) causes the relay to drop out and connects the MC handset across the remote line so that two way conversation can take place in a normal manner. When it is desired to ring a phone at a remote point, the ringdown key is operated to the "ring" position (non-locking) which puts ringing current across the line.

The test jacks are headphone bridge connections to circuits such as studio and channel outputs.

Panel #5 is identical to Panel #4 except for allocation of the circuits. The ringdown positions are used for local phone circuits, such as studios, shops, etc.

As in any well-equipped station there is ample equipment provided to be used in case of emergency. This includes a spare amplifier of each type, wired to jacks for convenient use. Also there are spare line and bridging coils, fixed pads of various losses and plenty of tie trunks available so as to obtain maximum flexibility in the system.

All amplifiers and power supplies are of the RCA plug-in type. The advantages of these units have been covered in a previous issue of BROADCAST NEWS.

Acknowledgment is hereby given to Mr. F. J. Brott and Mr. Stan Bennett of KOMO for much of the material used in this article. It was the close cooperation between the engineers of RCA and KOMO, and the complete understanding between these two groups as to the technical requirements, that made it possible to design and install all studio equipment with a minimum amount of trouble and delay.

KOMO'S NEW 50,000 WATT TRANSMITTER

By F. J. BROTT* and C. E. MILLER**
Radio Station KOMO

KOMO's new 50,000 watt AM transmitter is located on Vashon Island, 13 miles southwest of the "downtown" area of Seattle. The site was selected as being ideal to best serve Western Washington. It gives KOMO a salt water path to the major populated areas and takes maximum advantage of the directional coverage pattern required by the F.C.C. The clearing and grading of the site to accommodate a ground system a quarter of a mile wide by three-eights of a mile long was a major project; an entire hill was moved to fill and level the area.

* Chief Engineer.
** Transmitter Plant Engineer.

Antenna System

The antenna system is an "end fire" with three 500 foot Lehigh guyed towers spaced approximately .3 wavelength. The array is oriented to give a 178 KW signal toward the heavily populated Seattle area and 147 KW toward Tacoma and Olympia to the south.

One inch wide copper ribbon was used for ground radials. More than 180,000 feet of ribbon was used in this installation. Forty-eight foot square copper mesh ground screens are used at the base of each tower. Tuning houses are of concrete block and tile with concrete slab roofs. Tuning house shielding is of sheet copper. Cyclone fencing encloses each tower and tuning house.

Transmitter Building

Functional design was followed throughout the transmitter building. The construction is of reinforced concrete. The main floor is 18 inches above grade level. Located on the main floor are:

(1) The main transmitter room which contains the RCA 50F, 50 kilowatt transmitter. The phasing unit and phase monitor rack, the RCA type 5C, 5 KW auxiliary transmitter, the speech input racks and the transmitter control console.

FIG. 1. KOMO's 50 KW transmitter site and building. Right wing houses supervisor's office and test laboratory. Left wing has operators' bunk room, coffee kitchen and tube storage. Full basement has double garage, 50-F blower equipment, RCA 5-C water cooling equipment for auxiliary transmitter and storage. Towers are three 500 foot Lehigh vertical radiators.

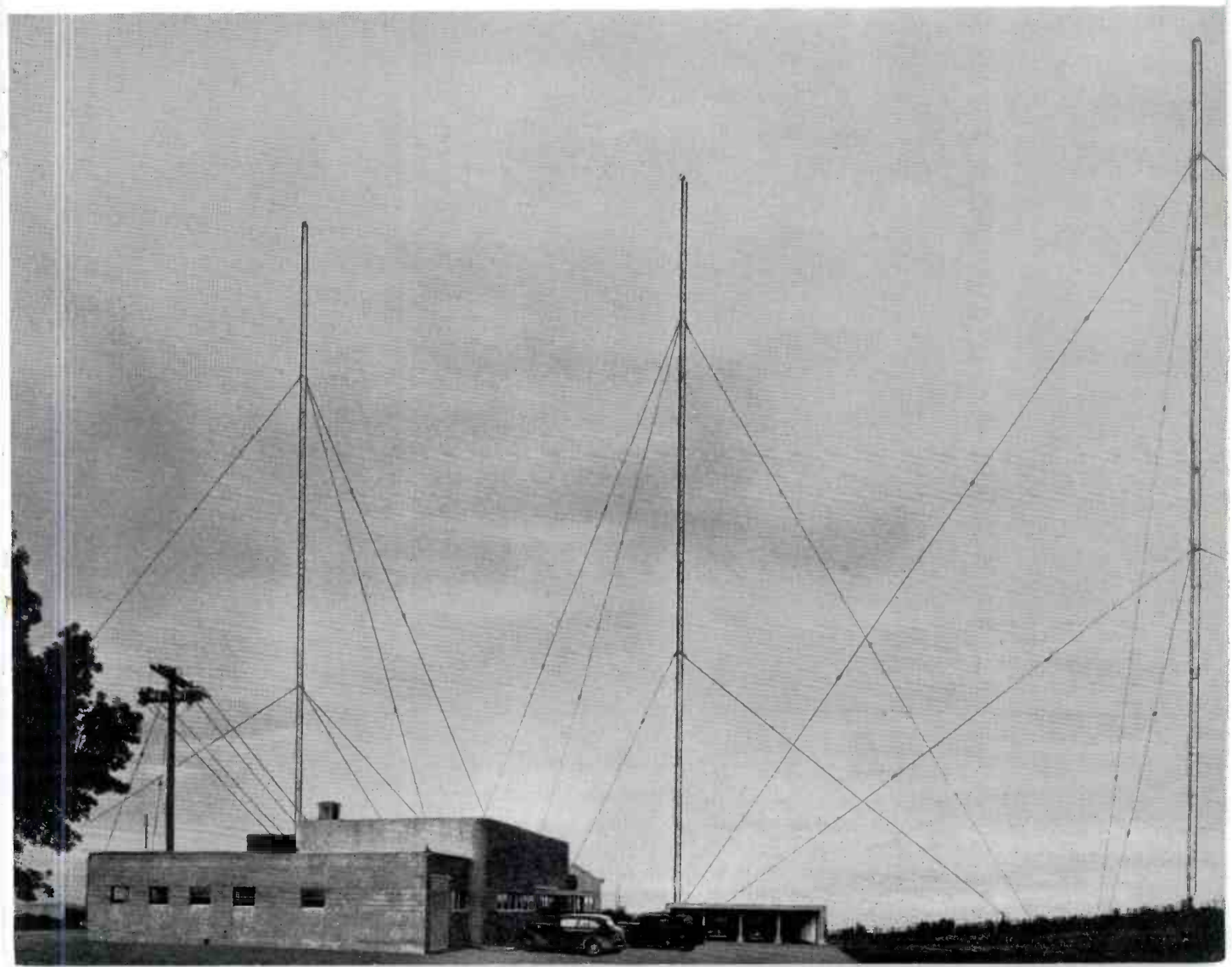


FIG. 2 (Above). The streamlined 50,000 Watt AM transmitter, Type RCA BTA-50F, is installed in the new transmitter building erected by KOMO on Vashon Island, approximately 20 miles from the broadcasting station in downtown Seattle. The supervisory control console contains extension controls for the transmitter as well as audio switching controls for regular operation.

(2) A fireproof vault, directly back of the 50F transmitter which contains the high voltage plate transformers, filter and modulation reactors and modulation transformer. This vault is protected by an automatic CO_2 system.

(3) A large shop equipped with adequate workbench space, machine lathe, drill press, grinder and the usual small tools.

(4) A large storage room with double doors opening on to a loading dock. This room is used for storage of 9C22 tubes and crates, rectifier tube crates, etc. Spare parts cabinets are also located here.

(5) A small service shop opening directly off the transmitter room contains a complete kitchen unit, consisting of electric range, sink, refrigerator, dish cabinet and tea wagon. Small tubes are stored in cabinets on one wall of this shop.

(6) A bedroom with double bunks, shower bath and clothes closet.

(7) The plant engineer's office is equipped with drafting table, map tables, map and drawing cabinets and files.

(8) Directly off the engineer's office is a laboratory with test bench, screened booth and storage cabinets for test and measuring equipment.

(9) What appears to be one corner of the building actually is an isolated room, with walls, roof, floor and foundation entirely separated from the main structure. This is the auxiliary power plant room and contains a 75KVA gasoline driven power plant which, upon failure of the regular power service will operate the 5 KW auxiliary transmitter, the tower and yard lights, the water system pumps and refrigeration as well as a portion of the building lighting. A control panel in the transmitter room equipment racks makes possible full automatic or manual operation of this power plant and the load transfer contactors. Lights on the control panel indicate the condition of the power plant and position of the various contactors.

(10) A small room adjacent to the phasing unit contains a water cooled dummy antenna, nitrogen tanks, dry air pump and charging manifold for the co-axial transmission lines.

Full Basement Allows Ample Storage Room

The grade at the north side of the building is ramped down to form a driveway into the basement which contains a two car

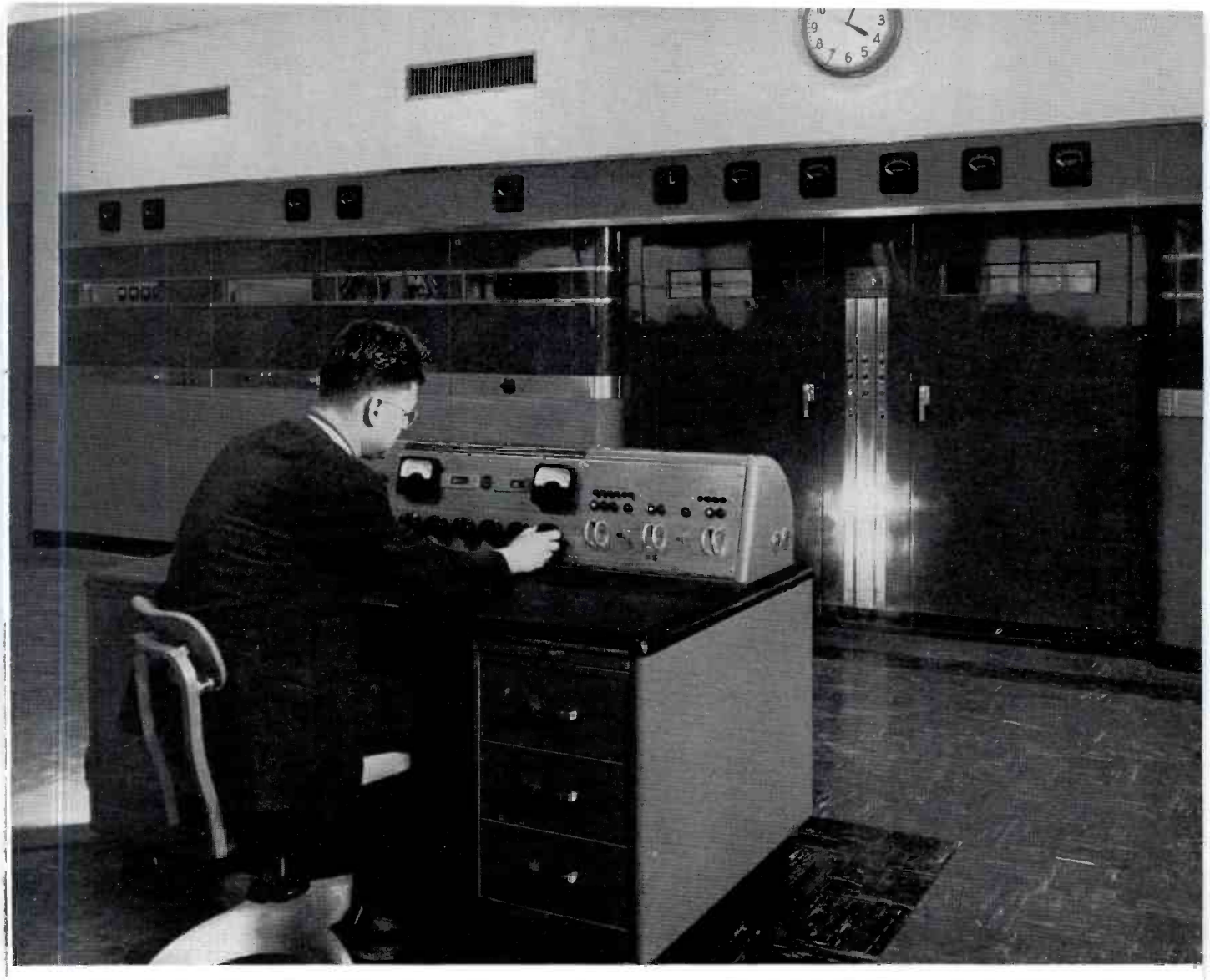


FIG. 3 (Above). KOMO's new RCA 50-F 50 KW transmitter and supervisory console. A concrete fireproof vault with automatic CO_2 equipment extends full length back of transmitter panels to house high voltage and modulation transformers.

garage for company cars, a blower room for the large blowers which supply cooling air to the 50F transmitter, an equipment room for the plate transformer, voltage regulator, and water cooling blower of the 5C transmitter, a furnace room containing the oil fired hot water heating unit and a large storage room.

Power is purchased from the local utility company at high line voltage. KOMO has its own substation located in a fenced in area adjacent to the west side of the building. Since considerable phase unbalance is experienced during peak load periods, three 12.5 KVA induction regulators were installed on the supply to the main transmitter.

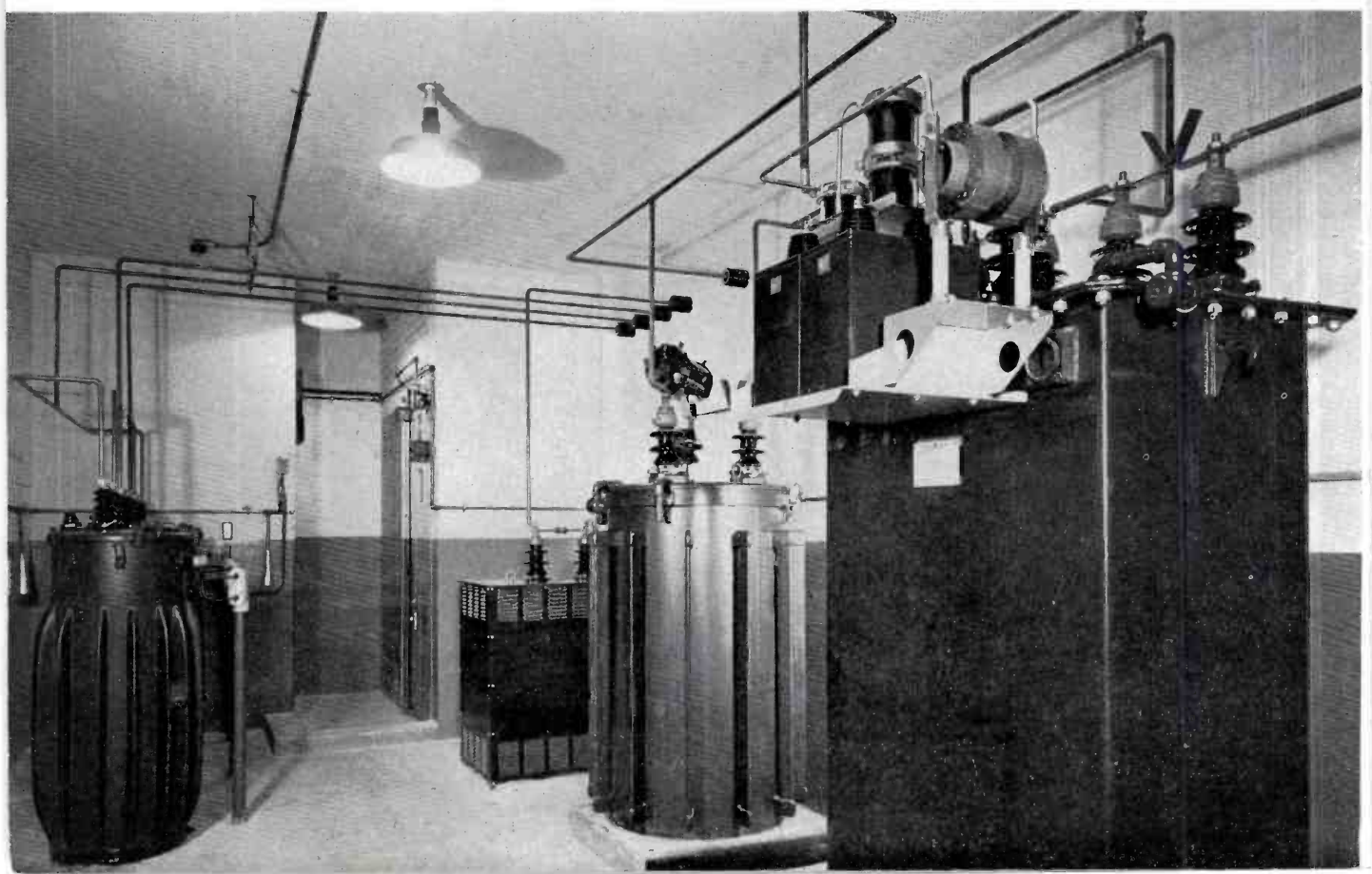
Three wells located on the property supply adequate water of excellent quality through an automatic pressure system.

The engineer, from his position at the transmitter control console has an unobstructed view of the entire antenna and ground system. The only access to the station by road is to the parking area which is directly in front of the building and in full view of the transmitter engineer. The co-axial transmission lines are carried across the parking area in a concrete trough, set flush with the urface and covered with iron grating. Beyond the parking area the lines are carried on a new type of flexible hanger approximately 30 inches above the ground. The lines are anchored to concrete blocks half way between each tower and the transmitter building, and are free to move, longitudinally, both ways from the anchor block. All telephone, intercom, control and power circuits and sampling lines are in buried conduits. A synchronized flasher mounted in the power distribution panel is used to flash all lights on each of the three towers. Austin transformers are used to cross the base insulators.

An unusual feature of this installation is the automatic switching system used to put the auxiliary transmitter on the air. A back contact on the 50F plate contactor is used to start the auxiliary. If the back contact is still closed after the 5C time delay has cycled, the 5C goes on the air. If the 50F plate contactor opens and recloses due to an overload, the 5C filaments will start but no plate voltage will be applied. After the danger of failure is past, the 5C filaments can be shut down. Switching back to the main transmitter when the auxiliary transmitter is operating is simply a matter of throwing one switch. A back contact on the 5C plate contactor throws the RF transfer relay over to the

FIG. 4 (Above). Closeup view of the BTA-50F Power Amplifier section. Two large doors provide access to the four tube positions, two of which are spares. Placing a "spare" in the circuit is simply accomplished by moving flexible filament and grid leads.

FIG. 5 (Below). The transformers through which power is fed to KOMO's 50 KW transmitter equipment are located in a reinforced concrete vault with fire doors which are interlocked with the transmitter controls.



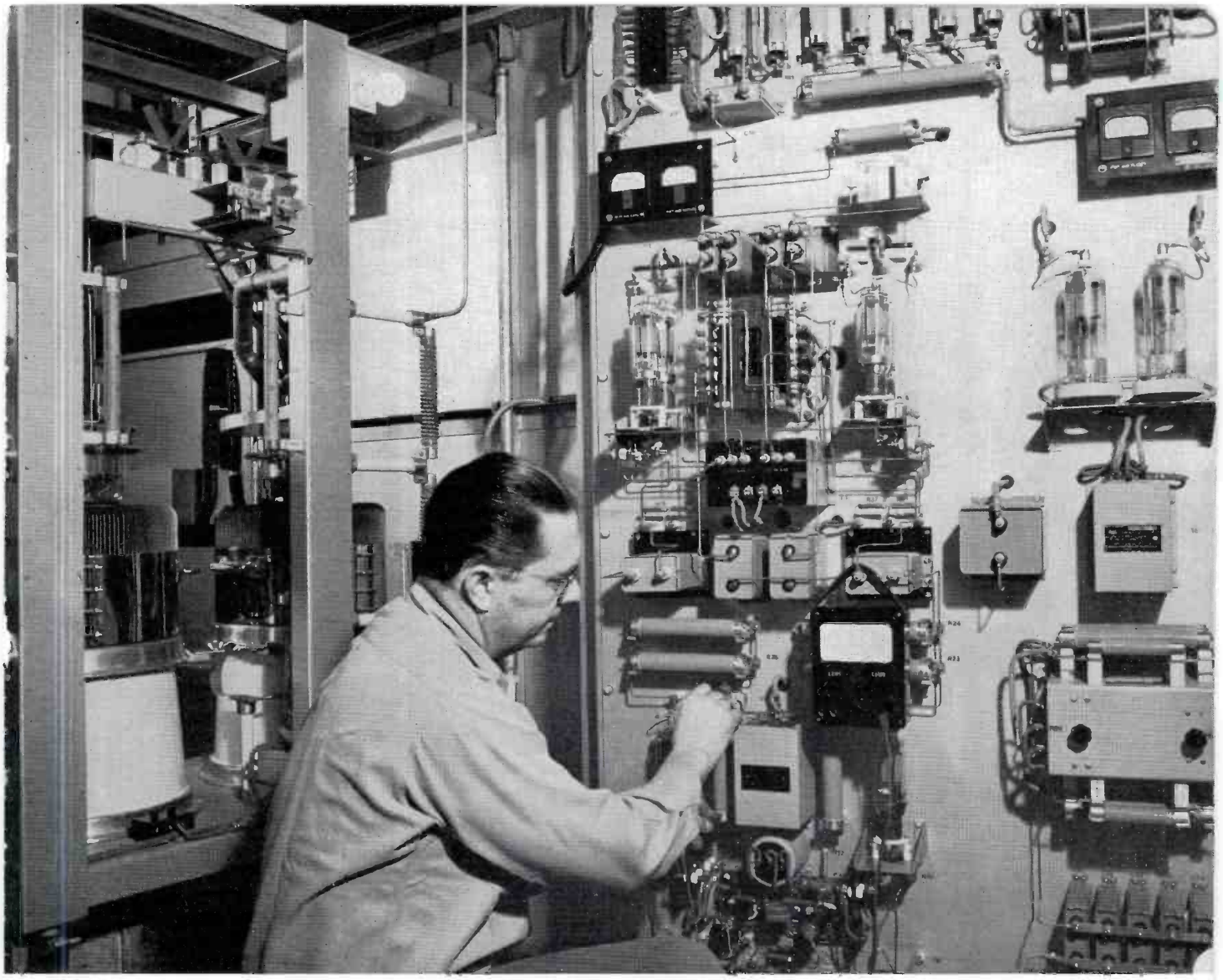


FIG. 6 (Above). Checking out the 50-F audio panel during installation is Cliff Miller, transmitter supervising engineer. This entire vertical panel swings ninety degrees for accessibility to all parts.

50KW position and closes the 50F plate contactor. The RF transfer relay cannot operate unless both the 50F and 5C plate contactors are open. The output of the transmitter which is not feeding the antenna is automatically switched over to the water cooled dummy antenna and can be operated into the dummy for test purposes. The relays and control switches for this system are mounted in equipment racks near the transmitter control console.

The same back contacts on the transmitter plate contactors are used to operate the directional RF relays. Auxiliary contacts on the directional R.F. relays are connected in series and used to reclose the plate contactor. Pilot lamps on the control panel show the position of each RF relay. Auxiliary relays associated with directional switching are also mounted in the equipment racks.

This directional switching system has proved very satisfactory. On one occasion lightning welded the R.F. relay contacts together at one of the tuning houses. The pilot lamps indicated the location of the trouble, which was cleared with a loss of only 15 seconds.

Phasing equipment at KOMO was supplied by RCA. Gas capacitors are used in the phasing tank and antenna terminating units.

Regular and emergency program circuits and order wire lines are carried to the island through submarine cables. A key is provided on the transmitter control console to switch from the regular to the spare program circuit. The air cooled 50F transmitter provides an abundance of warm air which can be used to heat the transmitter building. In the KOMO installation a duct carries part of the warm discharge air back to the blower room. Motor controlled dampers in this duct and on the intake air filter are operated by a thermal control placed in the discharge air duct. This control system maintains the discharge air at a constant temperature. Registers in the drop wall above the transmitter supply heating air to the operating room, and ducts run to other rooms in the building. The oil fired furnace takes over the heating job after sign off and keeps the building warm for the maintenance crew.

For a transmitter of this power the RCA 50F was remarkably easy to install. Performance is very good. Overall distortion

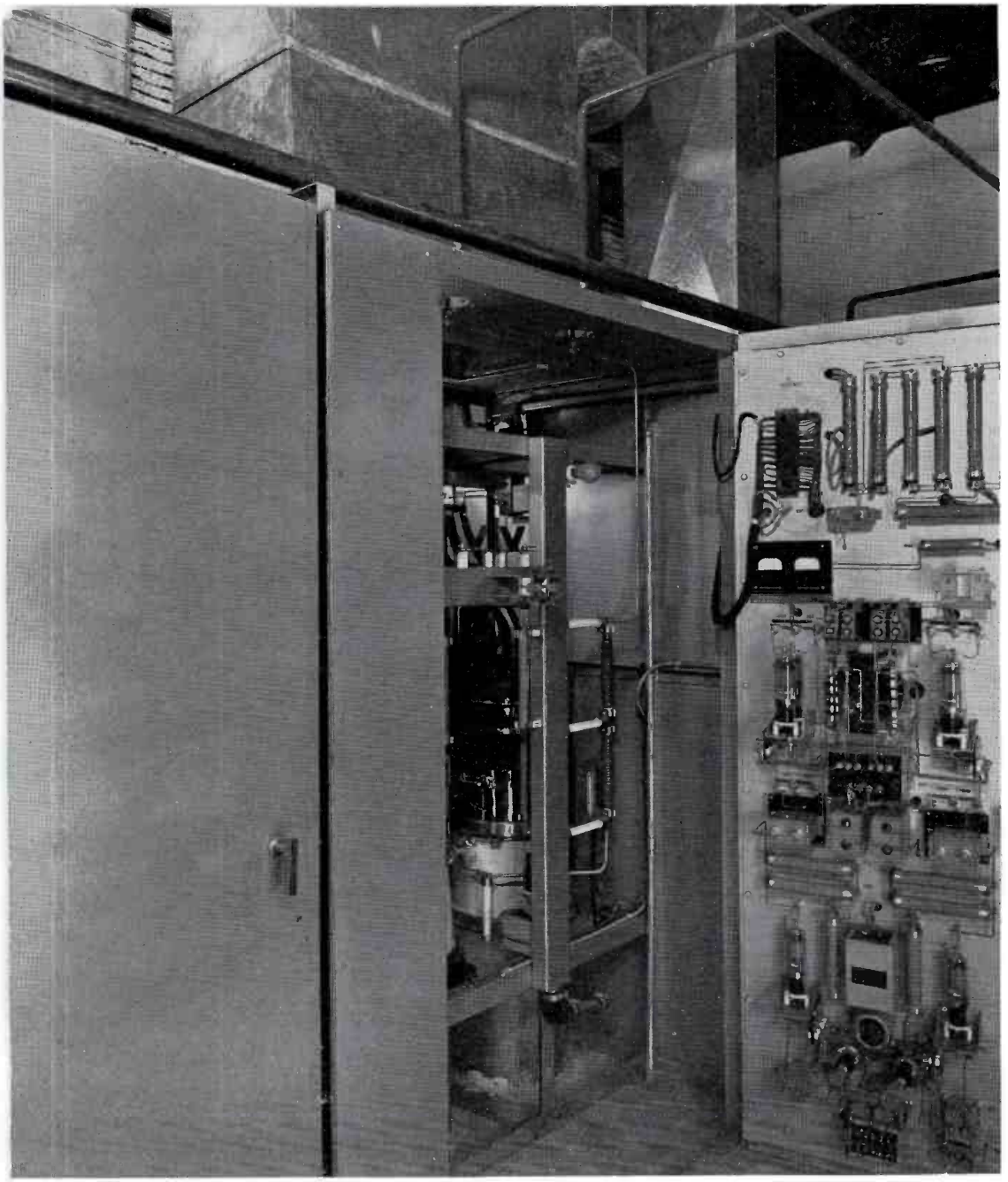


FIG. 7 (Above). This view looking into the rear of the audio and modulator compartment of KOMO's new 50,000 Watt transmitter shows how heat released in the operation of this equipment is directed into the building proper through ventilating ducts directly above the transmitter panel.

from studio input to air is under 2% at 85% modulation.

The RCA 50F 50 KW transmitter was selected for this installation for several reasons:

(1) The transmitter circuits are basically simple. There are no trick circuits that are difficult to maintain.

(2) The layout and construction are such that everything is accessible. Maintenance is simplified.

(3) The entire 50 KW transmitter including exciter, modulator, power amplifier, main rectifier and control and distribution unit sections are mounted behind a common front panel to provide a unified installation.

(4) Last, but not least, the service RCA gives its customers. For the past 12 years KOMO has used RCA equipment almost exclusively.

A reinforced concrete building was selected to give adequate fire protection to the approximate $175,000.00 worth of equipment which it contains.

Uninterrupted service is one of the primary design objectives of the KOMO installation. The functional design of the building, selection of conservatively designed equipment, installation of the emergency power plants, auxiliary transmitter, spare transmission lines and emergency program circuits are all part of the plan to provide for every contingency that might interrupt program service.

NEW, LIGHTWEIGHT REMOTE AMPLIFIER

by R. C. ABBETT

Audio Engineering Section
Engineering Products Department

The RCA type BN-2A lightweight and portable remote Amplifier has been designed to provide high-fidelity audio pickup facilities for AM and FM broadcast programs remote from the studio. The amplifier is ideal for use in picking up sporting events, street programs, political and social meetings, park concerts and similar gatherings. It may also be used as a permanent setup in small broadcast studios or for emergency use in large studios.

Three-Channel Facilities Provided

It is a complete three-channel amplifier providing excellent frequency response, low noise level and low distortion characteristics which make it useful for both AM and FM Broadcast Stations. The three amplifier channels use RCA 1620 indirectly-heated tubes, shock mounted to insure low microphonics and maximum protection from vibration often experienced during remote broadcasts. Each channel offers an overall gain of 92.5 db, more than adequate for any application. High level mixing is used throughout, reducing microphonics and general noise level to a minimum. It has capacity for four microphone inputs, the third and fourth switchable to channel 3, making possible a total of four microphones. Program may be fed to the output channel and the PA amplifier simultaneously. Also, the cue circuit may be switched to isolate the remote amplifier and feed PA direct.

A-C or Battery-Operation Provided

The BN-2A remote amplifier is designed with a *built-in power supply* for standard 115 volt, 60 cycle use, thus eliminating the need for an extra power unit and extra carrying case. Another design feature of the BN-2A is the provision for battery operation. When desired, it may be operated from an external battery power source (available as RCA MI-11214 battery box) by simply removing the A-C power connection and plugging in the cord of the MI-11214 box. The battery supply was designed for use with previous models of remote amplifiers and is wired with plugs ready to be inserted into the batteries—and supplied with a power cord for direct connection to the BN-2A remote amplifier.

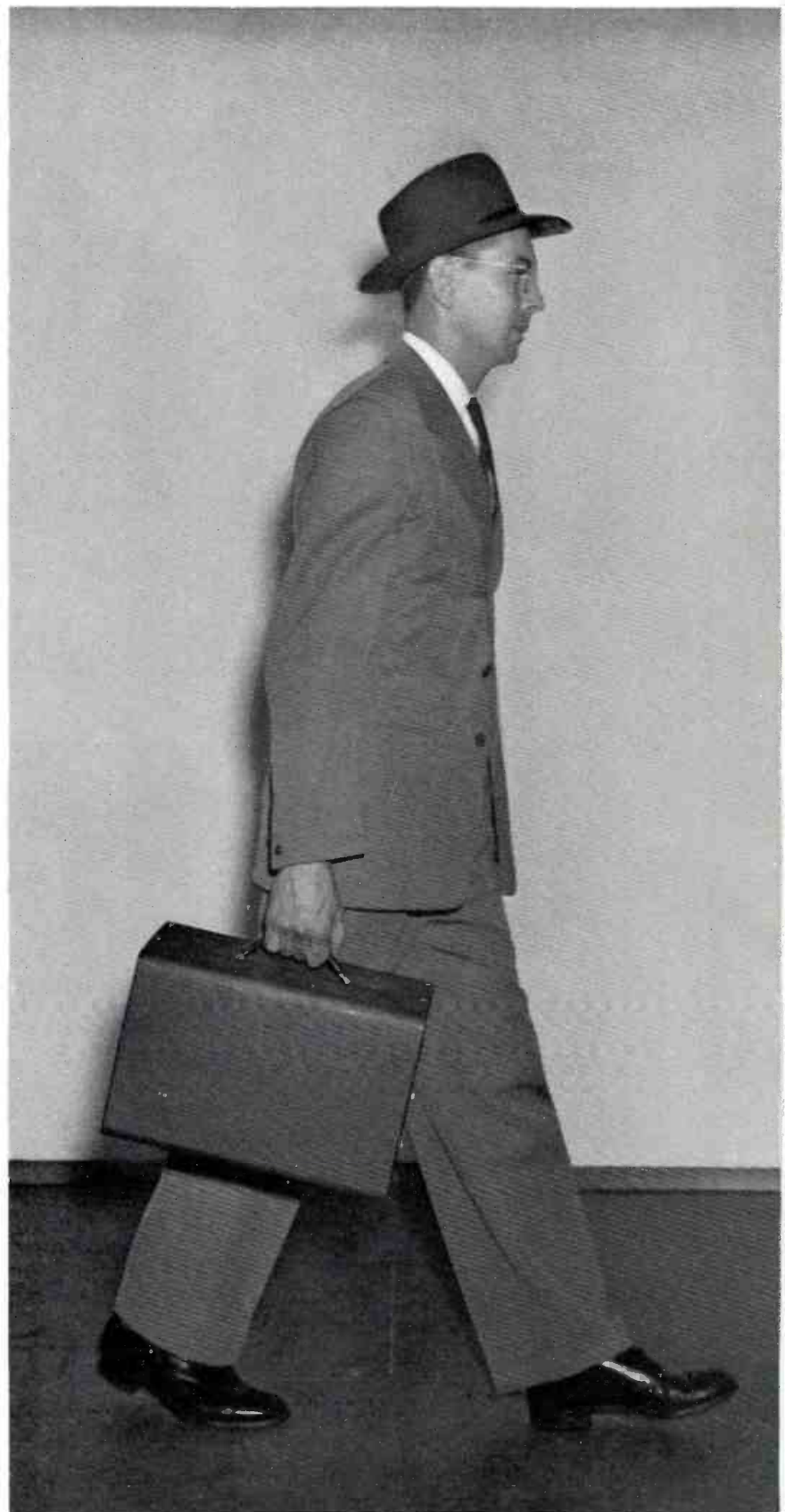


FIG. 1 (At Right). R. C. Abbett demonstrates the ease with which the BN-2A Remote Amplifier may be carried. Weighing only 29 pounds, the BN-2A proves to be ideal for remote services.

Portability and Accessibility

Portable, compact and completely self-contained for A-C operation, the BN-2A represents a marked decrease in size and weight over other models (only 14½" in length, total weight 29 lbs.). Its light weight makes it easy to carry. It is designed and styled with a sloping front panel in order to provide maximum visibility of controls, and greatest ease in operation. The case is finished in a deep umber gray metalustre wrinkle to give a pleasing appearance.

As may be seen in Fig. 4, the top of the BN-2A case is recessed to allow the handle to be pushed down, when not in use. Front panel controls and meter are fully protected by a front cover which snaps securely into place. The BN-2A steel case and its aluminum front panel cover are all that is needed during transportation, although a protective cover may be used to preserve its appearance. The single-unit type construction eliminates the added weight and bother of extra luggage-type carrying cases usually required. The power cord is carried within the front cover. Microphone and power connections are made on the rear of the cabinet. Cannon type connectors mounted on a removable plate are used for microphone connections. This plate may be removed and other type connectors used if desired. Line connections are made directly on the front panel.

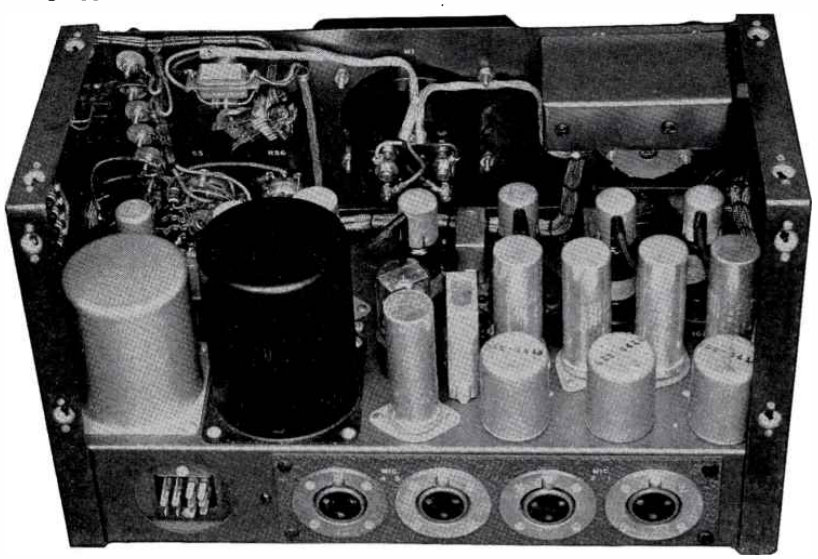


FIG. 2 (Above). Chassis-view of the BN-2A with back and top covers removed. Sturdy, yet compact construction results in small size and weight with all circuit components easy to reach.

Circuit Features

As shown in the diagram of Fig. 3, the amplifier consists of three pre-amplifier stages followed by mixers which feed into a three-stage program amplifier. The output of the program amplifier is monitored at the program amplifier output and also is connected to the "Line Out" switch through a 2 db pad. The pad aids in isolating the amplifier circuits from the telephone line. Two headphone jacks are provided for simultaneous monitoring of the amplifier output. Signal may be fed to a public address system from either the amplifier output or from a cue line. Similarly a jack is provided for monitoring a cue line.

A standard VU meter is used for maintaining constant output level and for tube checks. The A-C power supply is "built-in" but is automatically disconnected from the circuit when the amplifier is powered from an external source, thereby eliminating unnecessary drain from a battery box. A meter-light switch is provided for dimming the meter lights when reduced brilliance or a reduction in battery drain is desired.

Four inputs are possible, the fourth may be switched into channel 3. Each channel

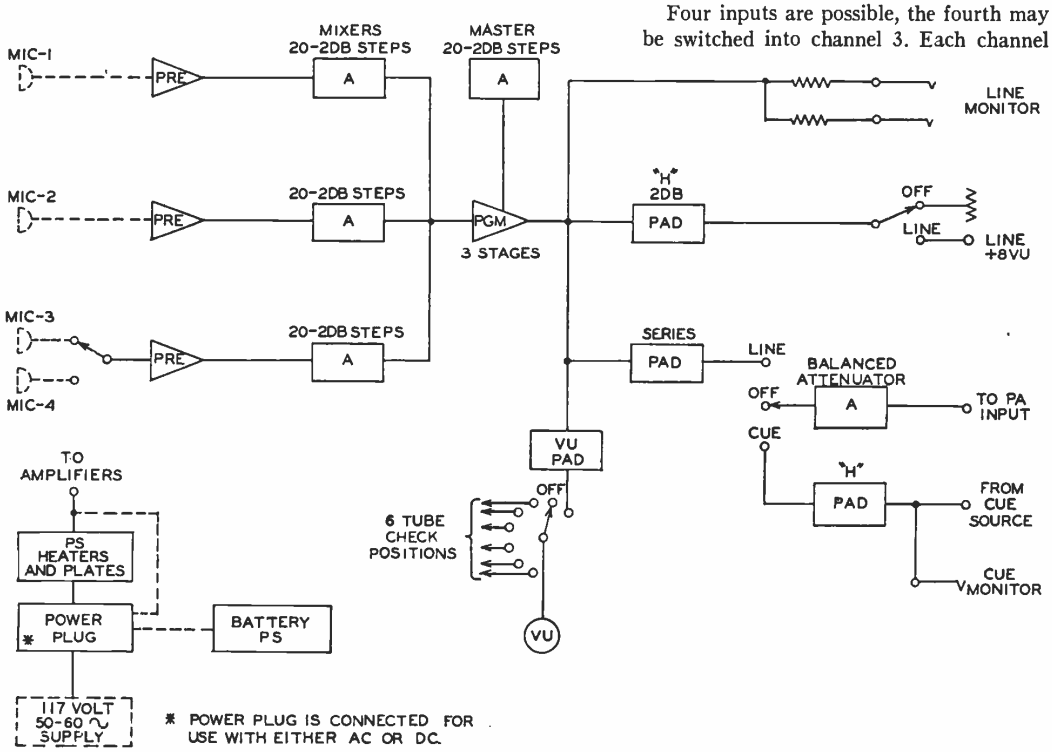


FIG. 3 (At Right). Simplified circuit diagram of BN-2A. A complete three-channel amplifier—capacity for four microphone inputs, high-level mixing and low microphonic 1620 tubes are a few of the features included.

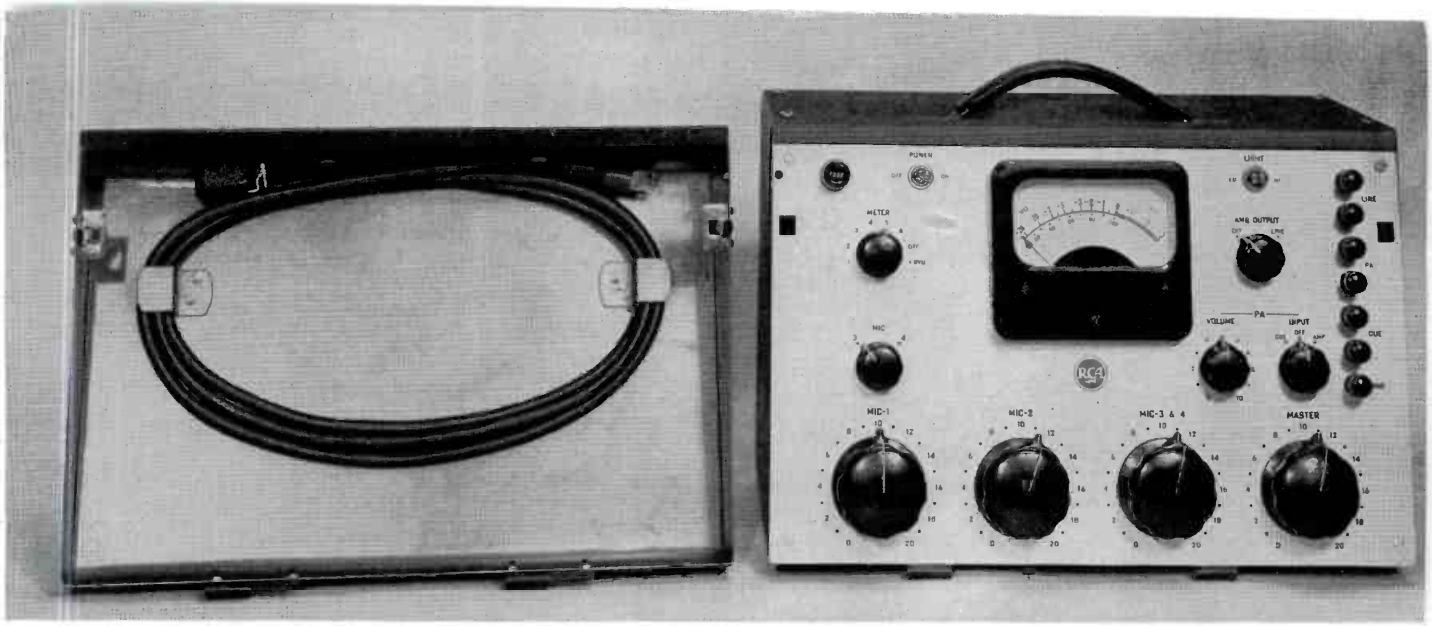


FIG. 4 (Above). The BN-2A with front cover removed to show sloping front control panel, which provides ease of operation and maximum visibility. Power cord fits neatly in front cover.

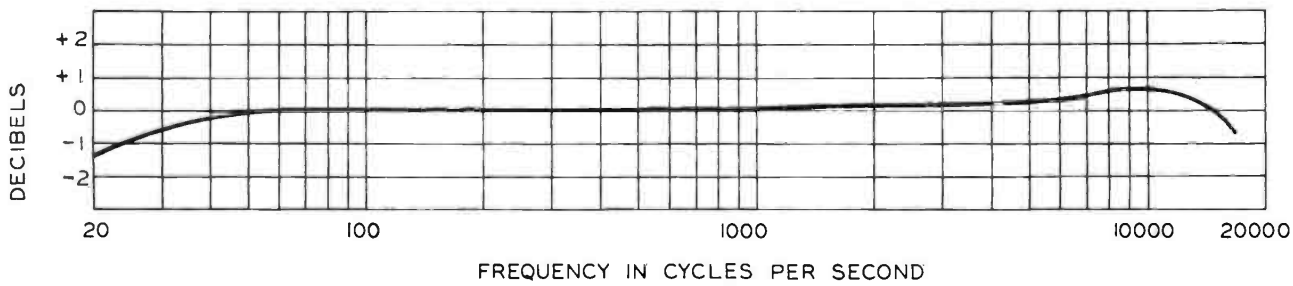


FIG. 5 (Above). Overall Frequency Response Curve of BN-2A. High-fidelity remotes from 30 to 15,000 cycles.

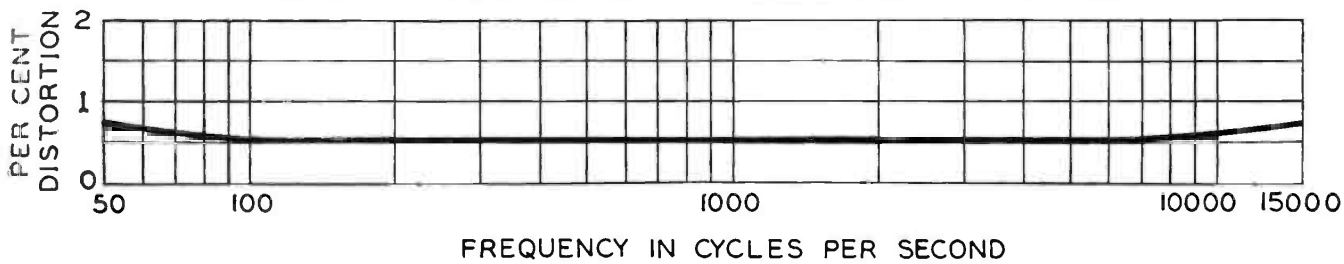


FIG. 6 (Above). Distortion curve for BN-2A. Distortion is less than 1 per cent over the complete frequency range of the instrument.

features a high quality (balance connected) input transformer unloaded to provide the best operating characteristic for all microphones. The mixer and master controls are of the step type and are the best obtainable. All transformers have electro-static shielding to reduce high frequency and noise pickup.

Non-microphonic tubes (1620) are used in the pre-amplifiers and low level program amplifier stages. Amplifier output tubes are of a similar type (6J7) thus a single tube may be carried as a spare for any pre-amplifier or program amplifier stage. The rectifier tube is a full wave 6X5-GT. Inverse feedback is used to reduce distortion and obtain uniformity. Overall response and distortion curves are shown in Figs. 5 and 6.

Maintenance

The BN-2A requires very little attention and offers many advantages from the standpoint of maintenance. The top or lid is easily removable by a 90 degree turn of the twist-lock fasteners, thus permitting on-the-job inspection and making tubes quickly accessible for changing. Two tube sockets and a fuse clip are provided on the under side of the lid for carrying spare tubes and a spare fuse. Only two spare tubes (one spare amplifier and one spare rectifier) are required (6X5GT and 1620 or 6J7). The one piece back and bottom may be similarly removed to make all electrical connections available for servicing. The panel cover, which protects the control knobs and meter, is easily removable.

Specifications

Source Impedance.....30/150-250 ohms
Load Impedance.....150/600 ohms
Normal Output Level.....+8 VU
Distortion (+18 db output 50 to 15,000 cycles).....Less than 1% rms
Maximum Output Level (less than 1% rms distortion).....+18 dbm
Maximum Gain (150 ohm source to 600 ohm load).....92.5 db
Frequency Response..±1 db 30 to 15,000 cycles
Noise Level (for +18 dbm output).....Better than —70 db
A-C Power Input..105/125 volts, 50/60 cycles, 25 watts
Battery Operation:
"A" Supply.....6.3 volts (nominal) 2.1 amps. (incl. VU lamp)
"B" Supply.....10 ma., 270 volts (nominal)
Dimensions:
14" Long, 9½" Deep (with cover), 10" High
Weight.....29 lbs. (complete with a-c cable and spare tubes)
Finish.....Umber gray wrinkle metalustre
Stock No. (less tubes).....MI-11230

W. W. Watts, Vice President in charge of the RCA Engineering Products Department, discusses models with visiting engineers.

CONSULTANTS ATTEN

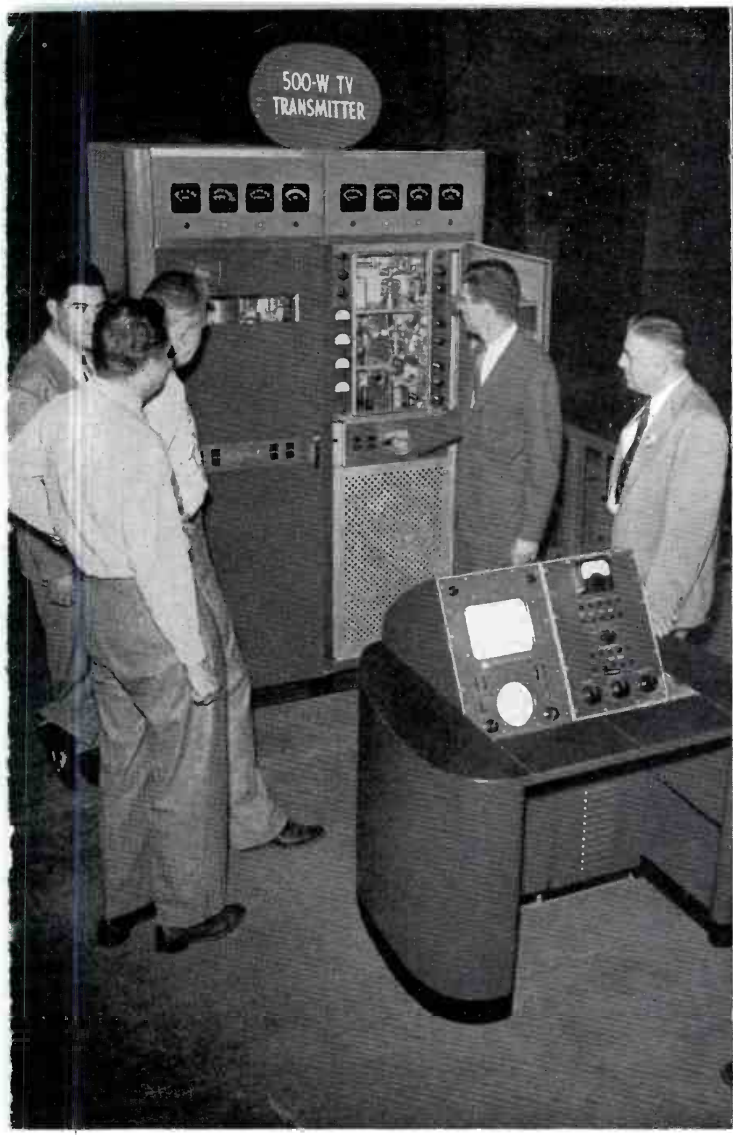
by E.
Engineering Prod

To discuss the most important problems confronting the television industry and to exchange ideas on the latest technical television developments, the RCA Engineering Products Department called together a group of the nation's leading consultants for a week-long seminar. So successful was this conclave, attended by 41 leading technical experts, that RCA is considering a plan to conduct seminars of this type every year.

The sessions, held during the week of August 30, included two full days' discussion of complete television equipment and a third day devoted to special problems such as antenna design, location of television station sites, installation layouts, and the clustering of television stations in metropolitan areas. Between the sessions of the seminar, the consultants visited the RCA Victor television receiver assembly plant, the transmitter manufacturing plant, the super turnstile television antenna testing site and the RCA Laboratories in Princeton, N. J.

In an effort to provide a comprehensive picture of television, the Consultants' Seminar also delved into overall television receiver problems from the standpoint of product availability, engineering performance, and receiver promotion.

A new technique was outlined which may help solve the problem of determining the most effective site for a proposed television antenna installation. The system, now under consideration by RCA, is to employ a radar type signal generator which is capable of 30 KW peak power output on any television channel. The device can be mounted in a captive balloon at a given position and field strength measurements taken under conditions closely paralleling actual operation. In this way it is hoped that the adequacy of any proposed site can be quickly and accurately determined.



The 500-Watt, RCA TT-500A, television transmitter now in production, is examined by the consultants during a tour of the transmitter plant.

Consultants observe television studio control equipment in operation, RCA engineers acting as studio control operators.

D SPECIAL CLINIC

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cts Department

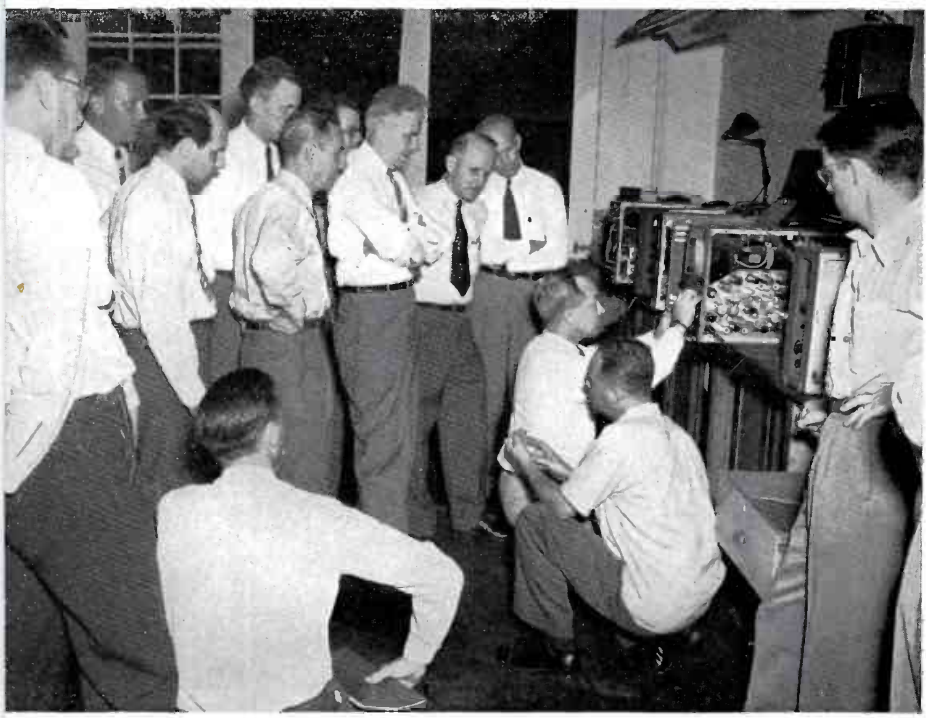
One session was devoted to the theory and practical application of Supergain and special directional antennas. Several new type custom built high gain antennas were announced which could double the gain obtained with present-day television transmitting antennas. With the specially designed antennas, it is possible to provide relatively sharp directional patterns to fit a television station into areas where proximity of other stations on the same or adjacent channels might otherwise result in objectional interference.

Kinescope photography, the art of producing precision photographic recordings from the face of high intensity projection type kinescopes, received special consideration. With the use of RCA's newly developed television photographic monitor it now becomes a relatively simple matter to reproduce high definition motion pictures for rebroadcast. This type of film recording promises to be a major source of material for television network programming during the next few years.

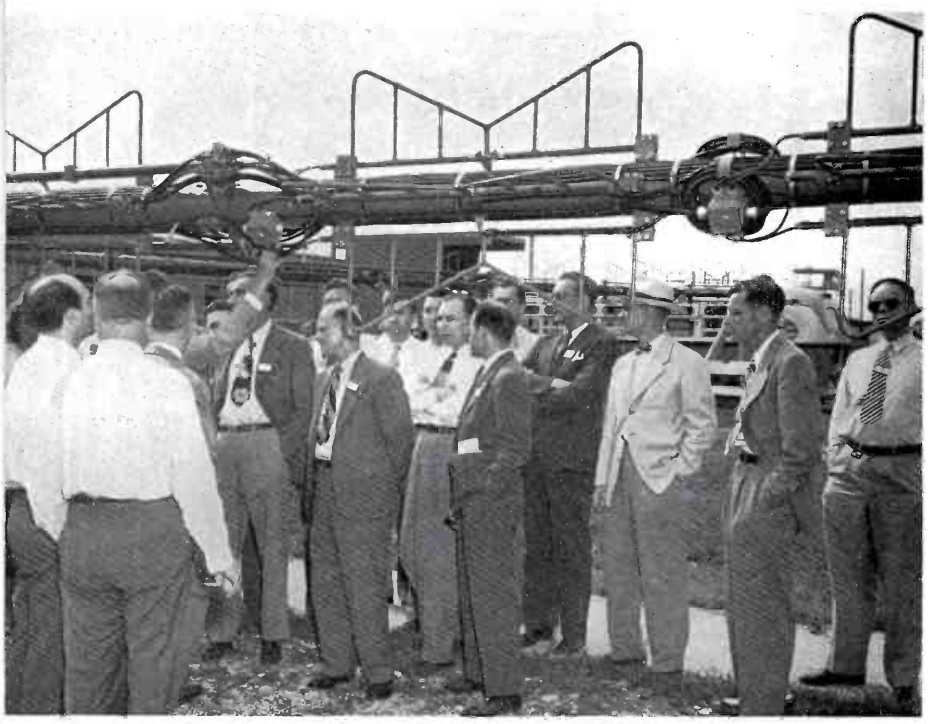
The seminar included a discussion of the problems in developing receiver antennas adequate for coverage of an extremely wide range of television channels. The problems of antenna directivity, phasing, the use of multi-element arrays, and duo resonant antenna characteristics were described.

Highlighting a session on television tubes was a discussion of the engineering and production problems encountered in the development of RCA's 16-inch metal-cone kinescope. It is believed that this new tube will be available in quantity during the early part of 1949.

Announcement was made of a new image orthicon television pickup tube which has low infrared sensitivity and which for the most part eliminates the "beard-like" effects found in the earlier television pickup tubes. The new image orthicon, RCA type



Operation of television field camera control units is explained by RCA television engineer, Norman S. Bean (lower right foreground).



Consulting engineers get a close-up of the RCA Super Turnstile transmitting antenna which is being checked at Building #56 test yard.

#5769, is designed for outside pickup service but has been used with very satisfactory results within the television studio.

An engineering development model of the RCA "Flying Spot Scanner" was demonstrated for the consultants. The new unit permits the telecasting of individual station call letters, test patterns, or picture material from easily interchangeable transparent 35mm film slides eliminating the use of much studio equipment. The device reproduces pictures with the halftone fidelity of photographic film. Further development of the scanner will probably make possible the use of opaque materials in addition to slides.

On the final day of the seminar, the consultants visited the RCA Laboratories in Princeton, N. J., where discussions were held with top RCA research engineers. Here the visitors delved into problems confronted in ultra-high frequency transmission and high band propagation. Color television development, stabilized magnetrons, and super-sensitive video pickup devices were some of the other subjects discussed.

Representing the various consulting agencies were: Kenneth M. Roberts, *Federal Communications Commission*; Martin R. Williams, *Martin R. Williams*; George M. Lohnes and Laverne M. Poast, *Lohnes & Culver*; Gerald Chinski, *Harris County Broadcasting*; Albert Preisman, *Preisman & Biser*; Stephen Kershner and H. T. Head, *A. D. Ring & Co.*; Russell P. May, *Russell P. May*; R. L. Hammett, *A. Earl Cullum, Jr.*; William E. Benns, *William E. Benns*; John H. Barron, *John H. Barron*; Lester H. Carr, *Weldon & Carr*; George C. Davis, *George C. Davis*; R. E. Kennedy, *Kear & Kennedy*; M. M. Garrison, J. R. McKenna, *Chambers & Garrison*; John J. Keel, J. W. Gilbert, *John J. Keel*; W. E. Jonker, *D. B. McKey & Assoc.*; E. M. Hinsdale, *Glenn D. Gillett*; Howard S. Frazier, *Frazier & Peter*; James C. McNary, *McNary & Wrathall*; Oscar W. B. Reed, *Jansky & Bailey*; George P. Adair, *George P. Adair*; Herbert L. Wilson and Karl Gerhard, *H. L. Wilson*; A. F. Inglis, F. H. McIntosh, *Frank McIntosh*; Wm. L. Foss and J. A. Moffet, *Wm. L. Foss, Inc.*; L. W. Andrews, *L. W. Andrews, Inc.*; W. L. Wright, *Mid-Continental Radio*; Francis Shawver, *Tower Services, Inc.*; W. F. Dubois, Virginia R. Erwin, Jos. A. Waldschmitt, *E. C. Page*; E. F. Lorentz, Leigh L. Kimball and Everett Dillard, *Commercial Radio Eqt.*

The new portable field intensity meter, RCA Type WX-1A is shown to consultants by K. B. Reeding of RCA Broadcast Measuring Equipment Sales.

At RCA's experimental Station W3XEP, consultants get firsthand technical advice on the operation and maintenance of the TT-5A television transmitter and control console.

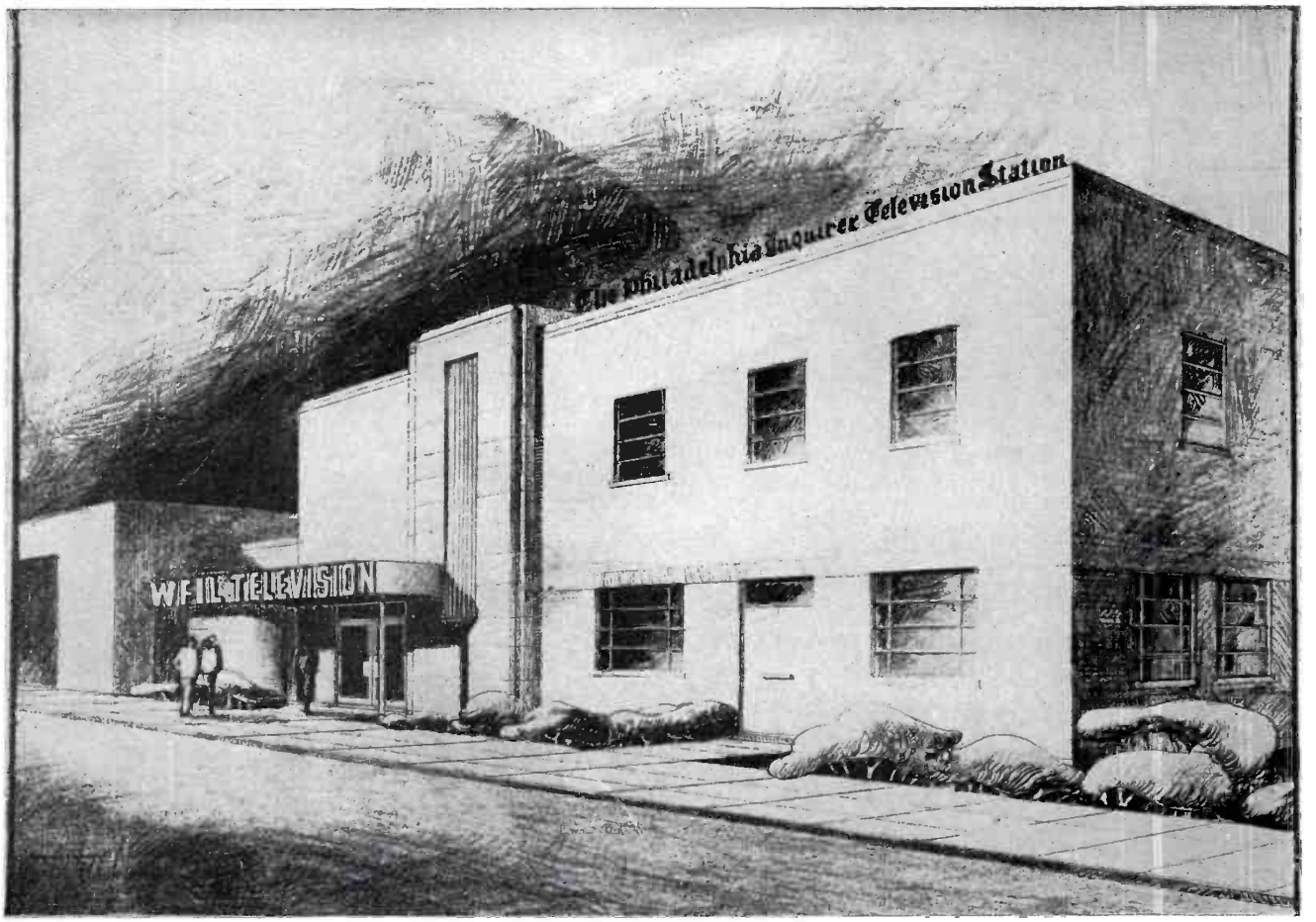


FIG. 1. Architect's drawing of the two-story building which houses the offices and studios of WFIL-TV, television station of the Philadelphia Inquirer.

WFIL's TV Studios

by LOUIS E. LITTLEJOHN
Chief Engineer, WFIL

In the September 1947 issue of BROADCAST NEWS the television plans of WFIL, the Philadelphia Inquirer station, were described at some length.[1] An important feature, briefly referred to, was a plan for building a TV studio and office building adjacent to the Arena at 46th and Market Streets, Philadelphia. This building was completed early this year and has now been in use for over six months. One of the first buildings to be constructed "from the ground up," for TV, it has many features of interest to those broadcasters who are presently planning television facilities.

The WFIL-TV operation is typical of that of large independent stations with close network affiliations. Thus, the primary consideration in designing a building of this size is the provision of a well-outfitted studio of size sufficient for all but the most elaborate productions.

WFIL-TV's main studio is 55 feet by 25 feet, which is about the minimum where it is desired to have several sets in use at the same time. This studio is on the first floor of the building. Also on this floor (Fig. 2) are the control room, projection room, announce booth and the property and electronics shop—i.e., all of the "operations" part of the setup.

The studio, of course, is two stories in height. A client's room, located just over the control room provides a good view of the studio. Also on the second floor (Fig. 3) are the offices, dressing rooms and film facilities rooms. Inasmuch as some of the clerical work of WFIL-TV is handled in the downtown offices of WFIL, and a part of their film activities by the newspaper's photographic department, it was not necessary to provide as much space for these activities as would be necessary in the case of a TV station not associated with an AM station or a newspaper.

One quite unusual feature of the WFIL-TV studio building is the fact that it adjoins the Arena (Philadelphia's indoor sports center) which is under the same ownership as WFIL. Permanent camera lines run from the control room in the WFIL-TV studio building to the camera positions in the Arena. Thus, for sports broadcasts from this point the Arena cameras can be controlled from camera control units in the studio control room (see following page).

Photographs, and a brief description of WFIL-TV's control room (which is one of the most modern and best equipped in operation today), of the studio proper, and of the camera positions in the adjacent Arena are presented on the six pages immediately following.

[1] "WFIL's Television Planning Sets Fast Pace For Nation's Video Stations," BROADCAST NEWS, Vol. No. 46, September 1947, Pg. 38.

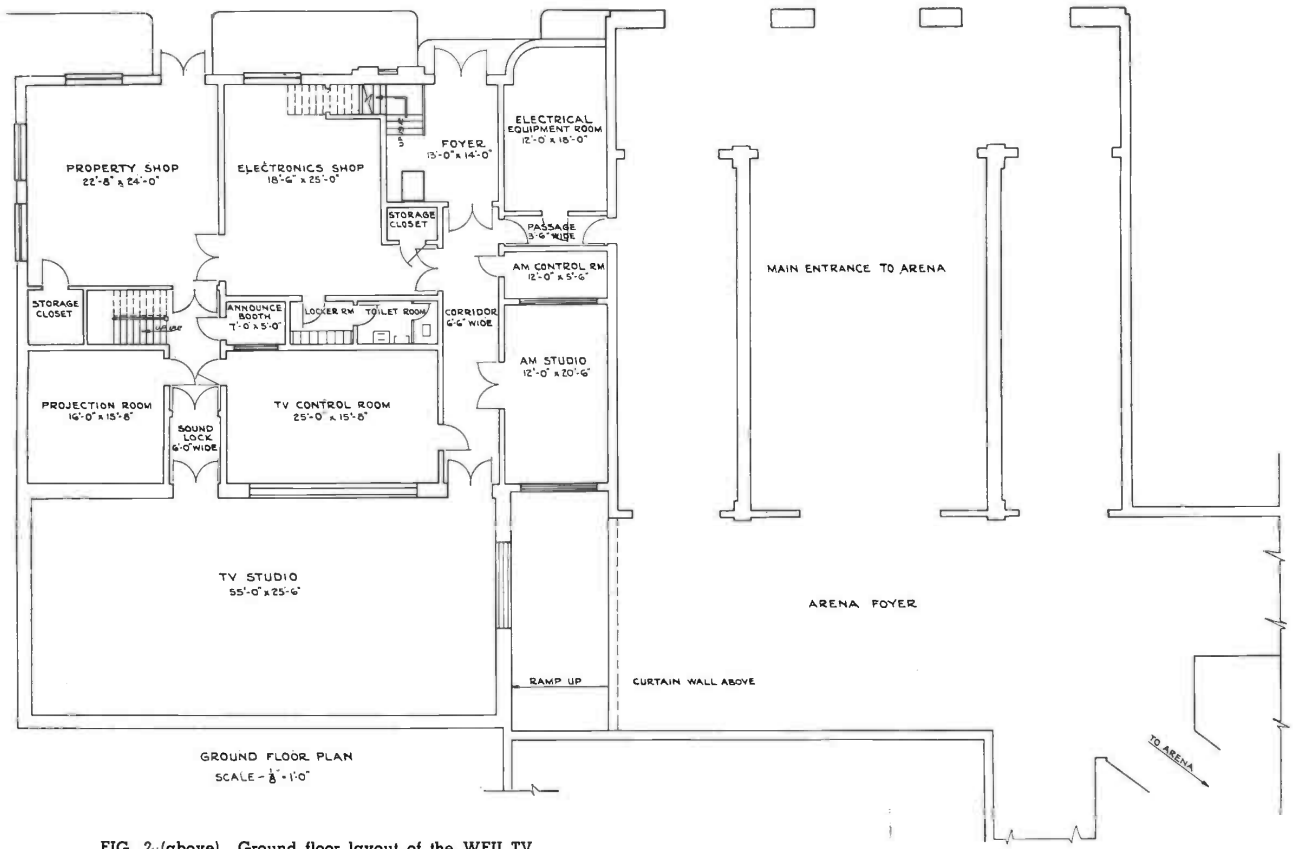


FIG. 2 (above). Ground floor layout of the WFIL-TV studio building. The new building area embraces the lefthand half of this drawing. The part at the right is the entrance area of the sports arena which the new building adjoins, and which is owned by the Philadelphia Inquirer.

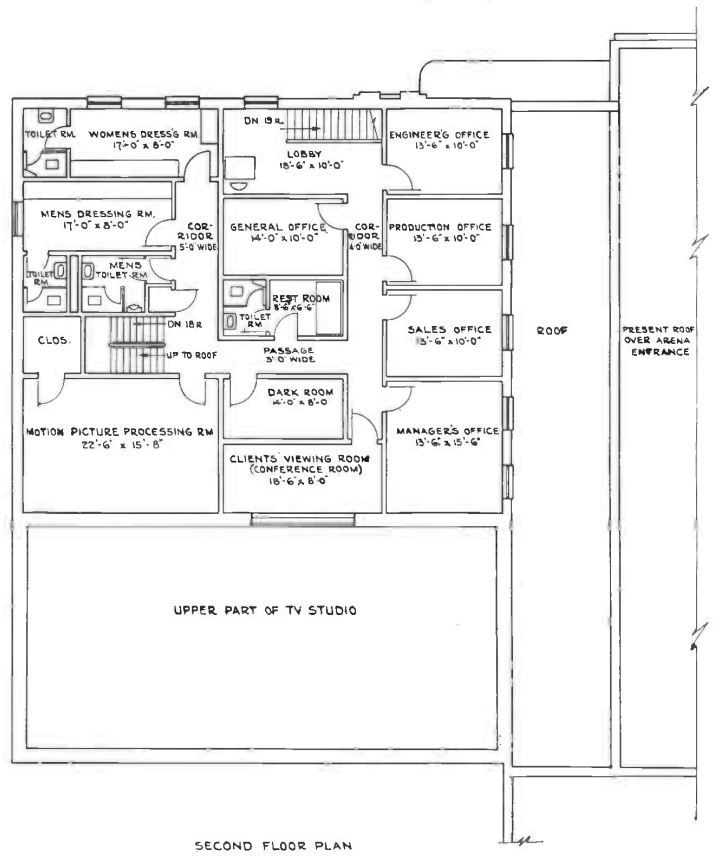
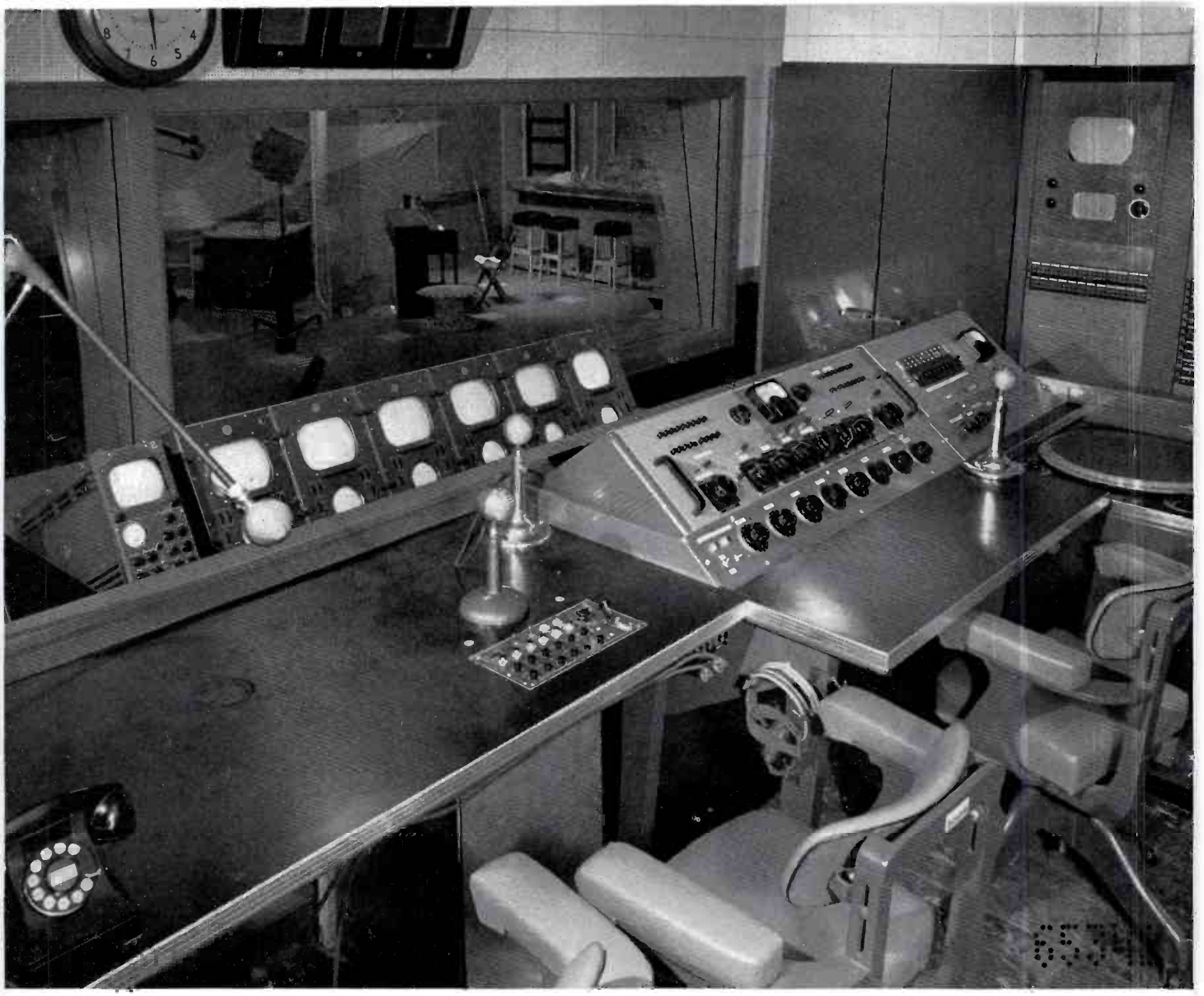


FIG. 3 (right). This is the second floor layout. General plan, it will be noted, places all mechanical and technical operations on first floor with programming production and business offices on second floor. TV studio proper is two stories high with client's room on second floor directly over the control room.



WFIL-TV Control Room

The illustration above, and the two on the opposite page, indicate the arrangement of equipment in the WFIL-TV Studio Control Room. This control room, which is located along one side of the main studio (see floor plan shown in Fig. 2) is 25 feet by 15 feet 8 inches—a size which would be large for an AM station but which is about the minimum practical for a TV operation of this type. The floor of the control room is 18 inches above that of the studio and the platform, at which the program director, technical director and audio operator sit, is raised an additional 18 inches.

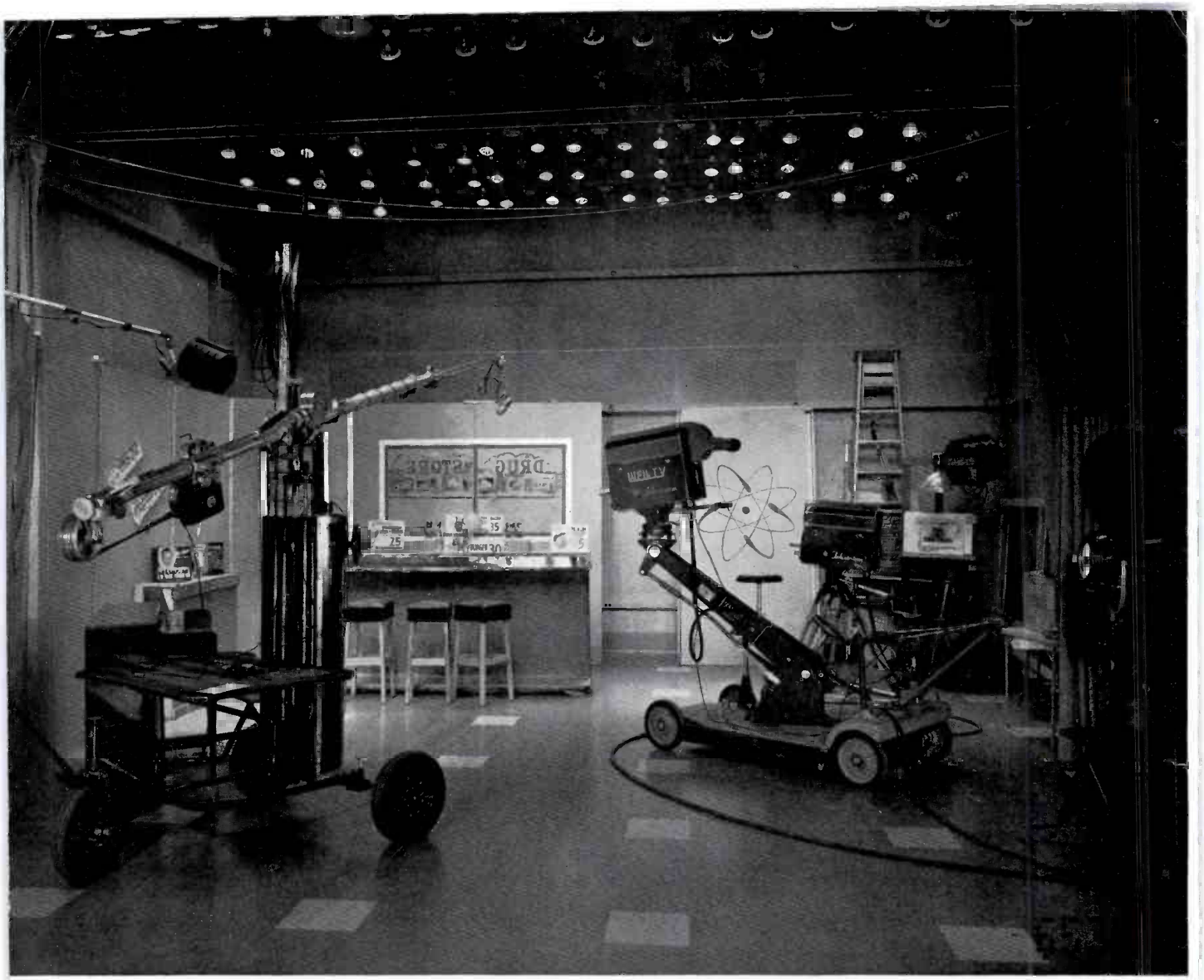
The raised level of the control room, together with the 19 foot long window, provide all of the control room personnel with a good view of the studio. Fig. 4, for instance, shows the view from the program director's position, while Fig. 9 shows the view from a position approximately that of the video operator.

The equipment in the WFIL-TV Control Room, it should be noted, performs several functions. These are: (a) control of studio cameras, (b) control of cameras in the next-door Arena, (c) control of film cameras, (d) the master control function. In larger operations, the film camera control and master control functions are sometimes located in a separate master control room. However, the arrangement used here simplifies operations and requires fewer operating personnel. Similarly, the racks containing synchronizing generators, video power supplies, distribution amplifiers, etc., which are sometimes placed in a separate "equipment room", are in this case located in the control room.

FIG. 4 (above). Equipment in the WFIL-TV control room is arranged on two levels. On the lower level, directly in front of the window, are eight video monitoring units. The two smaller ones, at the extreme left, are the portable type camera controls for the two field cameras which are located in the next-door Arena, but are controlled from this point. The six permanently-installed, studio-type units include: two studio camera control units, two film camera control units, a master (outgoing line) monitor, and a preview (or "cue") monitor.

FIG. 5 (opposite page, upper). This view of the control room shows the construction and position of the raised platform on which the program director, technical director and audio operator sit. The five racks on the righthand side of the control room contain the two synchronizing generators (one regular and one spare), an "off-the-air" monitor, and the audio line panels. The small window, just to the right of top center in this view, looks into the announce booth.

FIG. 6 (opposite page, lower). This view of the equipment on the raised platforms shows the audio position to better advantage. The audio desk consists of an RCA 76-B2 consolette with provisions for extra inputs (faders in the row below the consolette), and a special unit (at the right of the 76-B) which contains a VU meter and switching facilities for two-channel operation.



WFIL-TV Studio

The main studio of WFIL-TV is shown in the illustration above, which is a view from one end of the studio itself, and in the two illustrations on the opposite page, which are views from the clients' room (above) and the control room (below). This studio is 55 feet long, 25 feet 6 inches wide and 23 feet high. It was designed to allow one scene to be set up at one end of the studio and another at the opposite end; with the cameras in the center and the control operators having a good view of both sets. In practice, a third shallow set may be placed along the side wall facing the control room, although this begins to crowd things a bit and considerably restricts the camera operating area.

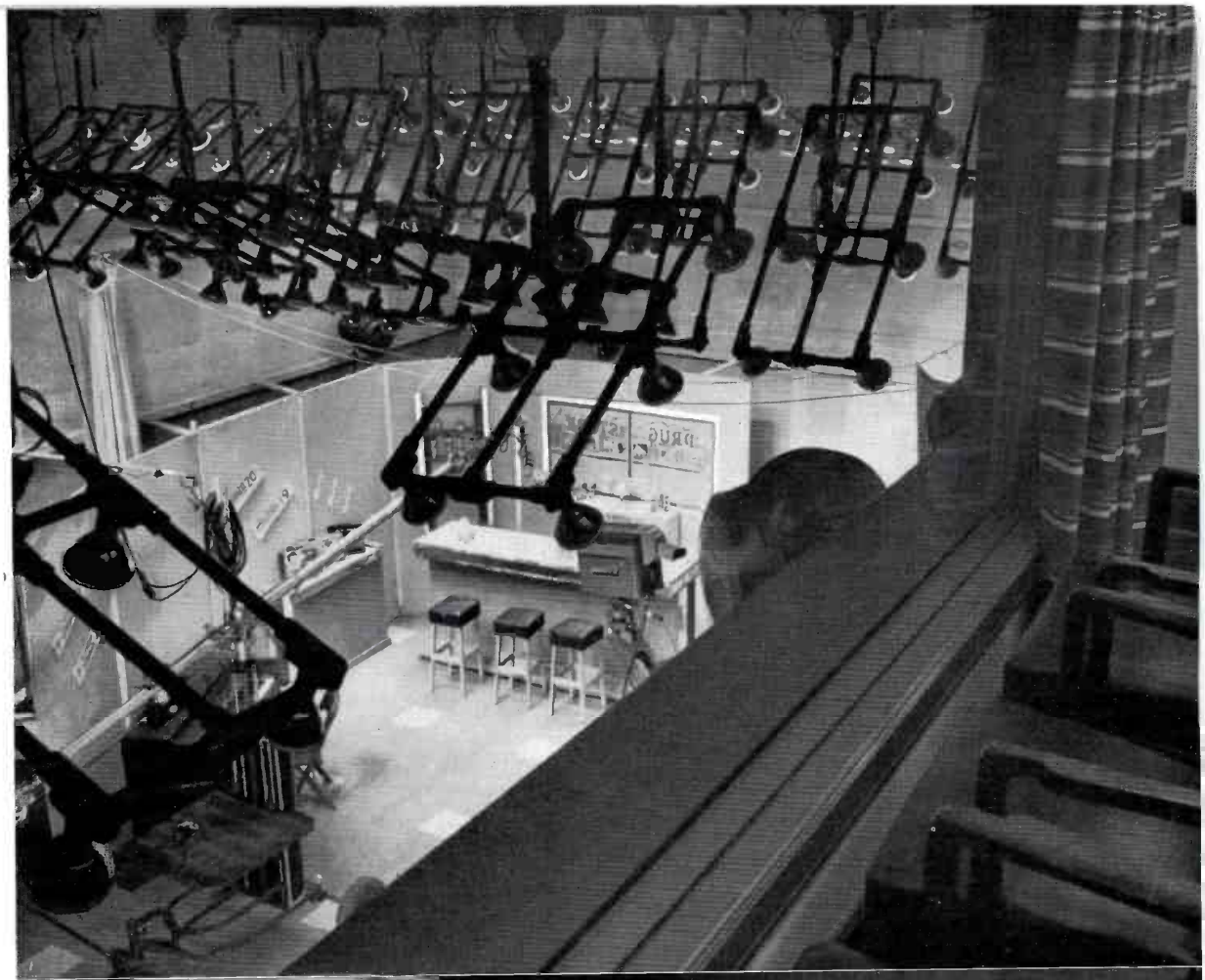
The floor of the WFIL-TV studio is composed of tile blocks laid on concrete. The walls and ceiling are covered with perforated transite. This provides an acoustical condition which would be on the "dead" side by AM standards. This is the present practice in TV studio design. The operation of camera dollies and microphone booms, the occasional moving of scenery, and the presence of many people in the studio, results in background noise which would be noticeable and objectionable if the studio were "live". When desirable, the "flats" used as scenery may be utilized to provide extra liveness for particular scenes.

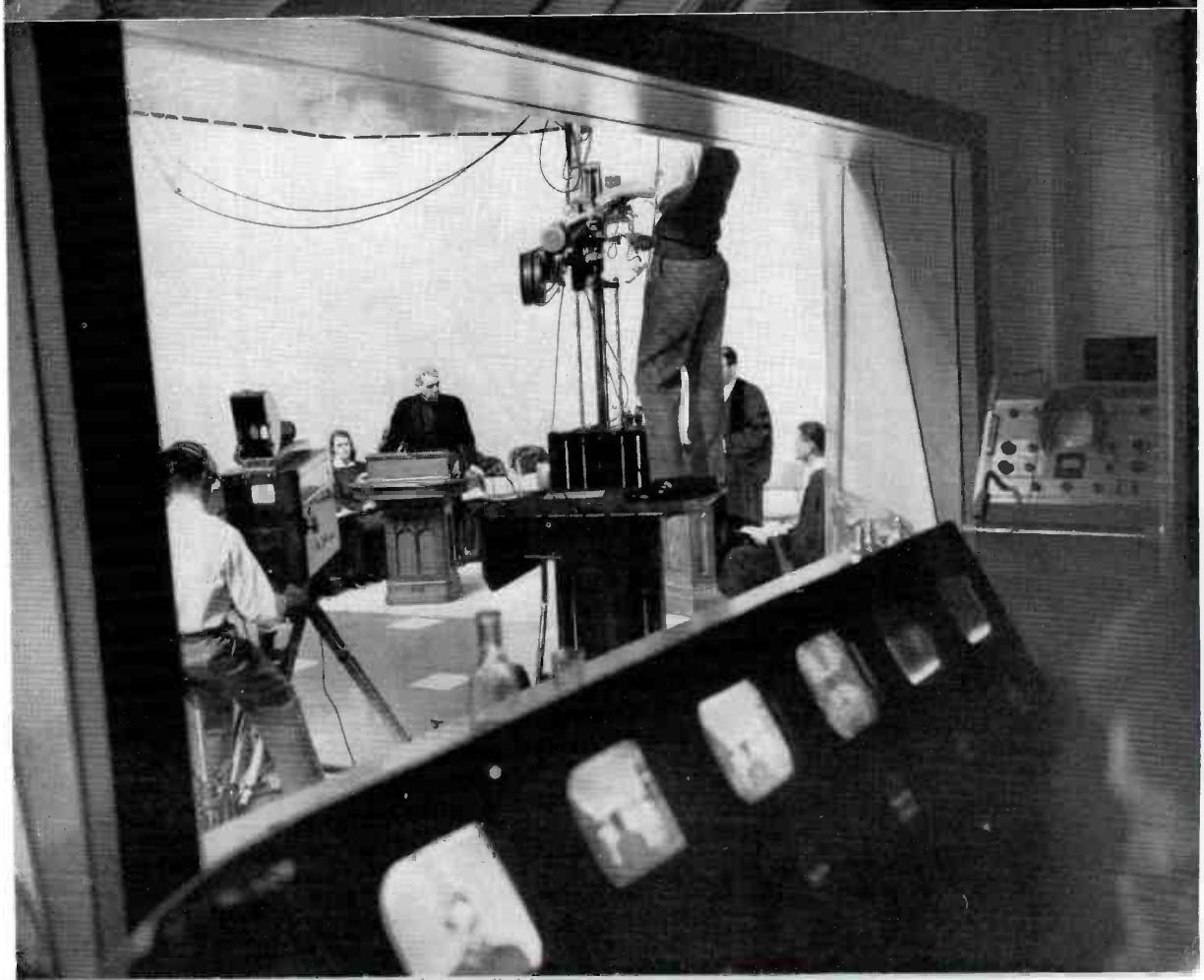
Many minor operational features are provided in the studio. One is a wiring duct which runs around the studio about one foot from the floor. This contains outlets every few feet which provide 110 volts or 220 volts, AC or DC for lighting and other needs. In one corner is floor opening containing gas and water inlets (for cooling demonstrations, etc.). A wood framework on the walls around all four sides provides a means of bracing scenery.

FIG. 7 (above). A view of one end of the WFIL-TV studio as set up for telecasting of a show ("Phil and the Three Cheers"), which requires a drug store soda fountain scene. Equipment in this studio includes an MI-2657A Perambulator Boom on which is mounted a Type 77-B Microphone. (Note cable dropping down from opening in ceiling, a Type KS-4A Stand (far left) on which is mounted a Type 88-A Microphone, one Type TK-30A Studio Camera on a crane-type dolly, and another TK-30A Studio Camera, which is temporarily mounted on a field tripod with dolly attachment.)

FIG. 8. This is a view of the studio from the client's room, which is located on the second floor, directly above the control room. This room, which is convenient to the manager's office (see floor plan, Fig. 3), contains a large table and a standard RCA 16mm projector, equipment which allows it to double as a conference and film previewing room.

FIG. 9 (opposite page, lower). View looking into the studio from the control room at approximately the position of one of the video operators. The frame at the left of this picture is not the edge of the window, but the post which divides the window into two sections (see Fig. 4).





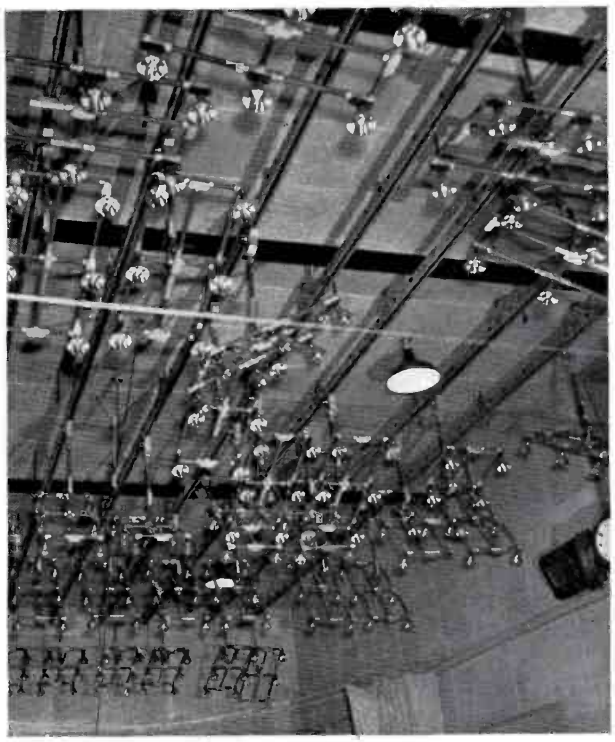


FIG. 10. Ceiling lights in WFIL-TV studio are incandescents mounted in fixtures each of which contains six 150 watt lamps. These fixtures can be moved on rails along the length of the studio, rotated, or tilted.

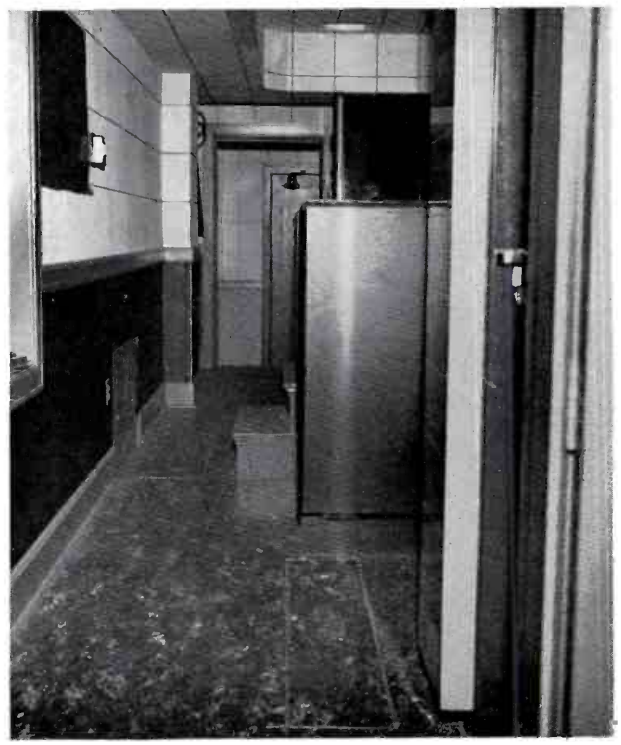


FIG. 11. This view along the rear of the control room shows the steps to the raised director's platform. This picture was taken from the hallway between the control room and the projection room (see Fig. 2).

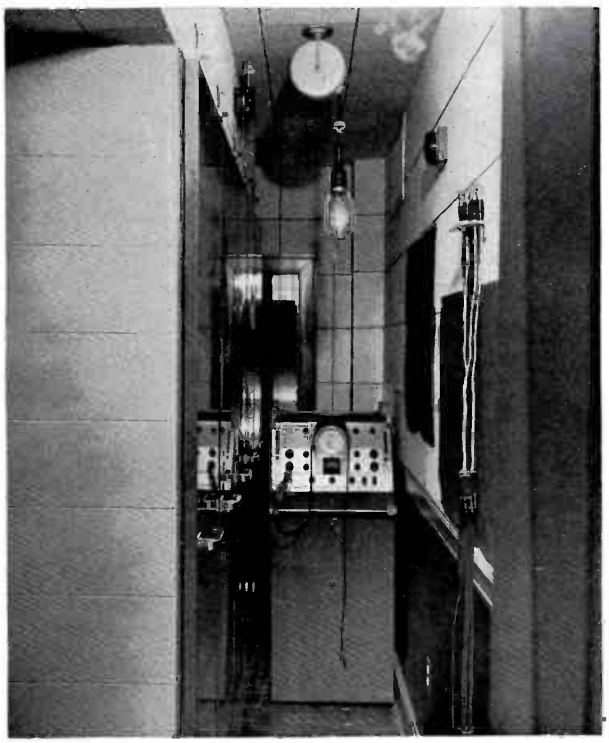


FIG. 12. This is a view behind the racks in the control room. The racks are separately ventilated, the air entering from a duct beneath the racks and being exhausted by an overhead duct visible here.

FIG. 13. A thermostat in the overhead duct controls the suction fans. Amount of air drawn from each of the racks can be controlled by dampers in the top of each rack, such as this one in the audio rack.

WFIL-TV (cont.)

In addition to the control room and studio, which have been pictured, the WFIL-TV installation also provides, in more or less standard form, the other facilities required for TV studio operations. These have not been illustrated because it was felt that they were of somewhat less interest. They deserve, however, to be briefly mentioned.

The film projection room, an important program origination point in any TV station, and especially so in non-network stations, is conveniently located just across the hallway from the control room (see floor plan, Fig. 2). In this room are located two Type TP-30A 16mm film projectors, two Type TK-20A Film Cameras, two slide projectors, monitor and intercom facilities. Two 35mm projectors will be added later. The camera controls for the film cameras are located in the control room. Additional film facilities include a dark room and film processing room (with Houston printer) on the second floor.

For field pickups WFIL-TV has an RCA Type TJ-50A Mobile Unit with two complete sets of field pickup equipment. A Type TTR-1A Microwave Relay equipment is used (where satisfactory lines are not available) for relaying video signals from remote points. The signals from remote points are usually picked up at the transmitter location on top of the Widener Building in downtown Philadelphia. Either microwave relay or telephone line may be used between the studio and the transmitter location.

In addition to the operating areas there are the standard provisions for scenery construction, equipment repair, dressing rooms, offices, etc. There is also a small AM studio for emergency AM use, or for use in holding "pre-camera" rehearsals. These and other features of the building plan will be evident from a study of Figs. 2 and 3.

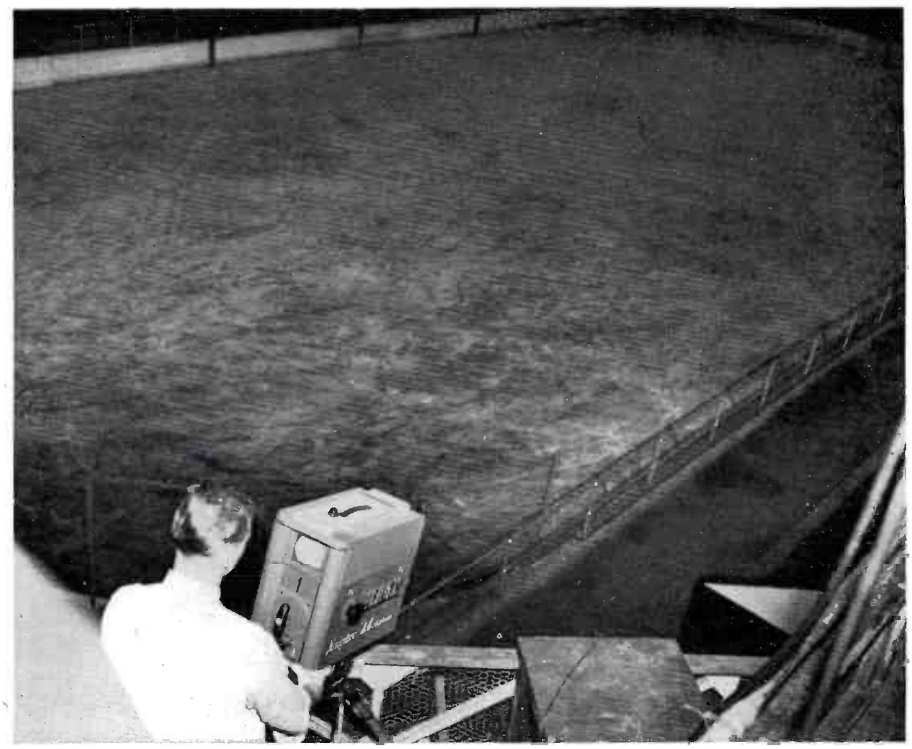


FIG. 14. WFIL-TV's location adjacent to the Philadelphia Arena results in the latter being practically a second studio for the station. This is particularly true during the winter months when programs are carried from here practically every night. Several permanent camera positions, two of which are shown above and below, are available.

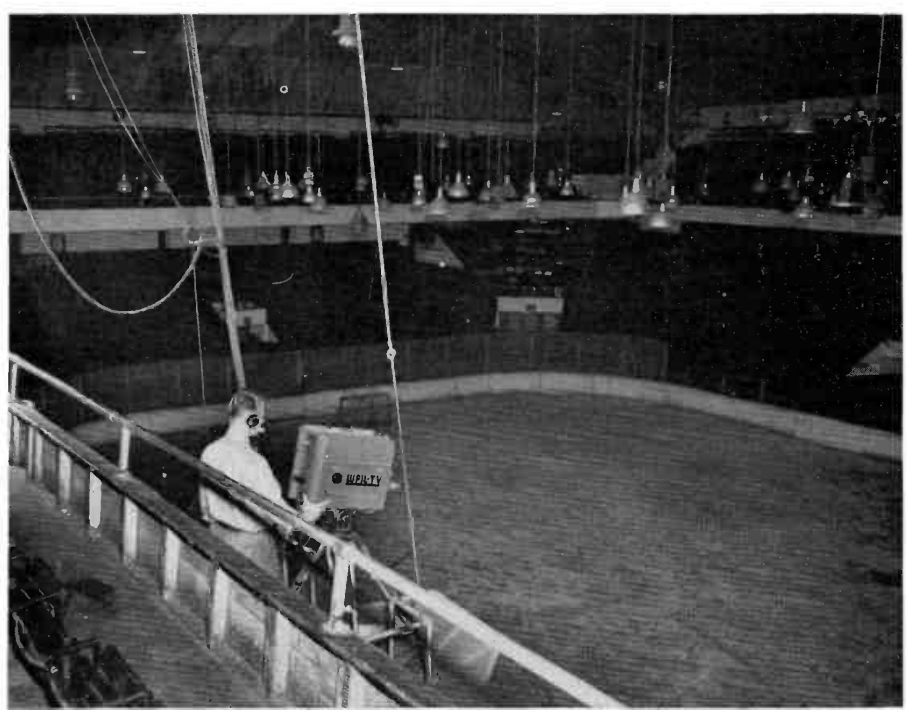
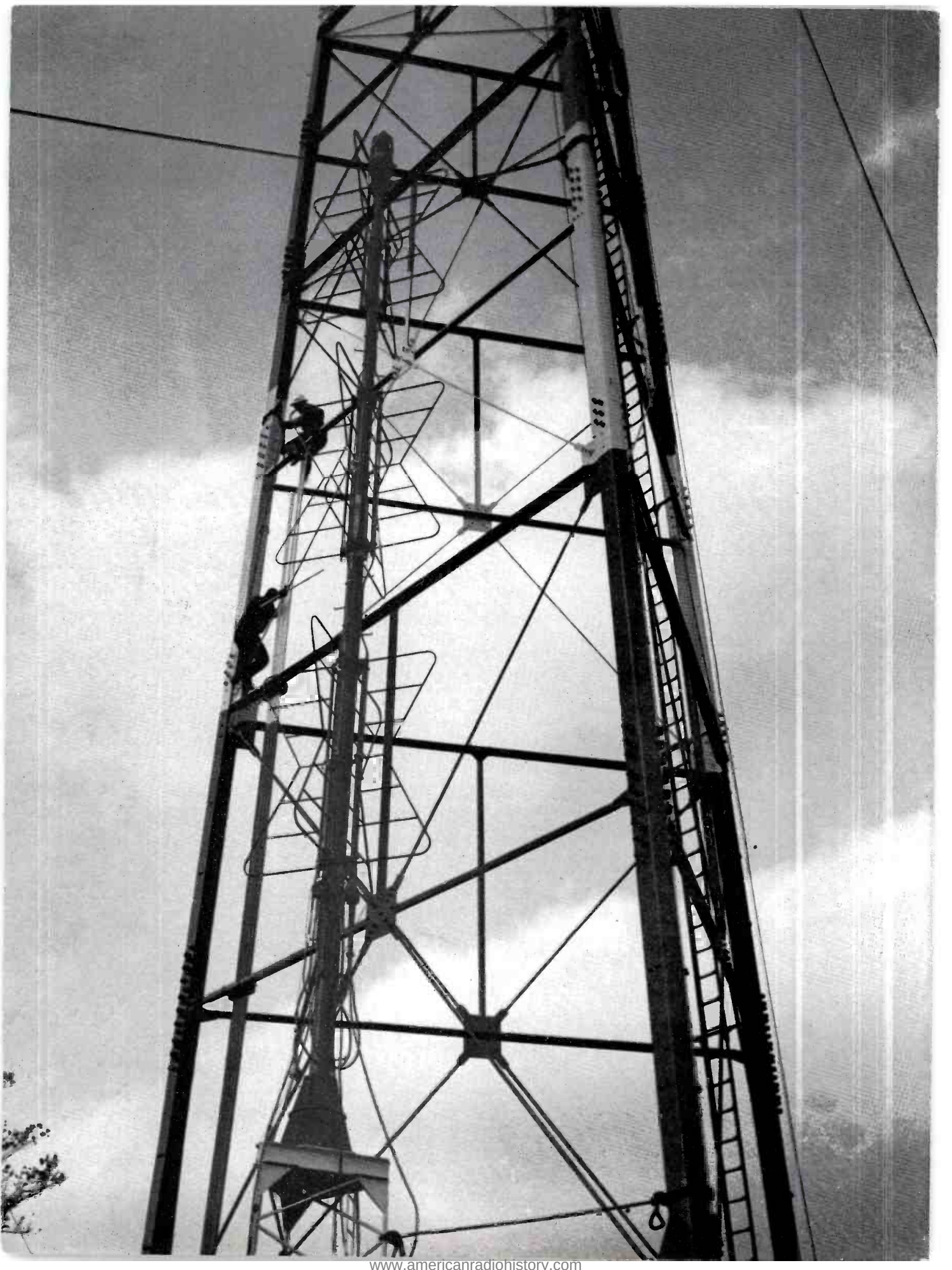


FIG. 15. This view of the Arena, and the one above, show the setup for telecasting hockey games. One camera position, shown here, is on a small platform built out from the balcony midway along the rink. The other, shown above, is on a corner platform which also has space for the announcer's table.



WEWS TV Antenna Installation

by

J. B. EPPERSON

Chief Engineer, Scripps-Howard Radio, Inc.

WEWS, Scripps-Howard's Cleveland television station began regular operation on December 17th, 1947. The unusually good coverage and ghost-free reception of the WEWS signal is, no doubt, due to the efficiency of the RCA Type TT-3A Super Turnstile Antenna system and to the excellent transmitter location. This batwing antenna, perched atop a 388-foot supporting structure, radiates 16.3 kw of peak-to-peak video at an effective height of 1526 feet above sea level. In addition to the strong clear television signal sent out to Cleveland and surrounding areas, this antenna also radiates WEWS-FM with an antenna output power of 10.3 kw. The RCA Triplexer at WEWS was the second one to be put into operation. The first triplexer was installed at WNBW,[1] Washington.

The Ideco supporting tower, Fig. 1, with the super turnstile antenna aloft, is located nine miles airline south of Cleveland on State Highway No. 94. The transmitter location is only 23 miles north of Akron which places Akron well within the WEWS service area. The effective height above average terrain is 642 feet. The natural land elevation plus the supporting tower gives an effective height which is about 1000 feet above Lake Erie in downtown Cleveland. Fig. 2 shows the eight profiles as plotted for miles vs. height above sea level. The North Radial, upper left hand corner, is the radial looking

[1] Triplexed Antenna System at WNBW/WRC by L. J. Wolfe. BROADCAST NEWS, March 1948.

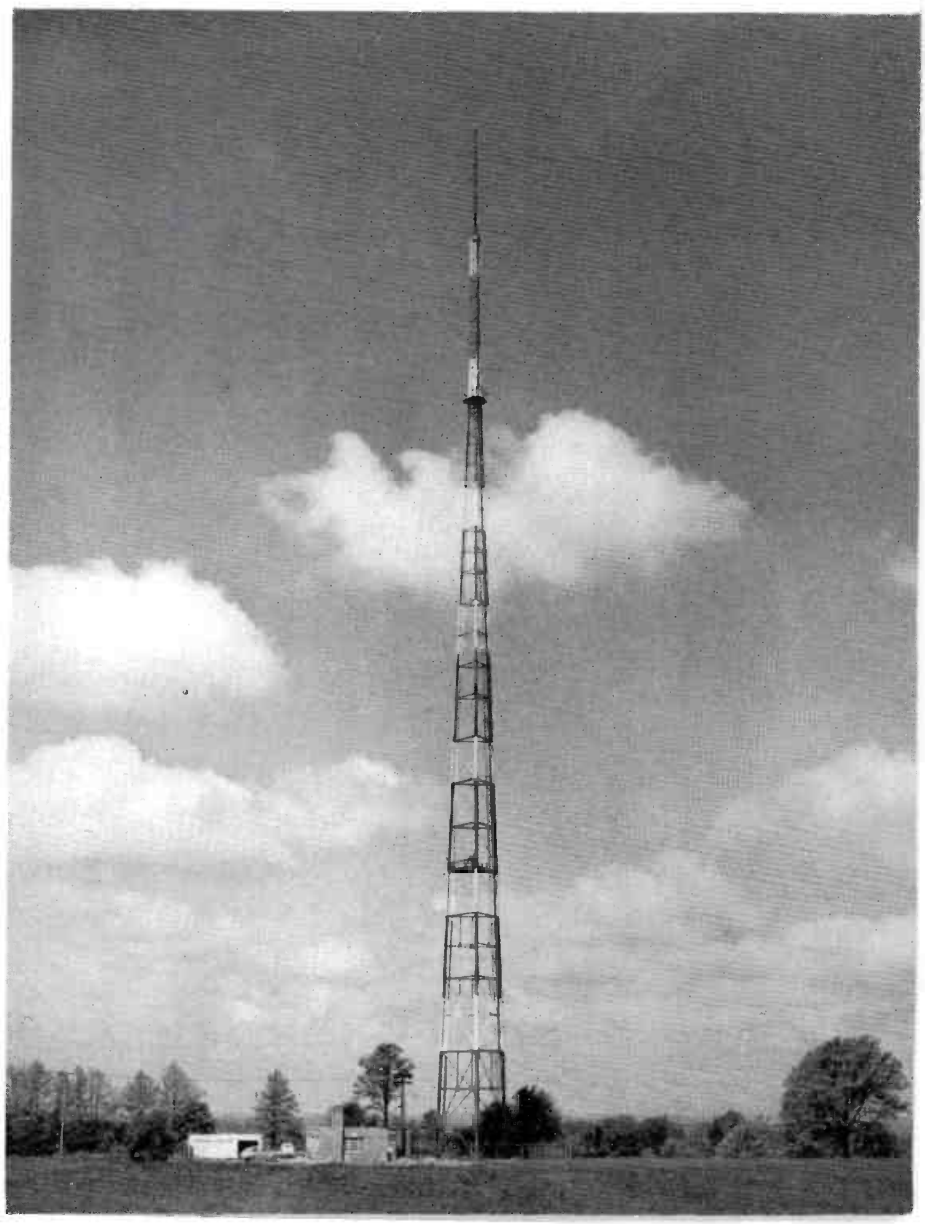


FIG. 1 (right). Soaring at an effective height of 1526 feet above sea level, this RCA Super Turnstile Antenna radiates the WEWS television signals with strength and clarity. At the 115 foot level is an RCA 7000 mc. relay receiver which terminates the 9 mile STL.

FIG. 1a (left). The WEWS antenna assembled and ready for hoisting into position on top of the 388-foot tower. This three-section turnstile radiator is typical of the RCA antenna being erected at almost every television station now under construction.

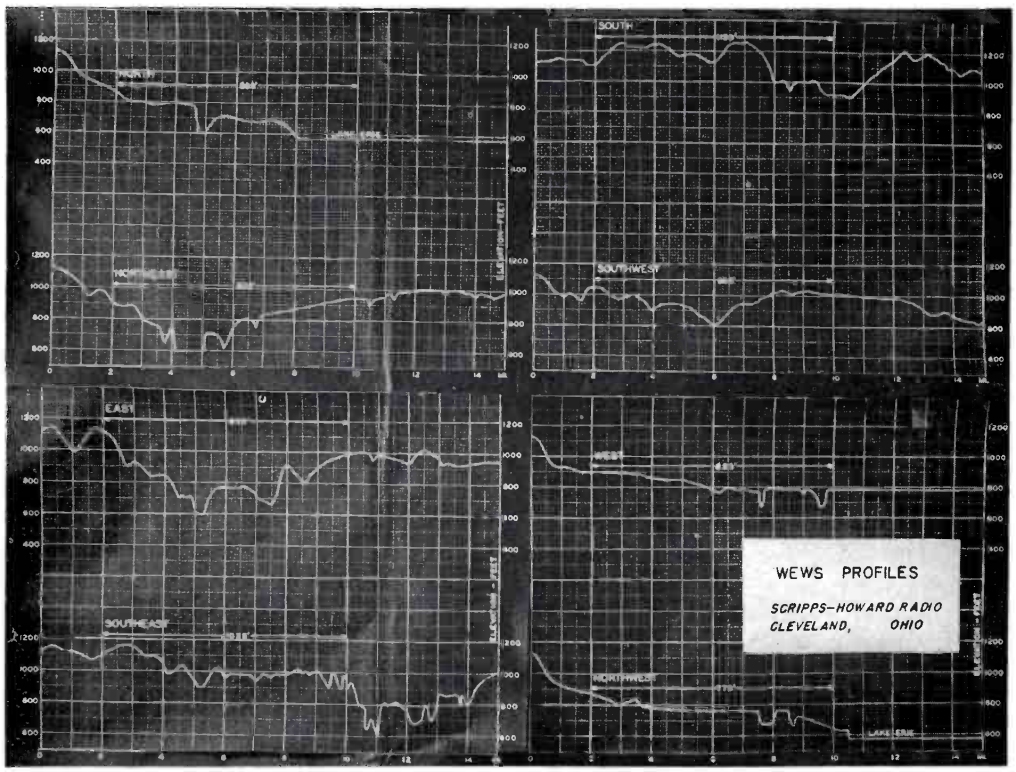


FIG. 2 (left). Profiles taken in eight directions from the WEWS transmitter.

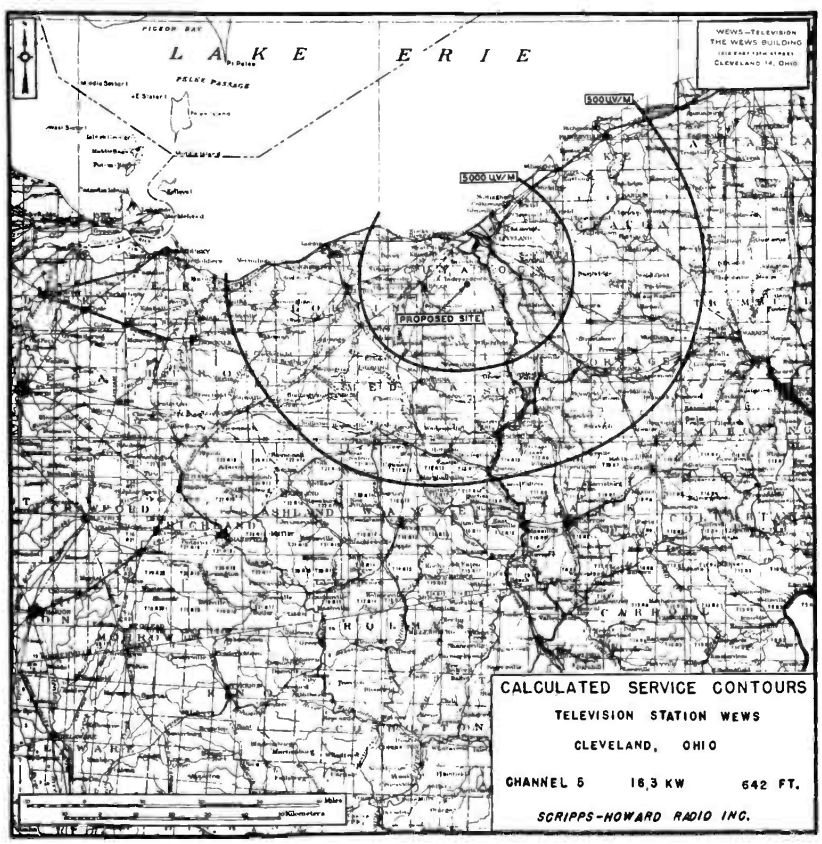


FIG. 3 (left). WEWS calculated 5000 and 500 uv/m contour lines.

toward Cleveland from the transmitter location. It is seen from Fig. 2 how the effective height of 1526 feet above sea level for the Super Turnstile provides good line-of-sight in all directions with minimum shadow effect. The signal strength in the downtown area is sufficient to allow the operation of television receivers in several locations with only indoor antennas for pickup. One such receiver operation has been reported by Eddie Leonard, Chief Engineer for NBC's Cleveland facilities. Eddie reports excellent reception in the NBC building on Superior Avenue with an indoor antenna. He has no trouble with ghosts or ignition interference.

Fig. 3 shows the calculated 5000 and 500 microvolt-per-meter contour lines. As yet the proof-of-performance survey has not been completed for a check on the theoretical values. Extensive surveys, however, have been made by certain television service organizations. The results of these surveys are in fair agreement with calculated values, but on the whole indicate

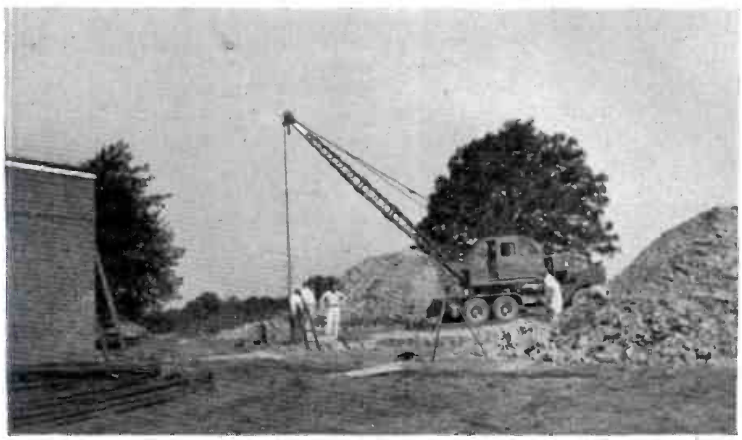


FIG. 4. Excavation for the tower foundation gets under way at WEWS, Cleveland.

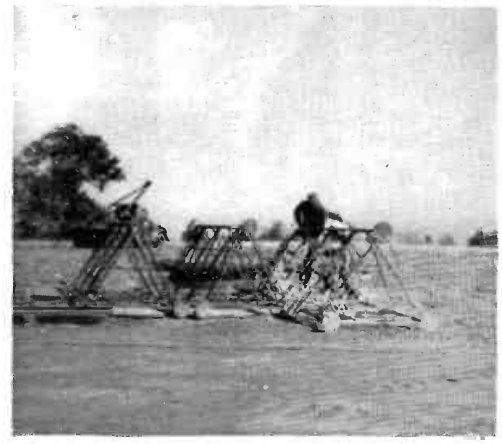


FIG. 5. Top sections of tower are removable.

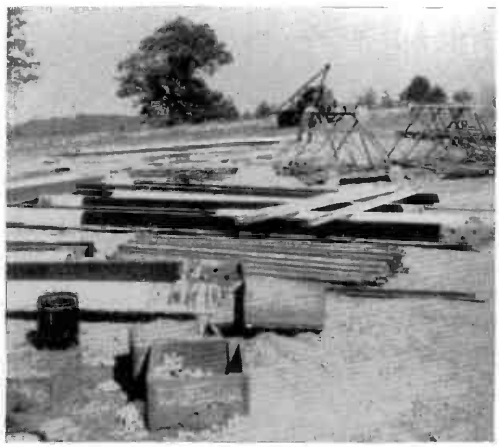


FIG. 6. Tower steel is sorted and painted.

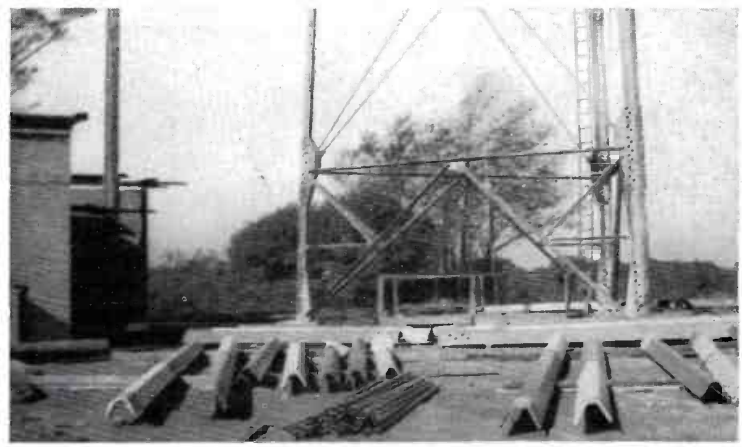


FIG. 7. Tower construction under way. Double leg splices are used in lower section.

a somewhat greater coverage than that predicted.

Tower Supporting Structure

The supporting structure was built by the International Derrick & Equipment Co., of Columbus, Ohio. Excavation and foundation work was handled by the Brook Park Construction Co., of Brook Park, Ohio. Fig. 4 shows the excavation work getting under way. Tower erection work was handled by the Reese Steel Construction Co., of Flint, Michigan.

The tower, which is 388 feet in height, self supporting and triangular, is one of the heaviest ever built by Ideco for this height tower. It has been designed in accordance with RMA Standards to provide a safe working load of 30 pounds per square foot. The equivalent indicated wind velocity in miles per hour is 110. The probable failure load is 86 pounds per square foot with an indicated wind velocity of 195 miles per hour. In addition to providing a super turnstile mount, the tower has been designed to support one six-foot microwave parabola at the 388-foot level, a similar parabola at the 225-foot level and two more at the 115-foot level plus all necessary transmission lines. It was originally planned to use a four-section Pylon FM antenna, or an equal length of triangular, uniform cross section. For this reason the upper 56 feet of the tower was made up of five removable sections consisting of four 10 foot and one 14 foot lengths. Some of these sections are shown on the ground in Fig. 5. The tower was designed in this manner to allow the order to be placed early since the FM grant was not final at the time and there was no desire to hold up television construction. Later it was decided to triplex the f-m signal on to the super turnstile. The removable sections, however, will permit the installation of a four or five section super turnstile at a later date without the necessity for extensive tower modifications and with a minimum of time off the air. Since the overall height of the tower and antenna is limited to 1550 feet above sea level, the supporting structure will necessarily have to be reduced in height when an improved super turnstile installation is made. The supporting structure is of the "narrow base" type measuring only 29′ 3⅝″ between leg centers. The foundation has been designed for a thrust of 369,400 pounds plus 50% overload and an uplift of 317,400 pounds plus 100% overload. Approximately 90 cubic yards of concrete were poured in to the three supporting piers. Each pier is 16′ in depth and is an inverted "T". Stub legs, surrounded with a 3-foot slab of reinforced concrete, extend the entire 16 feet to find anchorage in the 15′ x 15′ x 2′ concrete pad at the lower end. The entire foundation rests on solid rock at the 16′ depth.

In Fig. 6, the tower steel has arrived and is being given one coat of paint before construction. The tower legs were prefabricated in Pittsburgh—the remainder of the tower in Columbus. Each piece of steel is numbered to correspond with assembly drawings. In Fig. 7, tower construc-

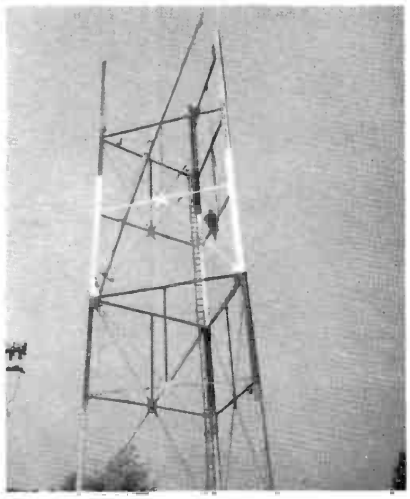


FIG. 8. Tower reaches the 50-foot level.

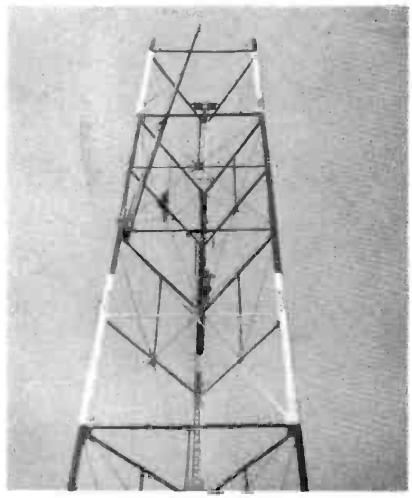


FIG. 9. Tower reaches the 140-foot level.

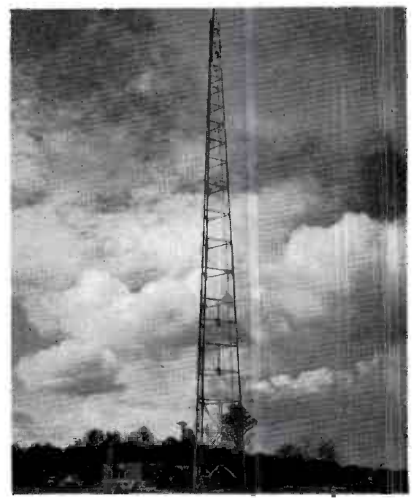


FIG. 10. Top of tapering section at 332 feet.

FIG. 11. Knocked-down Super Turnstile Antenna.

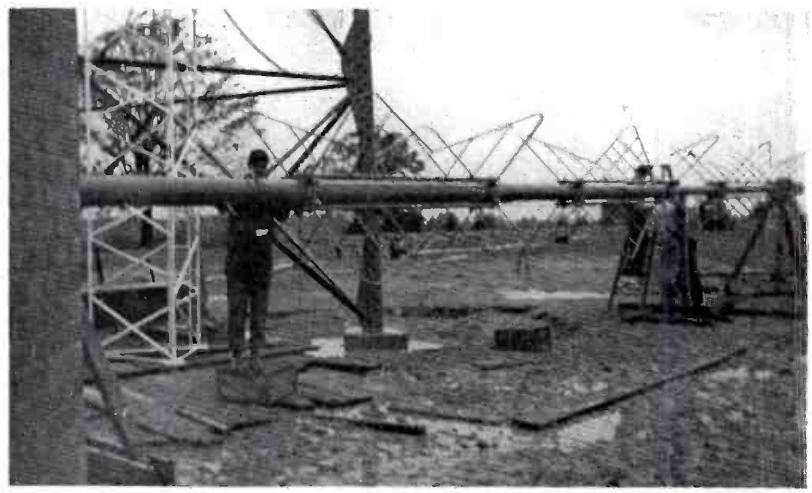


FIG. 12. The antenna was supported in horizontal position for assembly and wiring.

FIG. 13. Horses were made from scrap lumber.

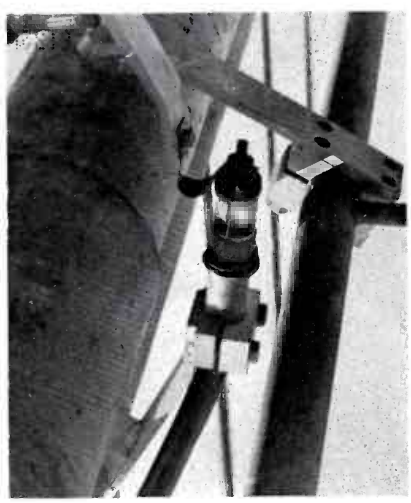


FIG. 14. Feed line clamps and end seal.

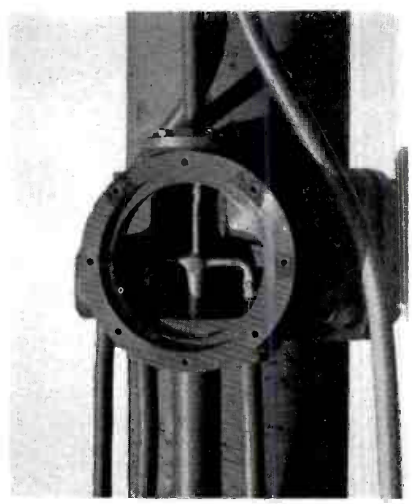


FIG. 15. Close-up of junction box.

tion is getting under way. Double leg splices are used on the lower sections of the tower to add mechanical strength. Driving the bullpins through these double leg splices was a difficult job since perfect alignment was required. In Fig. 8 the tower is at the 50-foot level. In Fig. 9, the 140-foot level has been reached. In Fig. 10, at the 332-foot level, the end of the tapering section has been reached and the uniform cross section lengths are to be installed with the super turnstile being mounted on the top 14-foot section.

Super Turnstile

Fig. 11 shows the RCA antenna stored alongside the building. The turnstile was shipped completely knocked-down for assembly in the field. The antenna consists of the supporting pole seen in the foreground, radiator assemblies in the three boxes to the right of the window, flanged socket for the pole structure which is seen below the window and additional cartons not shown which contain the r-f junction boxes, r-f feed lines, sleet melting equipment, top beacon with necessary wiring and all necessary hardware. The antenna and line installation was under the immediate supervision of Mr. R. K. Olsen, Chief Transmitter Engineer for WEWS television and WEWS-FM. Tuning of the diplexer and triplexer was handled by Mr. Glen Beerbower of the RCA Service Co.

To facilitate assembly and wiring of the radiating elements and sleet melting equipment, junction boxes, etc., it was decided to place the pole in a horizontal position with support at the two ends. It was immediately obvious that a third support was necessary at the center to prevent a 10-inch sag. Fig. 12 shows the antenna in the horizontal position supported by wooden horses constructed, as shown in Fig. 13, from scrap lumber. The three sets of radiators were clamped on the pole at designated positions in accordance with instructions furnished by RCA. Likewise, the junction boxes were clamped in place and the six feed lines installed. Fig. 14 is a close-up of a midpoint section showing the feed line clamps and end seal. Fig. 15 is a close-up of one of the junction boxes. The junction boxes serve to terminate the transmission lines from the transmitter by parallel branching connections to the six element feed lines. The element feed lines are three quarters of an inch in diameter and have an impedance of 156 ohms. Fig. 16 is a drawing which shows the completed turnstile with all feed lines and de-icers installed.

After assembly and forming of the transmission lines the turnstile was hoisted and placed in its socket for final mechanical check as shown in Fig. 17. In Fig. 1a the antenna has been moved alongside the tower and placed on the top 14′ section of the tower while at ground level. This allowed proper forming of the 1⅝″ lines from the junction boxes for connection to the twin 3⅛″ lines from the transmitter. The entire feed system, through the junction boxes to the end seals at the elements, was tested for gas leaks at this point and made gas tight. Fig. 18 is a close-up of the lower section of the antenna just before it was hoisted to its final mooring 388 feet above.

Operation of the TT-3A Television Antenna has been very satisfactory for radiation of both television and frequency-modulated signals.

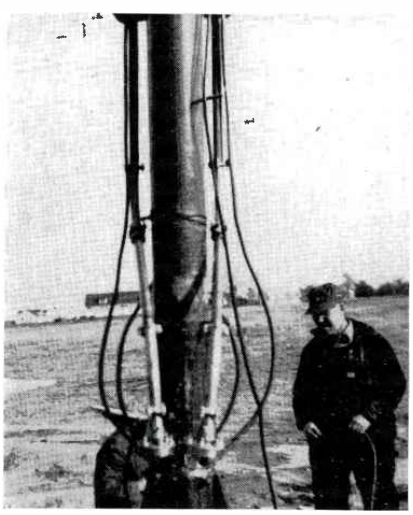


FIG. 17. The Super Turnstile receives final check.

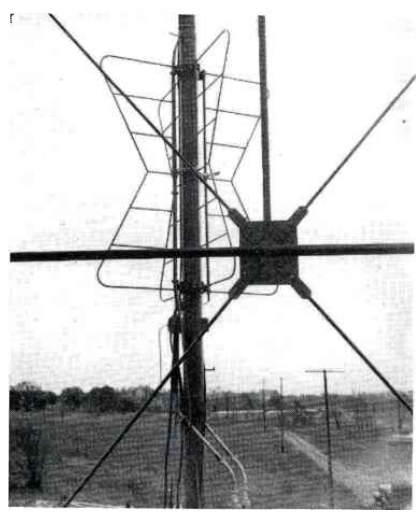


FIG. 18. Close-up of the lower section.

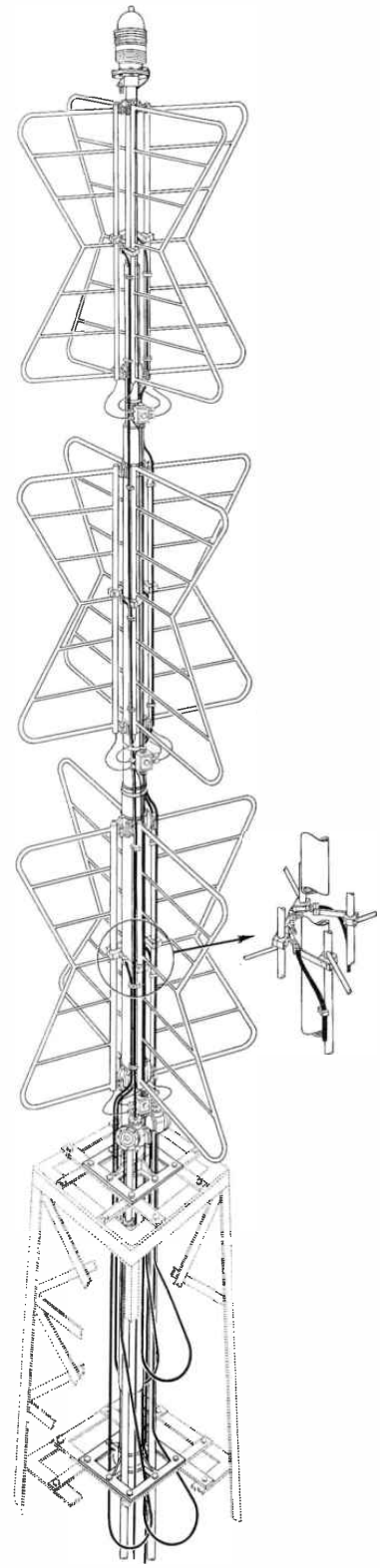


FIG. 16. Drawing of turnstile wiring and assembly.

WPAY-FM SERVES WIDE AREA

WPAY-FM, owned and operated by the Scioto Broadcasting Company, extended the WPAY primary service area to all communities within a 60-mile radius of Portsmouth, including Huntington, Ashland, Maysville, Chillicothe, and Ironton.

The broadcast period is from 3 to 9 p.m. daily, and this service duplicates present broadcasting of WPAY-CBS programs. Expansion of FM or frequency modulation facilities is contemplated in the near future, when it is planned that WPAY-FM will duplicate the present 6:30 a.m. to 1 a.m. broadcasts of WPAY-AM. The transmitter for WPAY-FM is located atop a Kentucky hill directly across the Ohio River from Portsmouth.

WPAY-FM Equipment and Transmitter Building Details

In constructing the ultra-modern transmitter atop the highest hill between Pittsburgh and Louisville, the Scioto Broadcasting Company first had to build more than two miles of winding roadway up the valleys and hills to the transmitter site.

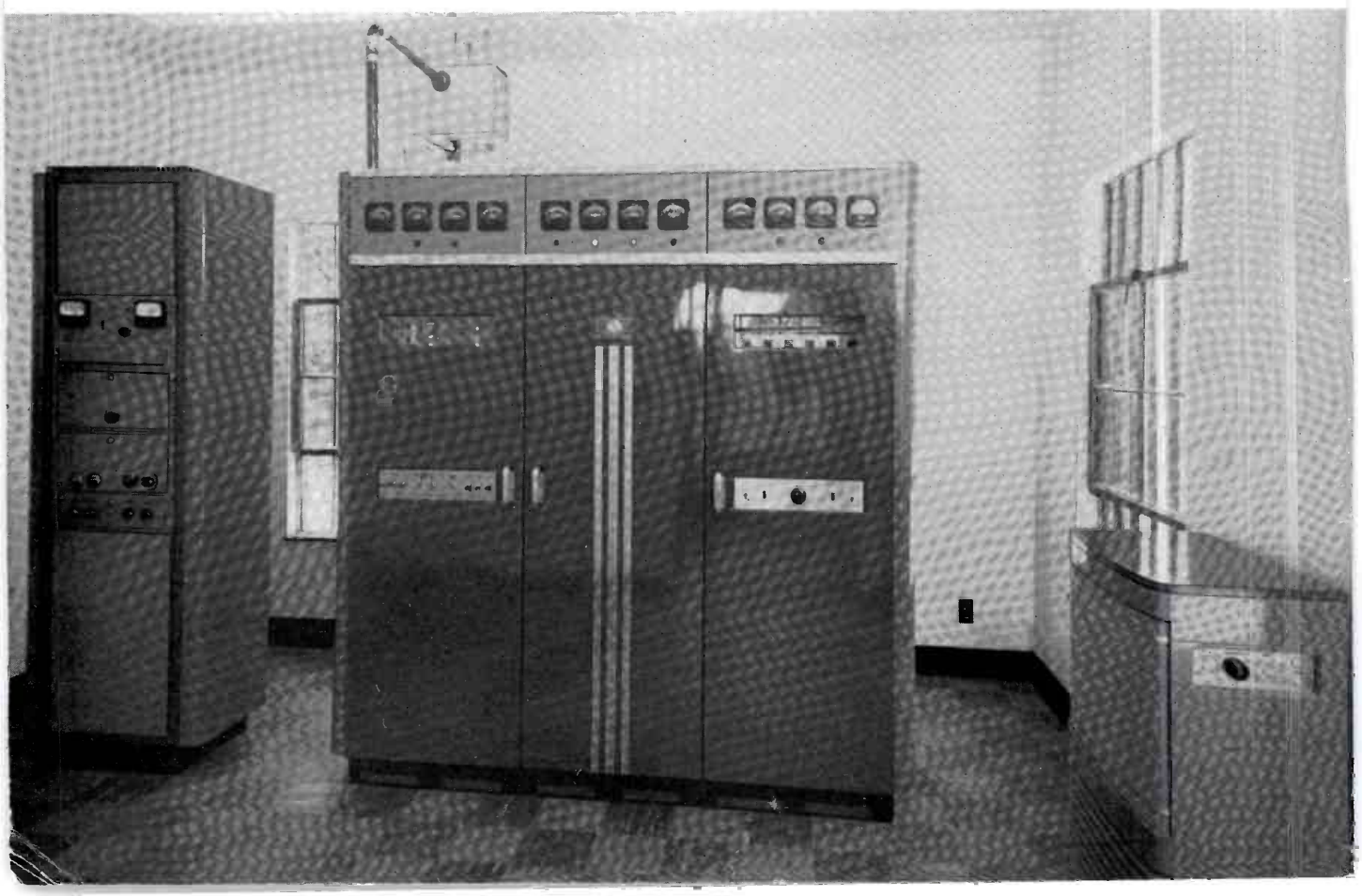
The transmitter building is constructed of baked tile, steel and concrete. It consists of a transmitter room, living quarters with built-in electric stove, refrigerator, and sink; bathroom and garage. The heating plant is located in the garage room and the system is of the radiant heat type with copper coils embedded in the floor. Fuel oil is used to heat the water. Ventilating is by means of a large fan located to the rear of the building and which pulls the heat out of the other rooms. Flush fluorescent lighting is used in all rooms.

The water supply is obtained from a 6,000 gallon cistern. Efforts to obtain water from a well failed although the drill was driven 333 feet into the earth. Power lines and program service was made possible by erection of new facilities as the area was not served by the utilities before. The transmitter is an RCA BTF-3B of 3,000 watts power. RCA amplifiers and monitoring equipment also are used.

An RCA two-section Pylon mounted on a 173-foot tower is employed to obtain an effective radiated power of 7,000 watts. The Truscon tower mounted on a concrete base rests on solid rock. It was erected by the Mid-South Tower Company of Southern Pines, N. C. Tower lights are controlled by a photoelectric cell. The two-section RCA Pylon, as presently installed, is 1290 feet above sea level.

The height of the antenna is 520 feet above the average terrain and the actual distance above street level is 800 feet. WPAY-FM operates with the power of 7,000 watts on a frequency of 104.1 megacycles. (Channel 281.) An FCC inspector said it was one of the few stations that have met with the full terms and stipulations of the construction permit. With WPAY-FM reaching communities within a 60-mile radius, it is estimated that an area 75 per cent larger than that currently served by the AM station is reached, day and night.

The WPAY-FM transmitter building was planned and designed, and all equipment installed by Chief Engineer Maurice Myers, under the supervision of Gerald F. Boyd, Manager, and Eugene Carr, Director of Radio and Television for Brush-Moore Newspapers, Inc. From the very beginning—selecting a site, to the final job—producing the Inauguration Program, all work was planned and supervised by the Scioto Broadcasting Company. No architect, road contractor or outside professional help was required.



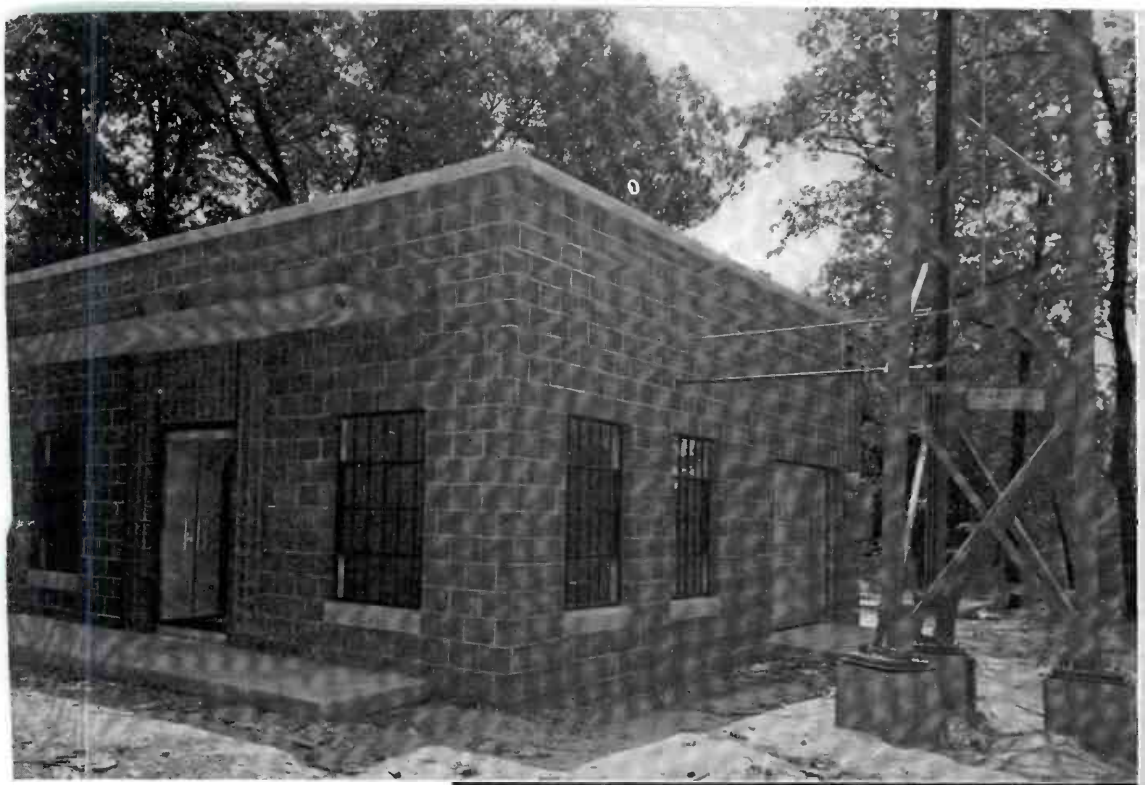


FIG. 1 (at left). View of the WPAY-FM transmitter room showing (left to right) Audio facilities and monitoring equipment, RCA 3 KW FM transmitter, and RCA LC-1A duo-cone loudspeaker.

FIG. 2 (above). The brick-constructed transmitter building of WPAY-FM, which is located on a Kentucky hill directly across the Ohio River from Portsmouth, Ohio (site height 1,090 ft.).

FIG. 3 (at center). Mr. Gerald Boyd, Manager of Radio Stations WPAY and WPAY-FM, Portsmouth, Ohio.

FIG. 4 (at right). Mr. Maurice Myers, Chief Engineer for WPAY and WPAY-FM, shown at the station's studio location.

FIG. 5 (at far right). The WPAY-FM, two-section Pylon antenna mounted on a 173-foot tower. The RCA 3 KW FM transmitter and Pylon antenna provide an effective radiated power of 7,000 watts.

USTOM-BUILT DUAL-RECORDING CONSOLE

by A. S. KARKER
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Engineering Products Department

RCA custom-built, dual-recording consoles are designed and equipped to provide simplicity of operation plus versatile selection. For example, the dual-recorder described in this article may be employed as two single channel recorders, or for dual-recording of the same program. It may also be used for continuous recording, without the necessity of a break to change recording blanks. An added feature enables the dual-recording console to be used as a program monitor, when not recording, or to receive the cue and monitor the program being recorded.

Description

The complete custom-built recording console and cabinet consists of two RCA type 73-B Professional Recorders (MI-11825/11850-C) which are mounted on each side of the turret installed at the top center of the cabinet (see photo of Fig. 2). The turret panel contains the controls for operation of the left and/or right recorder, recording switching system, metering and monitoring. The recording and monitoring amplifiers are the plug-in type and are mounted on shelves in a compartment below the control panel, making them easily accessible and removable for servicing. The Recording (Orthacoustic) Filter, MI-4916-A, is also mounted in this section, as well as the A-C and audio terminal blocks, thus making it unnecessary to move the console for connecting additional lines and also permitting the cabinet to be placed against the wall in a convenient permanent location. The Automatic Recording Equalizer (MI-11100) is mounted in a metal cylinder that is parallel to the tube housing the cutter head feed screw. As the cutter head moves on the feed screw towards the center of the record, a contact riding on the equalizer provides the proper amount of compensation. There is a large storage space under each recorder with shelves for recordings or blanks. The cabinet is finished in an attractive two-tone umber gray and trimmed with chrome.

How It Operates

The operation of the right and left recording channels are quite similar. The right recording channel will first be described below. After the recording and monitoring amplifier are adjusted to the proper levels, it is not necessary to change these adjustments—since all other control operations may be made directly from the control panel.

By simply operating the center selector switch (directly under meter on turret control panel), the operator has his choice of seven positions—three "OFF", and four "RECORDING" positions (left recorder, right recorder, both recorders and single recording). For the purpose of illustration, we will assume that this switch is in the position engraved "right". With the key switch (which is located above the right recorder controls) placed in the center position, the recording amplifier operates in a normal condition (for audio response

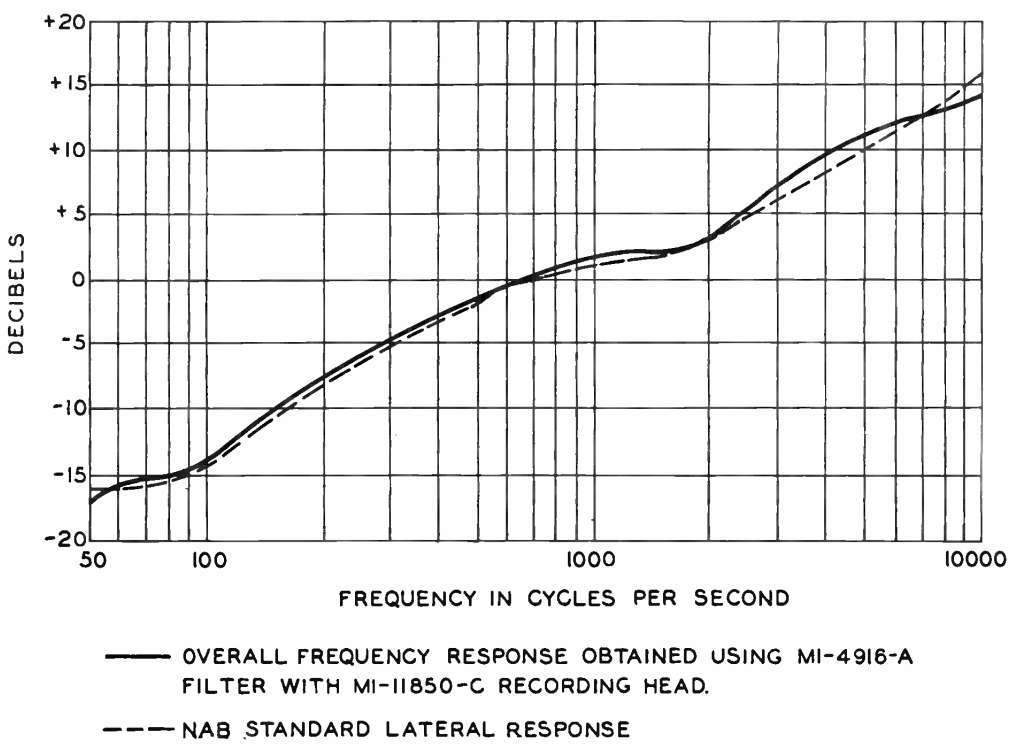


FIG. 1 (At Right). High-fidelity recordings are assured with the 73-B Recorder equipment which incorporates the MI-11850-C recording head and MI-4916-A Orthacoustic Recording filter.

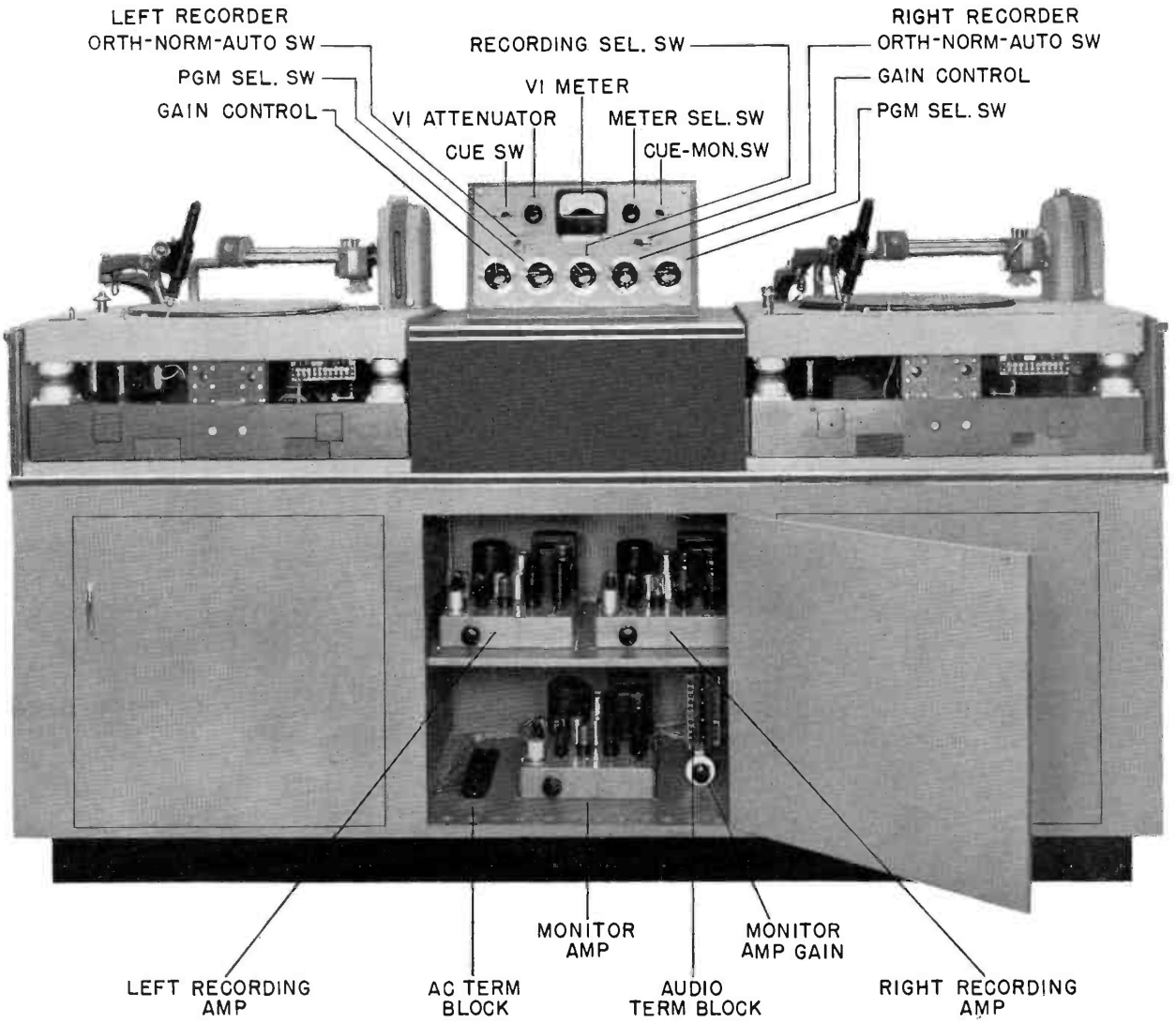
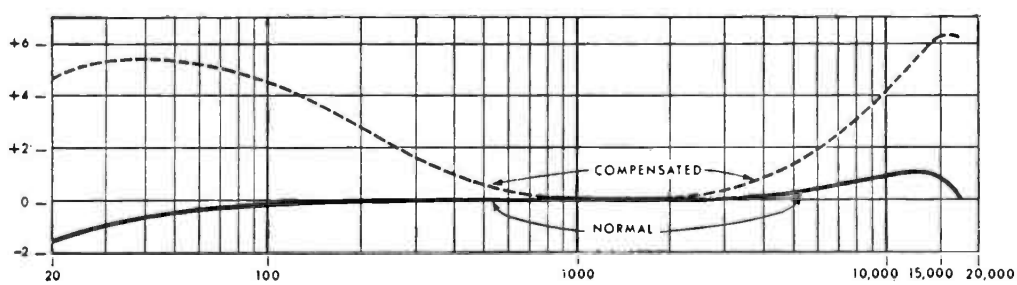


FIG. 2 (Above). Front view of the WKJG Dual-Recorder with left and right-front panels removed and center cabinet door opened to illustrate construction. Recording and monitoring amplifiers are located in center cabinet where they are easy to reach for adjustment or servicing, if desired. Cabinets at right and left are utilized for storing recordings and blanks.

FIG. 3 (At Right). Recording Amplifier Type BA-4C response curve. This high-quality amplifier is used for both recording and monitoring purposes.



and data, refer to BA-4C Amplifier, 11223-B) Fig. 3. If this key switch operated to the right or orthacoustic sition, the recording amplifier response ill be the same as that of recording filter (MI-4916-A Fig. 1) or should this key switch be operated to the left, the Automatic Recording Equalizer (MI-11100) is placed in the circuit.

The meter switch is placed in position marked right, which will place the volume level indicator across the output of the right recording amplifier in order to adjust the gain control for the proper audio level to supply the cutter head. The VU Meter has an attenuator which is adjustable by means of the switch on the left side of the meter. With the controls and switches set up as described and the recorder operating as per instructions supplied with it, it is easy to produce high-quality recordings which will be found useful for delayed broadcasts, rehearsals, auditions or for the reference file.

Operation of the selector switch directly under the meter permits the selection of the left or right recorder, or each recorder operating independently for transcribing different programs simultaneously. In the "both" position, it is possible for the two recorders to be on the same program line. By operating the left recorder gain control, it is possible to regulate the input level to both amplifiers. The volume-level indicator meter may be placed across the output of either the right or left recording amplifier, as desired, by means of the meter selector on the right side of the meter.

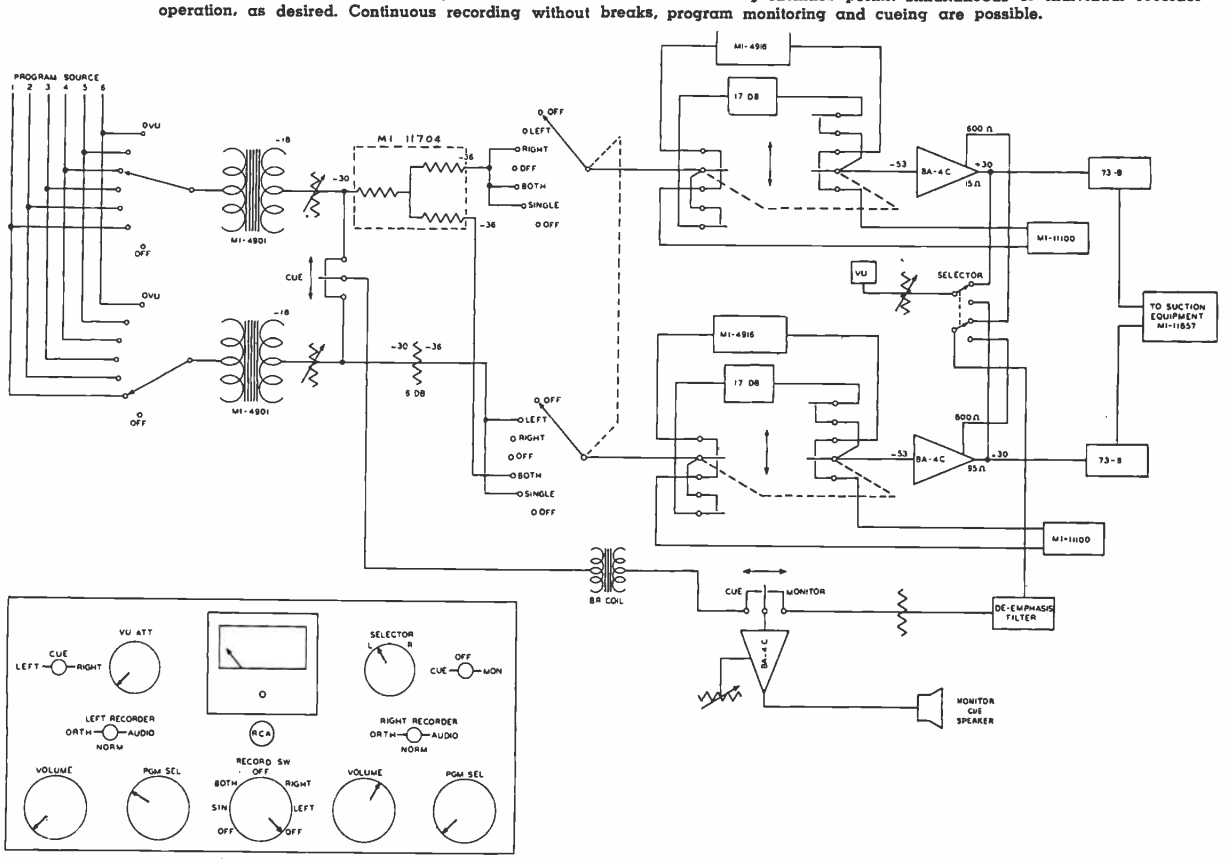
The monitor system is very flexible, since it may be used for monitoring or cueing. When the key switch, located in the upper right-hand corner of the control panel (center position is "off"), is operated to the left or cue position, the input of the monitor amplifier is bridged across the left or right recording channel ahead of the recording amplifier. The desired channel is selected by the operation of another key switch which is located in the upper left corner of the control panel. The placing of the monitor amplifier in this circuit position does not vary the recording level.

When the key switch is placed in the monitor position, the operation of the meter-selector switch connects the input of the monitor amplifier across the output of the left or right recording amplifier. The output is taken from a separate output source and does not affect the recording level. The high-level audio is attenuated by means of a fixed pad so that the cue and monitor audio power levels are about the same at the input of the monitor amplifier. A de-emphasis filter is employed in the monitor input to level off the audio response contributed by the insertion of the orthacoustic filter in the recording channel. All low-lovel audio power fed to the amplifiers is isolated and run in a separate cable, from that of the high-level audio circuits, thus eliminating cross talk. A simplified block diagram is included in Fig. 4 to illustrate overall operation of the dual-recording setup.

73-B Professional Recorders

The Professional recorders employed are the heart of the dual-recording system. They are RCA type 73-B's which have proved to be outstanding in the Broadcast field. (Specifications of 73-B are included at the end of this article.) They include

FIG. 4 (Below). Simplified Block diagram of the WKJG Dual Recorder in which switching facilities permit simultaneous or individual recorder operation, as desired. Continuous recording without breaks, program monitoring and cueing are possible.



almost every known device for making high-fidelity recordings and prove to be the ideal recorder for making Masters from which any number of pressings may be made. The 73-B recording equipment consists of a high fidelity (MI-11850-C) recording head, carriage and lead screw mechanism, a turntable assembly which includes a dual motor with rim drive mechanism, a turntable platter with rubber mat, a microscope and microscope lamp and a suction nozzle. Suction generating and hose equipment is not normally supplied, but is available as accessory equipment. The RCA RS-1A Suction equipment (MI-11857) is very useful for collecting acetate chips and for removing shavings from the record surface during recording.

Recording Filter

The Orthacoustic Recording Filter (MI-4916-A), employed in the dual-recorder system, is designed to provide the most desirable recording characteristic as set forth by NAM Standards for lateral transcriptions. This filter is primarily designed for use with the MI-11850-C High Fidelity Recording Head to give an orthacoustic response characteristic. An overall frequency response curve is included in Fig. 1 of this article.

Recording Equalizer

The Automatic Recording Equalizer (MI-11100) was developed to compensate for the variation in reproducing levels due to changes in surface speed of the recording blank relative to the stylus. Without this compensation, the recorded and reproduced level due to speed change would be of a lower level at the higher frequencies near the center of the record, than would be experienced near the periphery of the record.

Recording Amplifier

The BA-4C Amplifier (MI-11223-B) is a high fidelity, high-gain flexible 12 watt amplifier, with 105 DB gain. It is suitable for both high-quality recording and monitoring use. The response curve of Fig. 3 illustrates the excellent frequency response. The BA-4C has a plug-in type chassis using multi-conductor plugs. It is easily removed during maintenance.

Typical Station Installations

Custom-built dual Recorders of the most modern design and similar to WKJG's equipment which is described in this article, are used by many broadcast stations. Figs. 5, 6, 7 and 8 picture four examples of typical RCA custom-built dual-Recording installations. These photographs were supplied through the courtesy of Radio Stations WKJG, Fort Wayne, Indiana—KCRG (AM) and KCRK (FM) of Cedar Rapids, Iowa—KUTA of Salt Lake City, Utah—and "Radiocentro," Radio Station CMQ of Havana, Cuba.

Salient Specifications—73-B Recorder

Recorder Head Impedance (MI-11850-C High Fidelity Head) ....15 ohms nominal
Frequency Response.....±2 db, 30-10,000 cps
Sensitivity: (Groove velocity 6.3 cm/sec., .009" (peak to peak) at 1000 cps +30 dbm (1.0 watt)
Stylus.....Sapphire or steel
Turntable Diameter (handles blanks up to 18¼" dia. and up to ⅜" thick)....17½"
Turntable Drive...Rim driven through rubber idler rollers from two hysteresis synchronous motors
Turntable Speed (accuracy ±½%).....33⅓ or 78 rpm

FIG. 5 (Below). Here is the Dual-Recorder as installed in WKJG's recording room at Ft. Wayne, Indiana. The two RCA Type 73-B Professional Recorders are mounted on either side of the switching turret.

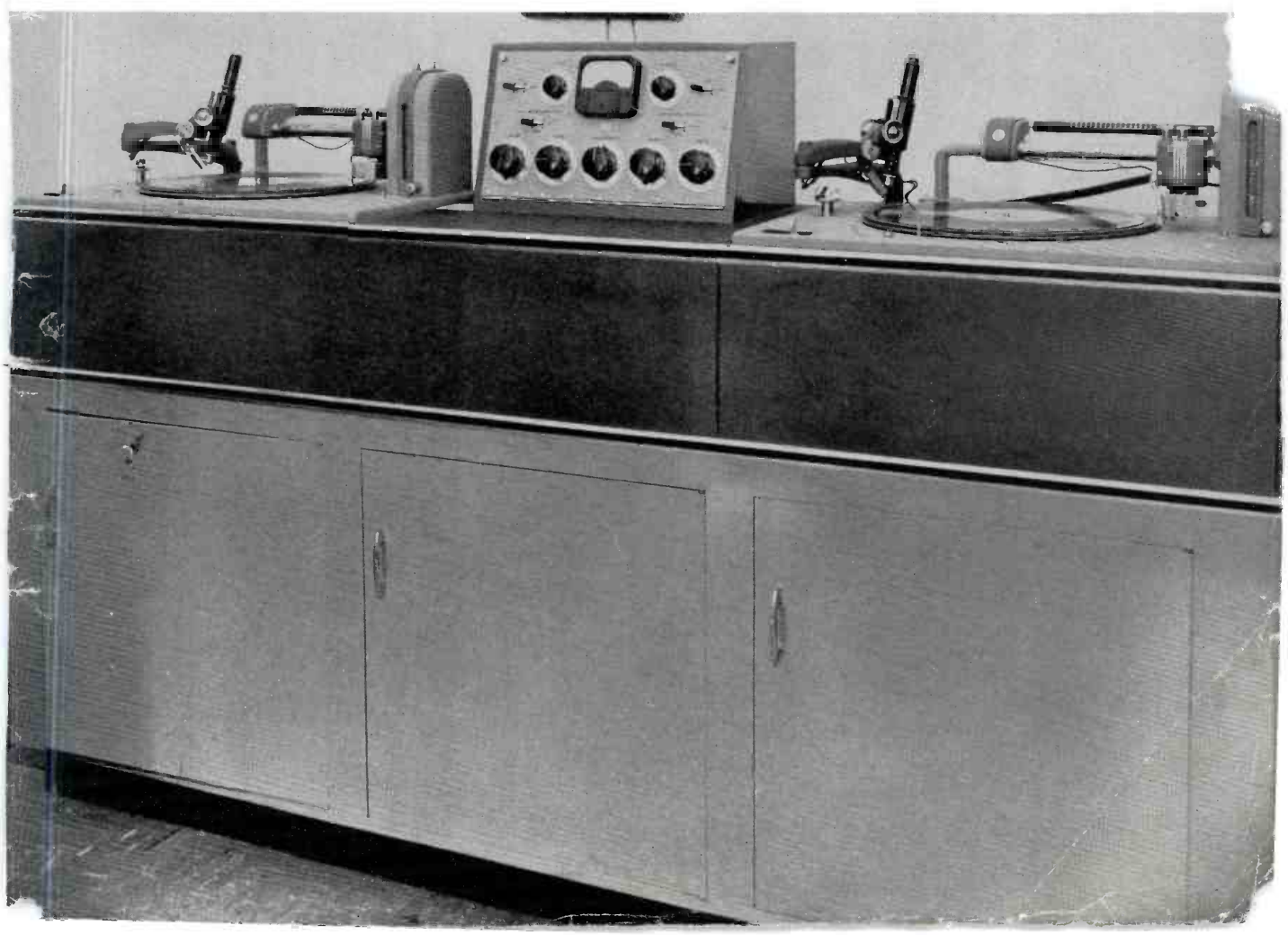


FIG. 6 (At Left). Wayne L. Babcock, Chief Engineer of KCRG/KCRK, shown at the right recorder of the station's custom-built recorder installation.

FIG. 7 (Below). In this closeup view the recorder installation at KUTA, Salt Lake City, Utah is shown.