AM · FM · TELEVISION
BROADCAST NEWS

RECORDING AND FINE GROOVE TECHNIQUE . . . See Pg. 8

Broadcast News

AM • FM • TELEVISION

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Contents

OUR COVER illustration for this issue is a closeup showing the recording head of the RCA 73-B Professional Recorder during a fine groove cutting operation (note chip being removed by suction equipment). Inset section shows off the 73-B to better advantage. This well-known recorder—standard equipment in a large number of stations—may now be adapted for "fine groove" recording by means of a relatively inexpensive modification kit. (See Pg. 8.) The color illustrations on the cover are reproduced from 4" x 5" Kodachromes made by our staff photographer, Rod Allen.

DON'T WRITE OFF DISC recording too quickly—it still has some advantages. This is particularly so when permanent—or even semi-permanent—recordings are required. Disc recordings made by the "fine groove" technique are cheaper (about two dollars per hour), and require less storage space (about 18 cu. inches per hour), than equivalent-quality recordings made by any other method.

WOW'S JOHNNY GILLIN is gone. His passing has been noted, and his accomplishments eulogized, by every magazine in the industry—and by many outside it. The WOW-TV story (Pg. 18) was written, and set in type, before his death. It was meant to be, and is, a straightforward technical description of WOW's television facilities. As such it may not portray WOW-TV for what it really is—a monument to Johnny Gillin's energy and vision, a record of his confidence in the future of the industry. WOW was not one of those super-rich stations which could go into TV "for insurance." It wasn't a network center, with an immediate assured TV audience. In fact, it wasn't even, until very recently, on a network line. It took courage to go into TV under such circumstances. Nevertheless, WOW began active work on television way back in 1946. Under its technical director Joe Herold and its production manager Russ Baker, a comprehensive TV training program was instituted. First a complete camera chain was constructed—"to get the feel of the equipment." Next RCA field equipment was purchased and a cooperative arrangement to experiment on programs was set up with Creighton University. Finally came WOW-TV itself, in a new building expressly designed for TV—a building based not on theory alone, but rather on the basis of actual production of TV programs over the two years preceding. It marks WOW as a pioneer in midwest TV—as it was in radio. And it's a lasting tribute to the man whose ability and energy built the operation practically from scratch.

FOOTBALL TV promises to be a big thing this fall—hence we are doubly happy to have an article which is both authoritative and timely. Phil Caldwell's story (Pg. 60) on the setup KECA-TV used at the Los Angeles Coliseum last year is exceptionally complete and well documented. It is recommended as required reading for all those planning football telecasts this fall.

And incidentally, if you do some football pickups this fall we would like to hear about them. We've often been asked why we don't do a roundup story on football TV—similar to those we've done on baseball TV. Well, we would like to—but there's less time to get around and see these telecasts, and there's much less standardization (in size and shape of stadiums, possible camera angles, etc.), so that the job is much more difficult. However, we would like to present as many individual station stories as possible—so send along all the material you can lay hands on (especially photos, diagrams and descriptions of unusual features).

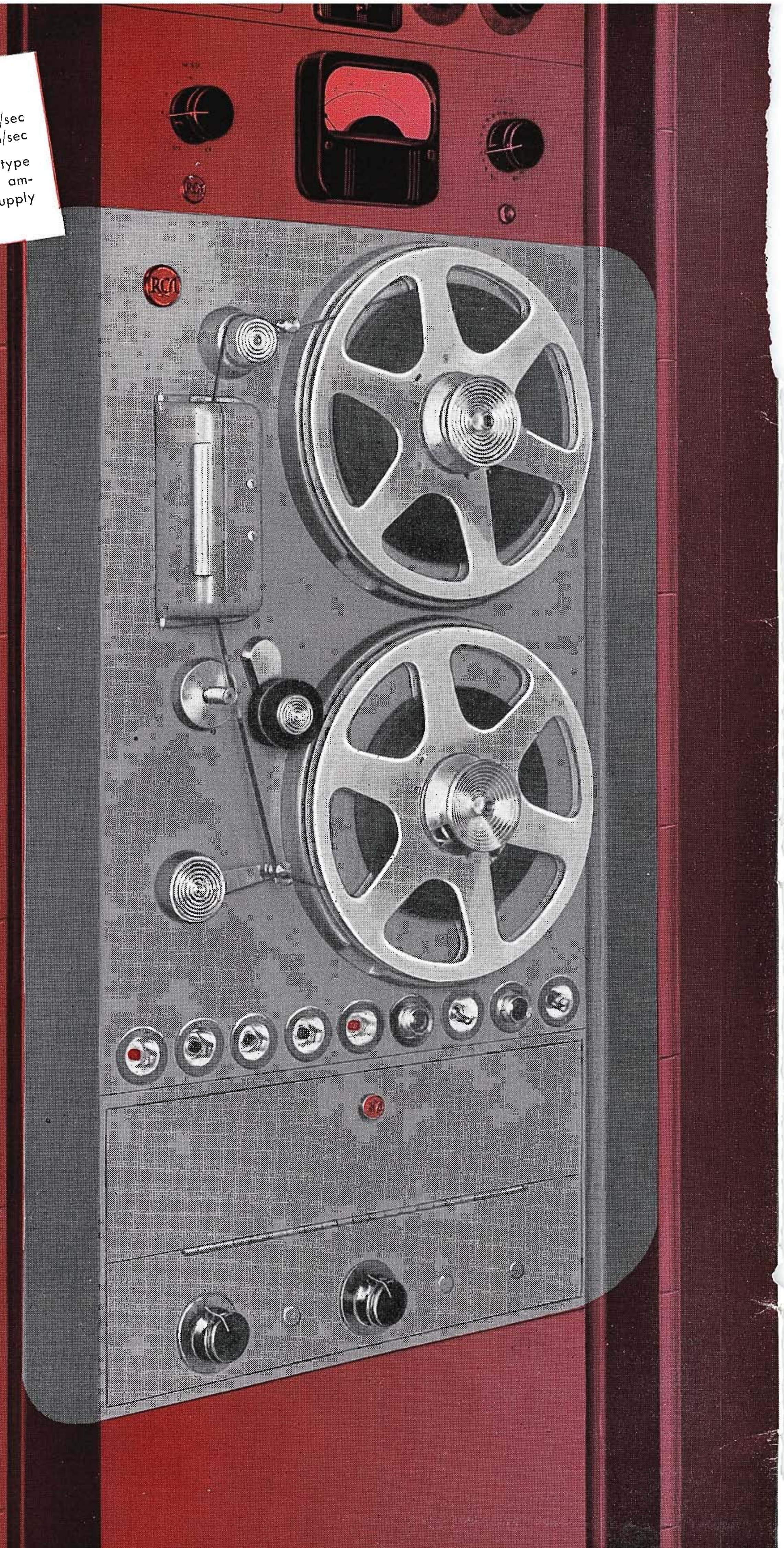
ERRORS: In the article on "How to Adjust Frequency Response in Video Amplifiers for TV" (Broadcast News No. 58, Pg. 54) the illustration shown in Fig. 27 (Pg. 62) should be reversed, left to right. In the same article the caption for Fig. 33 should read "Schematic of test circuit of a typical cathode follower used in obtaining the curves of Fig. 32."

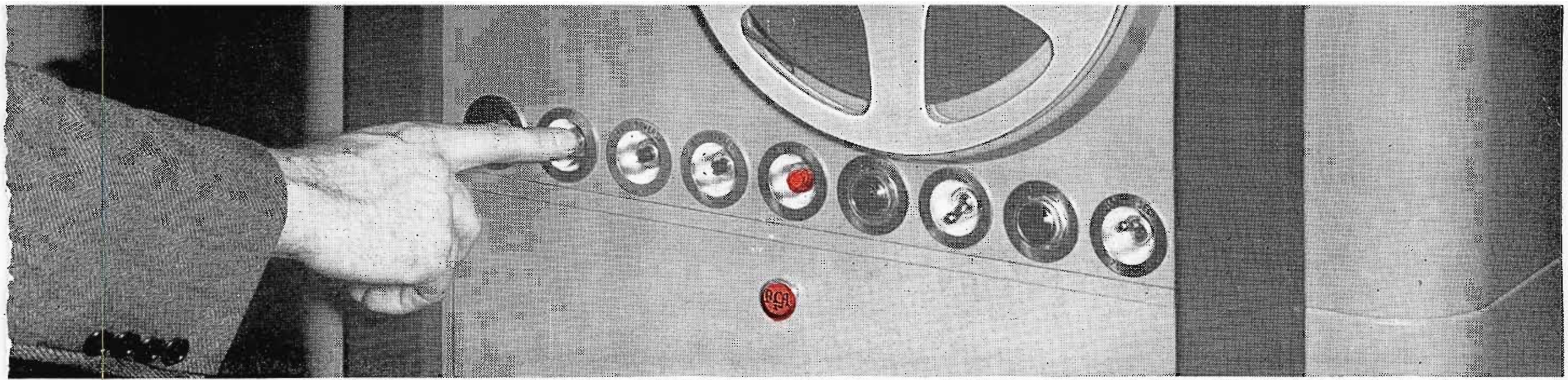
RCA TAPE RECORDER *Type RT-11A*

50 to 15,000 c.p.s. (±2 db) at 15 in/sec
50 to 7,500 c.p.s. (±2 db) at 7½ in/sec

COMPLETE—with motor board, plug-in type recording amplifier, plug-in playback amplifier, two standard NAB reels, power supply and panel and shelf.

- Split-second start and stop
- Push-button operation
- Extremely accurate timing—with synchronous capstan
- Smooth tape runs—via sapphire guides
- Automatic tape lift for fast "forwards" and rewinds
- Microswitch "tape-break" control—no tape spills, snarls
- Remote control of all operations
- Rack or console mounting
- Plug-in amplifiers
- Interlock system for vital controls
- 3 heads—Erase—Record—Playback



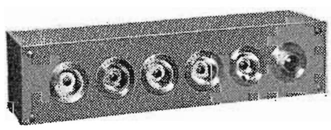


PUSH-BUTTON CONTROL puts tape recording facilities at your fingertips.

NEW—

High-Fidelity Tape Recorder

—the finest money can buy!



Remote Control Unit, MI-11948. Available extra.

This is the world's foremost professional tape recorder, the one recorder that has *everything*—accurate timing, low wow and flutter, plus quick starting. All operations are push-button controlled. All functions—including cueing—can be extended to remote positions.

Designed for applications where operating TIME and RELIABILITY are prime factors, the new Type RT-11A Recorder offers a number of exclusive features. For example, you can start or stop the tape in 0.1 second. You can jockey the tape back and forth for cueing without stopping. You can rewind a standard 10½-inch reel in one minute!

A synchronous capstan makes it practical to hold recording time to ±2½ seconds in a 30-minute run. And with synchronizing equipment . . . for which provision is made . . . *timing can be held to 0.3 second on any length program!*

Many more important features, too.

Self-centering "snap-on" hub adaptors assure perfect reel alignment with either RMA or NAB reels. A complete system of control interlocking virtually eliminates the possibility of accidentally erasing a program—makes it impossible to snarl or "spill" the tape. "Microswitch" control stops the machine if the tape is severed—applies reel brakes instantaneously. The tape automatically lifts *free and clear* of heads during fast forward runs or rewinds. Tape alignment over the heads is held precisely by a floating casting. Starting wow is reduced to the vanishing point.

BY ALL MEANS, *call your RCA Broadcast Sales Engineer for complete details. Or mail the coupon.*

RCA

AUDIO BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

RCA Engineering Products,
Department 7I,
Camden, New Jersey

Send me more information (including price and delivery) on your new De Luxe Tape Recorder, Type RT-11A.

NAME__________

ADDRESS__________

STATION OR FIRM__________

CITY__________ STATE__________

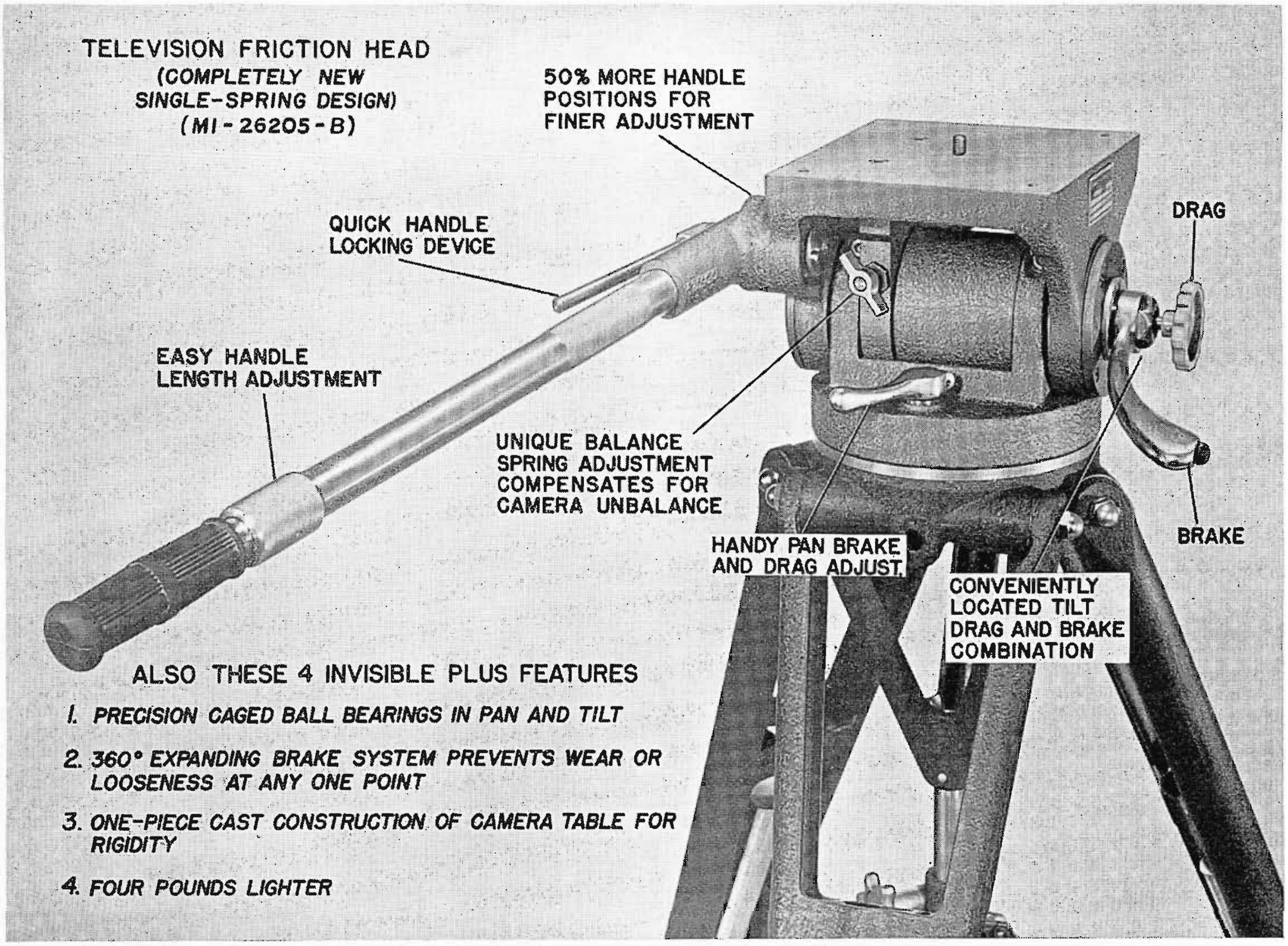


FIG. 1. Close-up of the new Camera Friction Head (MI-26205-B) showing the many design features provided.

TV FIELD EQUIPMENT ACCESSORIES

By J. P. McGRENRA
Television Equipment Sales

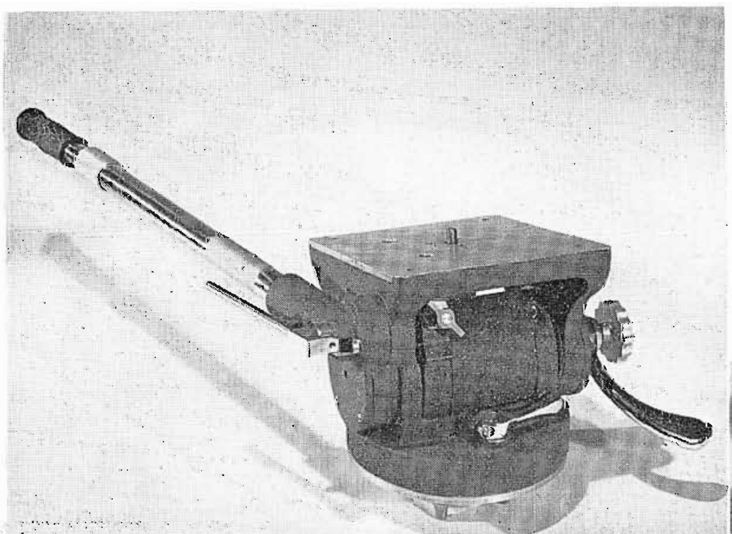


FIG. 2. View of the MI-26205-B Friction Head as supplied for use with Field or Studio Cameras.

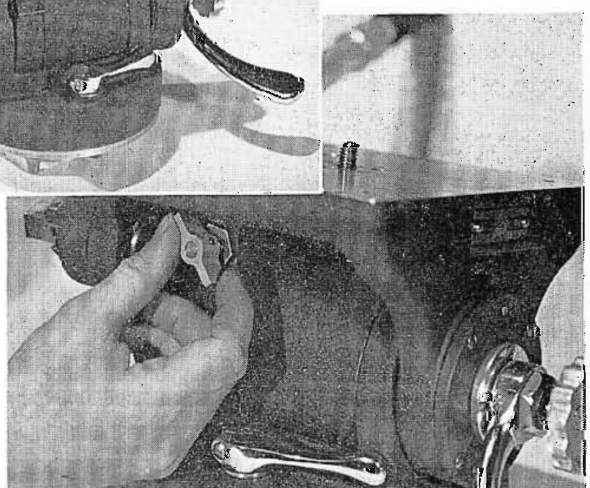


FIG. 3. A special spring adjustment enables correct camera balance.

The various new TV field equipment items, which were first announced and displayed at the recent NAB Convention, should prove invaluable to the Television Broadcaster. Among these equipment items are an improved Friction Head, a new Tripod, new Field Desk, and a Rotatable Mount and Remote Control for Microwave Parabola. Careful consideration should be given by TV station personnel to the many unique features provided. Actual installation of these equipments (which are described here) will be repaid by smoother, improved overall operation, reduced setup time, and reduction of expense. New design and operating features have been incorporated into these items as a result of design suggestions offered by TV broadcasters, as well as from actual experience gained by RCA engineers over the past years, during which time somewhat similar equipment has been in everyday service.

New Friction Head (MI-26205B)

The new camera Friction Head was designed especially for use with the RCA Field and Studio Cameras, MI-26101A and MI-26000A. A completely new single-spring design, the MI-26205B offers approximately 10 or 12 new features which are pictured and illustrated. Outstanding among these is the unique balance spring adjustment provided to compensate for camera unbalance. The Friction Head is ideal for use with the new TD-11A all-metal Tripod for field use and with RCA Studio Pedestals and Dollies for studio use. The Friction Head is of rugged all-metal construction, in which all materials have been carefully selected for both field and studio use. Since all castings used are aluminum, the friction head is light, yet sturdy, and lends itself to extreme portability. All visible surfaces of the castings are attractively finished in deep umber gray wrinkle and present a very neat appearance.

Rotation through 360 degrees in azimuth and ample tilt, up and down, are provided for operation with the RCA cameras. Extremely smooth in operation, RCA Field and Studio Cameras when mounted on this unit are well balanced in any position of tilt, by means of special hand-adjusted counterbalance springs. Thus, a minimum of effort is required by the camera operator.

TD-11A All-Metal Lightweight Tripod

As companion equipment, the TD-11A Tripod is ideal for use with the Friction Head just described in supporting field and studio cameras. When used with Television Tripod Dolly Type TD-15A, the tripod provides convenience and mobility. It also may be used with tilt head MI-26206 in conjunction with Microwave Relay Transmitter (TTR-1B) and Microwave Receiver Unit (TRR-1B).

The outstanding features of the new tripod are illustrated and pictured here.

The type TD-11A consists of an all-metal tripod structure of aluminum castings and tubular steel construction which provides a compact, lightweight, yet rugged design. It folds into a small-size unit which is easily portable. When collapsed for carrying, legs are latched to the center stabilizing post, thus preventing leg spread during transport.

In operation the TD-11A provides a "working-height" range of approximately 25 to 42 inches. Outstanding in design are individual tie rods which connect to and brace all tripod legs (these same three tie rods also couple to the center stabilizing post and provide a stable, rigid support).

The lower tubular portion of each leg is easily adjusted and slides within a long-length bearing which is held to close tolerances. Thus, minimum play and maximum rigidity are assured throughout the working range. When tripod legs are adjusted for desired height, they may be locked in position by means of hand-operated, clamp screws. The lower end of each leg is provided with a self-aligning, universally-mounted casting, which in one plane has a flat rubber surface for use on level flooring—and in another plane has a steel spike for use on rough surfaces. The flat-surface also provides a suitable mounting for use with Tripod Dolly, TD-15A.

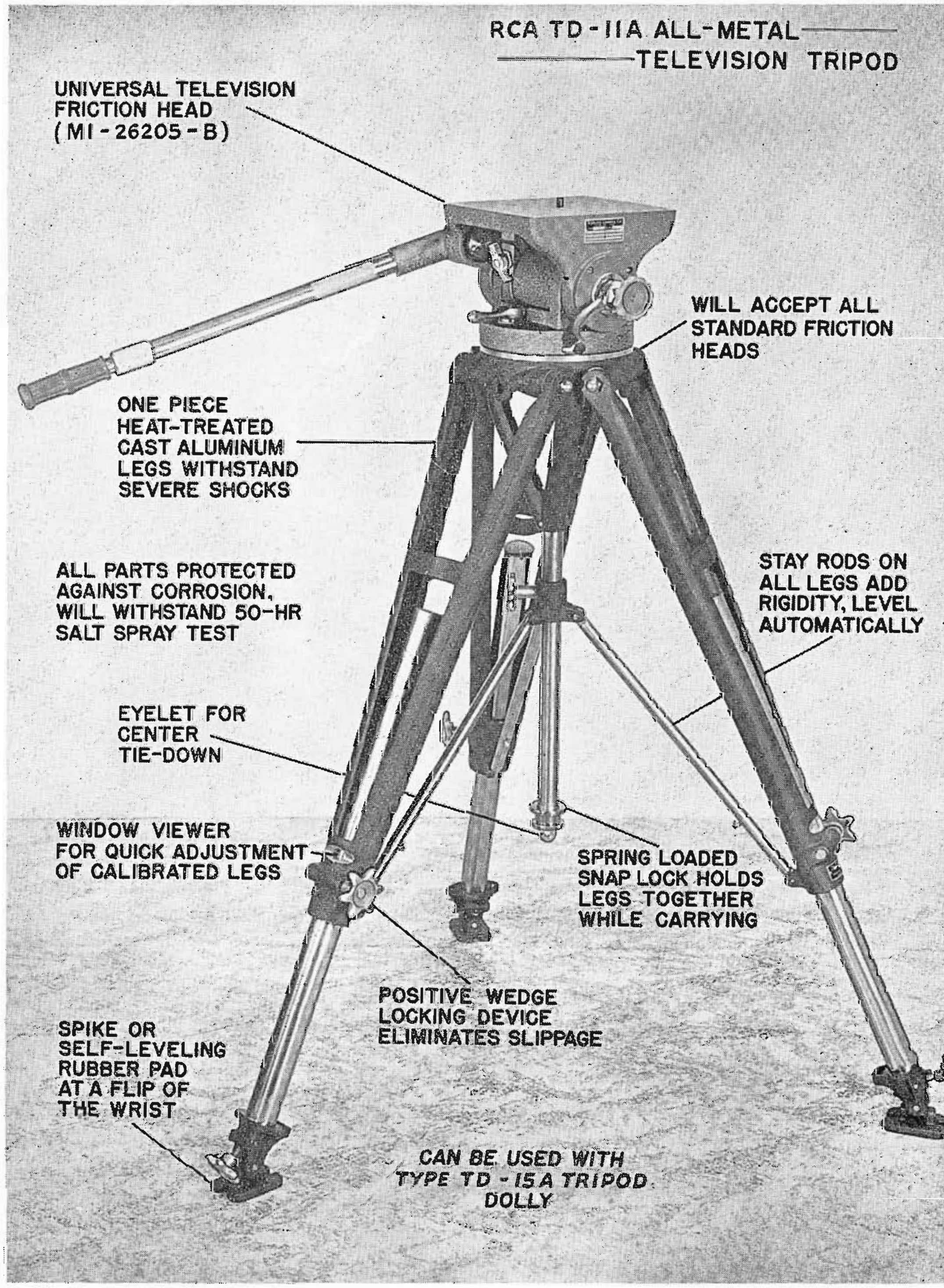


FIG. 4 (above). The TD-11A all-metal tripod may be used with Friction Head MI-26205-B in supporting RCA Field and Studio Cameras.

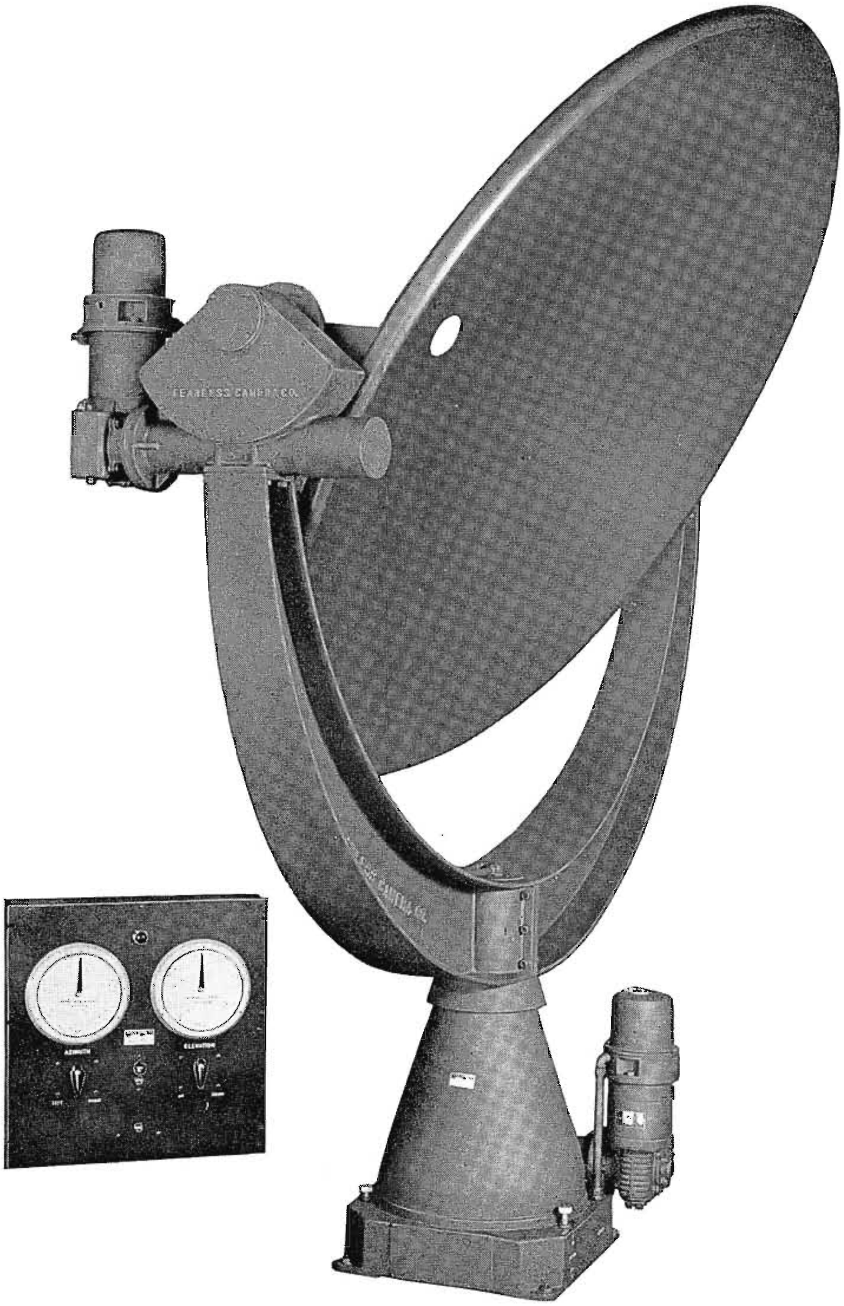


FIG. 5. The Rotatable Mount shown here provides for easy and accurate positioning or orientation of RCA Microwave Parabola. The mount is supplied complete with the control unit (at left) containing necessary meters, switches and controls. Quick-action reversing is possible when adjusting azimuth or tilt.

Rotatable Mount and Remote Control for Microwave Parabola, Type TF-55A

This equipment is designed to provide a rigid and accurate device to position the RCA Microwave Parabola and to insure long life operation with virtually no servicing. The system is comprised of two units —a control unit, which consists of switches and indicating devices, and a field mounting unit, which provides both azimuth and tilt positioning for the Parabola. The field unit may be remotely controlled from distances up to 1500 feet which may be increased as required by the use of special control equipment.

The control unit is panel-mounted, totally enclosed, and fits a standard relay rack. It is 15¾ inches high. An OFF and ON switch with a red indicator light is provided. There are reversing switches for both azimuth and tilt control. Large indicating dials calibrated in degrees record the exact position of the Parabola. These dials are controlled from the field unit by servo mechanisms.

The field unit has been designed to operate in the open without any protection and has been stressed for a wind velocity of 120 MPH. Maximum rigidity is achieved by the use of heavy castings throughout the entire mechanism. The Parabola is driven with 1/6 HP motors which provide a torque of 10,500 inch pounds at 1 rpm (which is the speed of both the azimuth and tilt drive). This torque is sufficient to operate the mechanism under severe icing conditions. The Parabola rotates 370 degrees in azimuth and is designed to tilt 15 degrees up and 30 degrees down. Limit switches have been provided on both azimuth and tilt to prevent damage by over travel. Disconnect switches are provided at the field unit so that it may be serviced without the danger of someone operating the control equipment. Both motors and all rotating shafts run on sealed anti-friction bearings and require no lubrication during the life of the unit. Motors are provided with overload protection switches. The coaxial cable from the microwave transmitter may be brought down through the center column to the base of the field unit.

Magnetic brakes have been provided on each of the motors which aid materially in positioning the Parabola to an exact location. These brakes prevent the motors from coasting when the switches are released and the Parabola may be precisely positioned in both the azimuth and tilt within plus or minus 10 minutes of arc. The system is completely wired and ready for operation, and requires only connections betwen the field and control unit for installation.

The standard power required for operation is 115 volts, 60 cycles, single phase, 6.8 amps. Equipment for operation on 220 volts can also be provided. The equipment can be furnished for use with either the 4-foot or 6-foot reflector (MI-26192-1 and MI-26192-2 respectively).

New Portable Field Desk, Type TC-90

The Auxiliary Field Desk is a sturdy, yet lightweight, all-metal unit designed to provide portability and ease in "setting up" for remotes. The Portable Field Desk (MI-26559) is suited for field use in supporting equipment for picking up sporting events, parades and outdoor or indoor shows where permanent equipment installations are not available.

The desk is constructed with a stainless steel operating desk-table surface, hard chrome finish framework, and with wrinkle finish top and bottom. The desk may be easily folded into a small package for easy transportation.

The desk is designed to accommodate standard Field Camera equipment and may be set up to comprise a simple operating console. A single unit can accommodate two camera control units on top and two Field Power Supplies underneath. Two desk units may be set up to accommodate: 2 camera control units, a Field Switching Unit and a Master Monitor, with suitable Power Supplies and Sync Generator underneath.

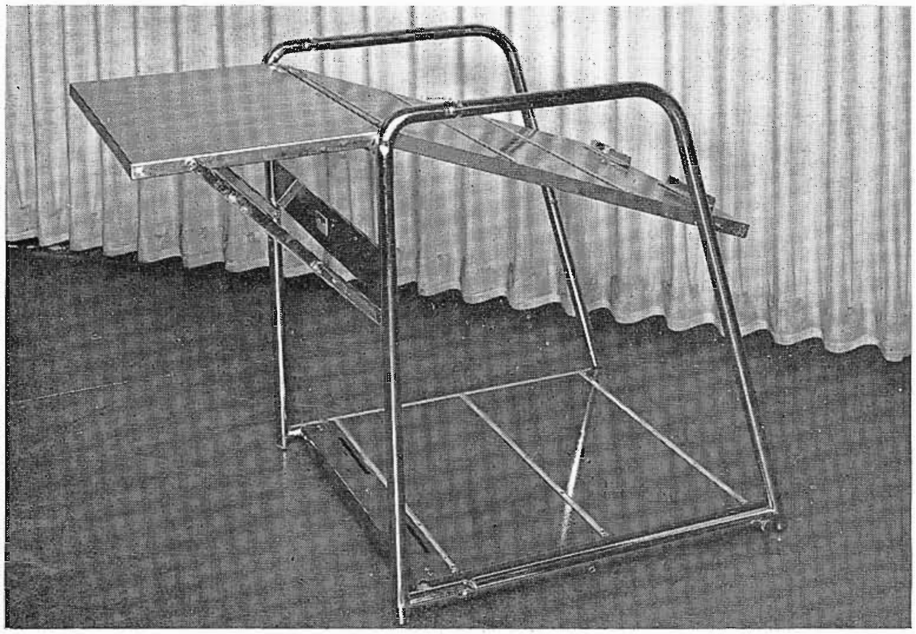


FIG. 6 (above). View of the all-metal, desk unit especially designed for field use.

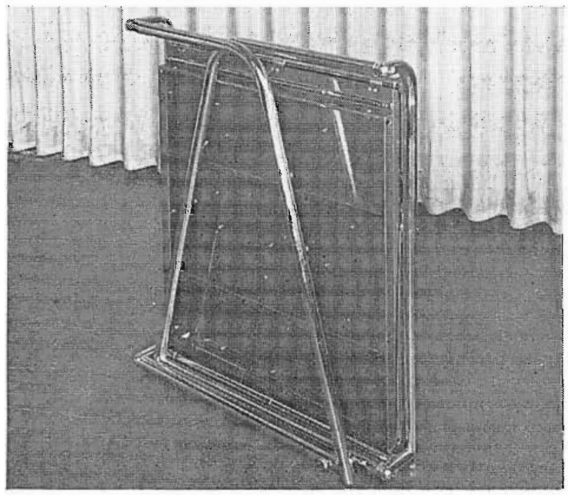


FIG. 7 (at right). The desk section may be folded into a small compact unit for easy carrying.

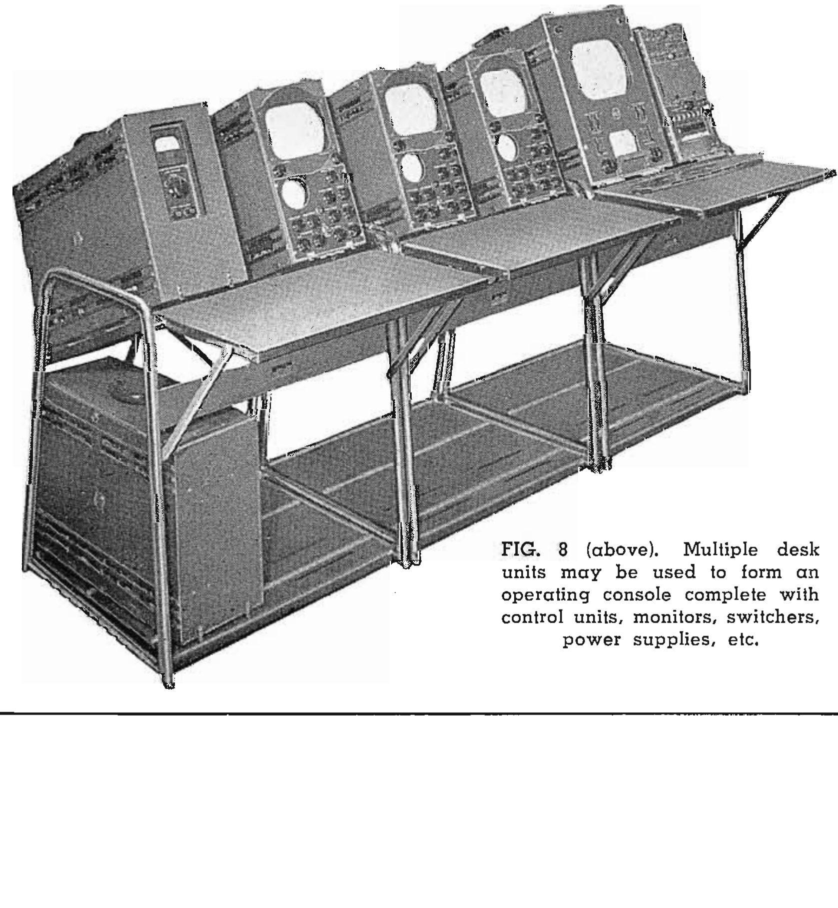


FIG. 8 (above). Multiple desk units may be used to form an operating console complete with control units, monitors, switchers, power supplies, etc.

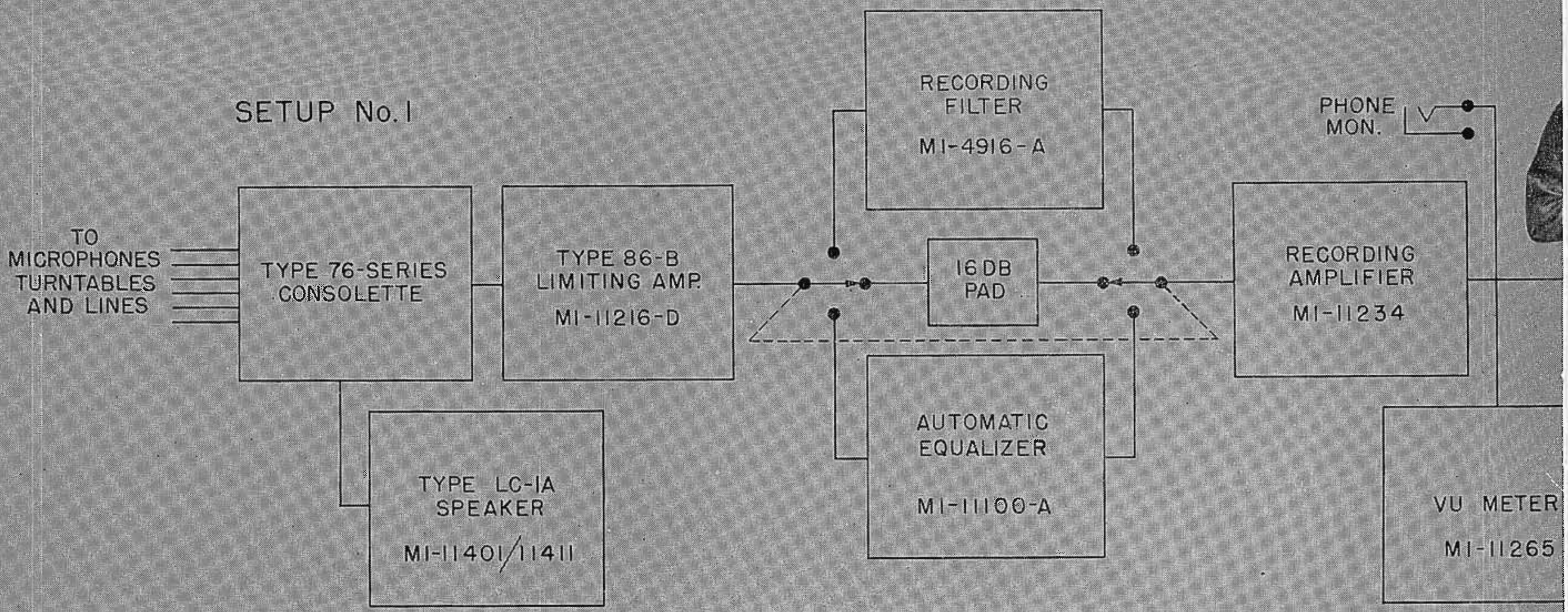


FIG. 1 Basic single channel setup, complete in all details, which provides professional recording facilities for microphone, turntables or program lines as desired.

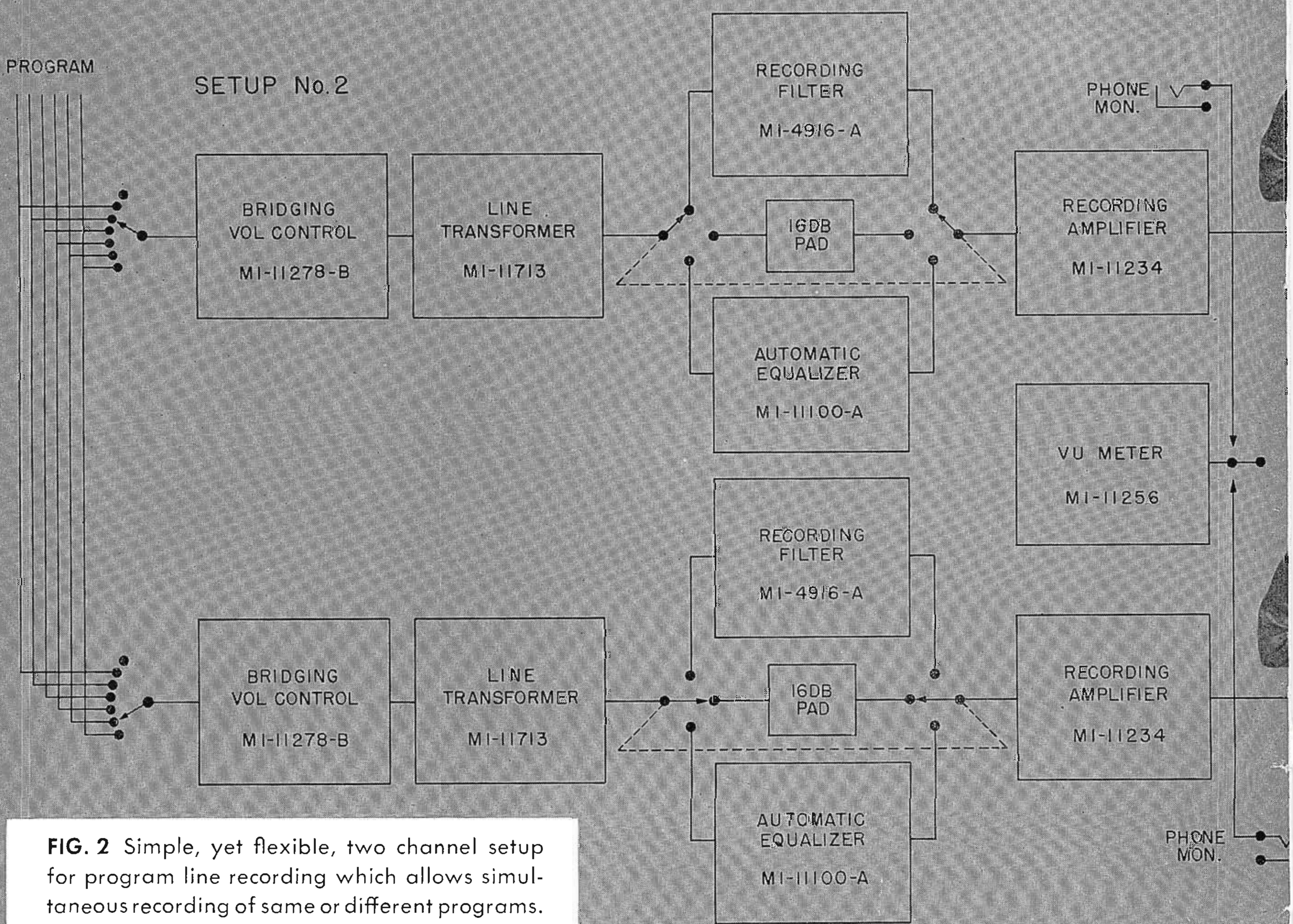


FIG. 2 Simple, yet flexible, two channel setup for program line recording which allows simultaneous recording of same or different programs.

RECORDING AND Fine GROOVE TECHNIQUE

By
H. E. ROYS
Audio Engineering Section

Introduction

The technique of professional recording for broadcast purposes has been developed to a high degree of perfection. Over the past 20 years many advances have been made in equipment design and in recording technique. Recently broadcast stations are finding it desirable to make provisions for fine groove recording setups.

Fine groove recording offers some advantages that should not be overlooked by the broadcaster. For example, a twelve-inch blank is good for 30 minutes of recording—15 minutes to a side—and the smaller blank means a substantial saving in both first cost and storage space. Moreover, due to the potentialities of the fine groove system an improvement in quality as will be pointed out later in discussing intermodulation and the innermost recording diameter, is also possible. All of this can be accomplished *by using only standard recording equipment as illustrated in Figs. 1 and 2* with very minor alterations.

In addition to a description of equipment, it is the purpose of this article to discuss recording techniques. Groove shape, stylus fit, and groove pitch are discussed, as are many of the design features that are essential whenever fine groove recordings are being made.

Equipment

The simple, yet proved system setups shown in Figs. 1 and 2 have been selected as practical "73-B" recording circuits (for 45, 33⅓ and 78 rpm) which will provide good "day-to-day" performance. Both are typical broadcast recording layouts—easy to setup—and are made up from standard-stock RCA recorder components and accessories. In the diagrams (Figs. 1 and 2), each recording component is represented by a block which includes the stock identification or ordering number. Most of these items are described and pictured in the RCA Broadcast Equipment Catalog which may be used for further reference. In addition, the complete line of Recording Equipment Accessories listed below is available.

Either recording system (Fig. 1 or 2) fully meets the requirements for high-quality recordings (fine groove or standard) in broadcast and television services, recording studios, advertising agencies and educational institutions.

Fine Groove Modification

For fine groove recording, no changes are required in the recording layouts illustrated. The addition of fine groove recording kit, MI-11882, to the 73-B recorder and a change in cutting stylus are the only modifications required. Recordings can be made at 45 rpm if new motor drive pulleys MI-11860 for 45 and 33⅓ rpm or MI-11861 for 45 and 78 rpm are obtained. Fine groove cutting styli can be obtained directly from Frank L. Capps & Co., 244 West 49th Street, New York 19, N. Y.

Three different types are available:

1. Routine microgroove styli.
2. Master styli, which are made to the customer's specification. The usual specification is: 90° included angle, 0.25 mil radius of the cutting tip, burnishing facet 0.2-0.5 mils.

RECORDING ACCESSORIES

Automatic Equalizer	MI-11100-A	Additional High Fidelity Recording Head	MI-11850-C
Orthacoustic Equalizer	MI- 4916-A	Fine Groove Recording Conversion Kit	MI-11882
Suction Equipment	MI-11857	Standard Cutter Head	MI-11853
Spare Chip Collector and Hose Assembly	MI-11858	Advance Ball Kit for MI-11850-C Recording Head	MI-11851
Sapphire Stylus 90°	MI- 4878-D	Motor drive pulleys for 45 and 33⅓ fine groove	MI-11860
70°	MI- 4842	Motor drive pulleys for 45 and 78 rpm	MI-11861
Amplifier (BA-4C)	MI-11223-B		
Universal Pickup Kit for 73-B Recorder	MI-11871		

Fine Groove Kit Below Now Available As MI-11882

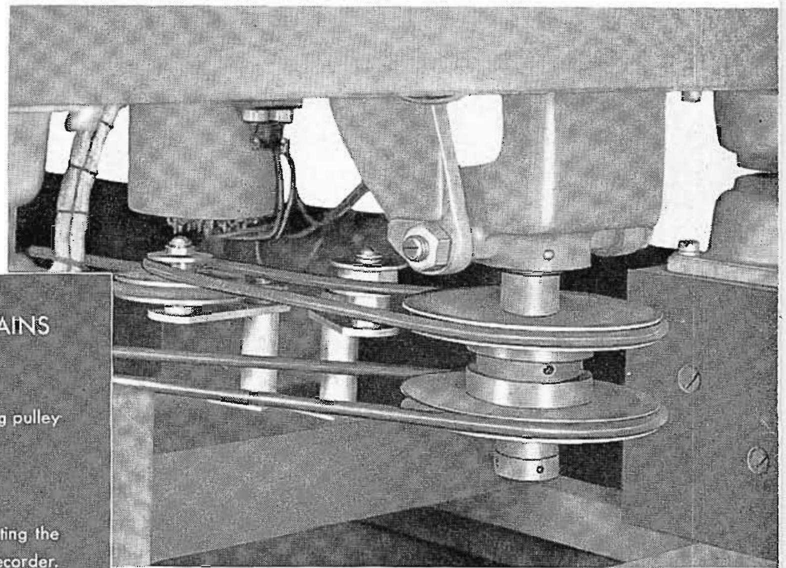
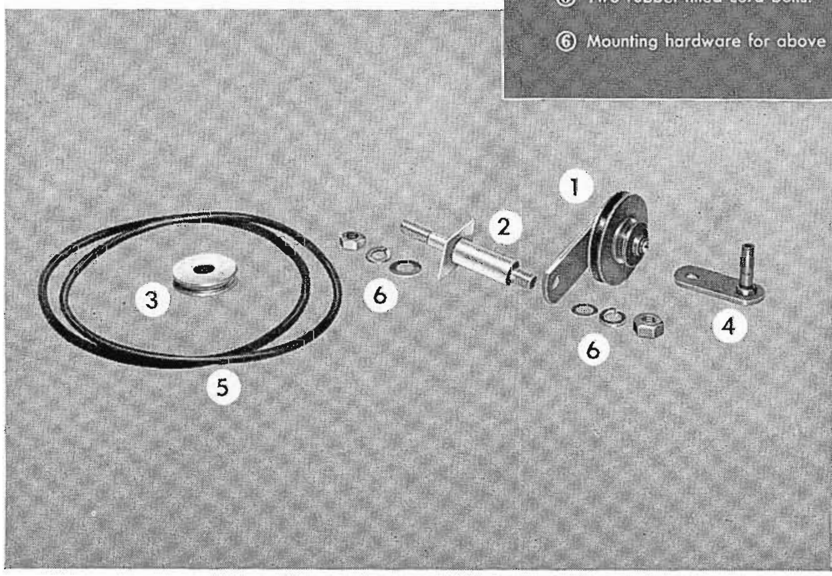


FIG. 4. View of the fine groove kit completely installed in 73-B, Professional Recorder.

WHAT THIS KIT CONTAINS

1. One pulley assembly.
2. One post assembly for mounting pulley assembly.
3. One double pulley.
4. One arm assembly for remounting the belt-idler pulley originally in recorder.
5. Two rubber-filled cord belts.
6. Mounting hardware for above parts.

FIG. 3. Containing a minimum of parts, the "73-B" fine groove modification kit is simple and easy to install.



3. Anti-Noise Modulation styli with multiple burnishing facets.
   a. V-groove, 111 stylus, included angle 87° and a sharp cutting point, 3 burnishing facets each 0.1 mil.
   b. Similar to (a) except the tip radius is 0.25 mils.

Fine Groove Kit

The kit (Fig. 3) is designed to adapt the RCA Type 73-B Professional Recorder for recording more grooves per inch than is normally possible. A speed-reducing pulley and belt system replaces the original belt coupling between the turntable spindle and the cutter-head drive mechanism. The new coupling reduces the speed of the cutting head across the turntable by half without changing the turntable speed, and thus doubles the number of grooves per inch. The design of the kit permits restoring the recorder to its original cutting speed conveniently and quickly.

Recording Technique

The technique involved in fine groove recording is essentially the same as that used in making standard NAB transcriptions. In order to minimize playback distortion, commonly known as tracing distortion, it is desirable to establish a limit for the recording level. A peak recording level of about 14 cm. a second has been assumed since the fork on 45 rpm records has indicated this to be a reasonable and acceptable level for fine groove recording. The value is believed to be in fair agreement with the levels normally used for transcription recording. A common means of adjudging the recording level is by comparing the output of the recorded lacquer with that obtained from a fine groove pressing (either 45 or 33⅓ rpm phonograph record). Some discrepancy may occur in doing this however, due to the greater yield of the lacquer under the pressure of the stylus tip, since the lacquer is much softer than the vinyl used for pressings. The loss in output would be more noticeable at the higher frequencies where the wavelengths are shorter. Frequency test records that have been calibrated for recorded level are particularly useful for level checks and RCA has several of these available.* Two banded frequency records, 12-5-25 (460625-6) for 33⅓ and 12-5-31, for 45 rpm operations are obtainable. The 33⅓ record has a wide, deep groove with a bottom groove radius of less than 0.5 mil so that it can be used for response measurements with pickups having tip radii that range from 0.75 to 3.0 mils. Frequencies from 30 to 12,000 cycles are covered by this record. Record 12-5-31 is for fine groove reproduction only and frequencies from 50 to 10,000 cycles are included.

Records 12-5-39 for 78 rpm, and 12-5-37 for 45 rpm are particularly useful for level checks since they contain frequency bands

* These records can be obtained from Custom Record Sales, 120 E. 23rd St., N. Y. C., N. Y.

recorded at different levels. Both records were made for distortion testing[1] and contain intermodulation frequencies of 400 and 4000 cycles. The 78 rpm record has peak levels ranging from about 4.4 to 27 cm. a second, varying in 2 db steps. The 45 rpm record has peak levels ranging from about 3.8 to 18 cm. a second also varying in 2 db steps.

High frequency tip-up, such as prescribed by NAB for a standard lateral characteristic can be used in the normal manner when cutting fine groove lacquers. However, in order to record the high frequencies on the lacquer it is essential that the width of the burnishing facet of the cutting stylus be small, otherwise appreciable loss in recorded level may occur. The loss becomes great whenever the width of the facet becomes appreciable with respect to length of the recorded wave.

RECORD CONSTANTS

Groove Dimensions

In disk recording the width or depth of the groove should be governed solely by the dimensions of the playback tip and not by modulation or the spacing between the grooves. It is the primary function of the groove to provide a means of establishing good, firm mechanical contact with the playback stylus tip. To do this, a recording stylus having a suitable tip shape must be selected and the depth of cut properly adjusted when recording. The depth should be such that the contact with the groove sidewalls is well below the top, so that surface scratches and edge irregularities are not reproduced as noise. An ideal groove contour and stylus fit for a 1.0 mil playback tip is illustrated in Fig. 5. For lateral recordings, contact along the bottom of the groove is not desirable as pointed out by Andrews in his article on the importance of groove fit[2]; hence it is usual practice to use a cutting stylus with a tip radius much smaller than that used for reproduction. For normal groove re-

[1] H. E. Roys, "A Method of Determining the Tracking Capabilities of a Pickup", Audio Engineering, Vol. 34, No. 5, May 1950.

[2] D. R. Andrews, "Importance of Groove Fit in Lateral Recordings", Audio Engineering, Vol. 33, No. 7, pp. 18-19, July 1949.

FIG. 5. Diagram showing the groove cross section and ideal stylus fit for fine groove recording.

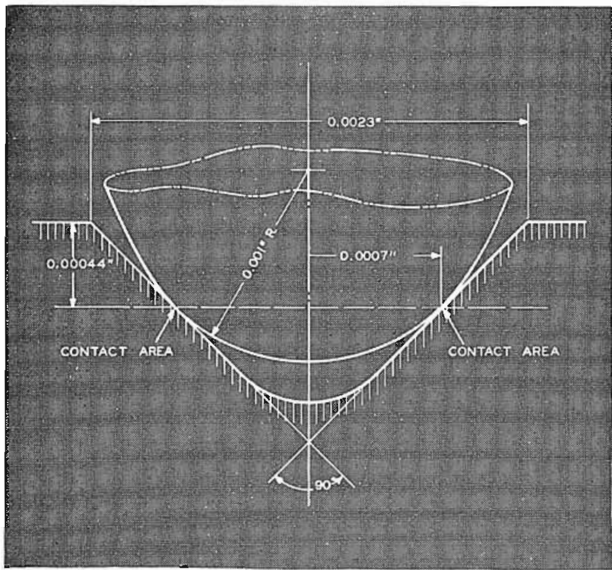


FIG. 6. The RCA 73-B Professional Recorder may be used to cut grooves at "three" speeds (78, 33⅓ and 45).

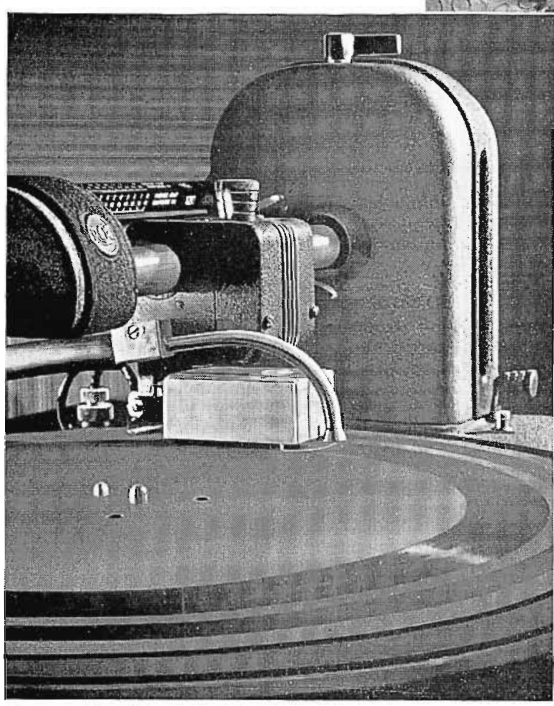
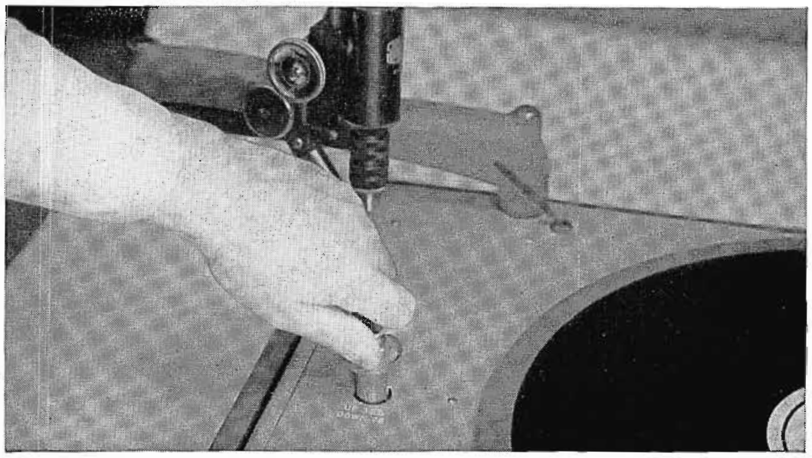
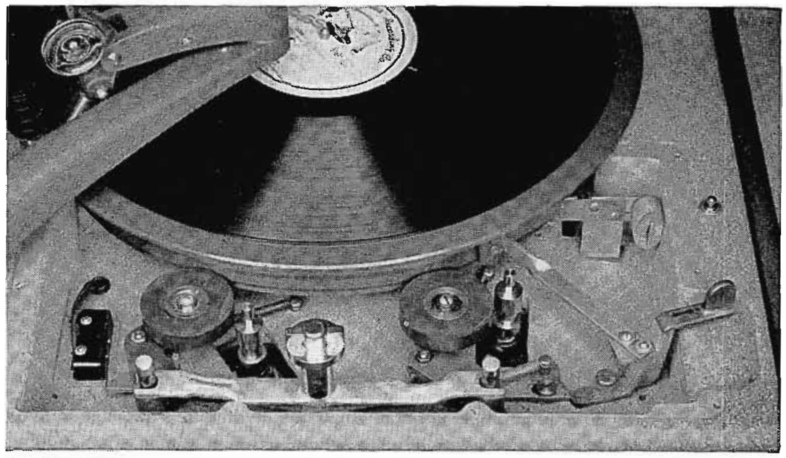


FIG. 7. Closeup view of the 73-B Recorder Head during actual cutting operation. Note cutting stylus and chip being removed my means of suction equipment.

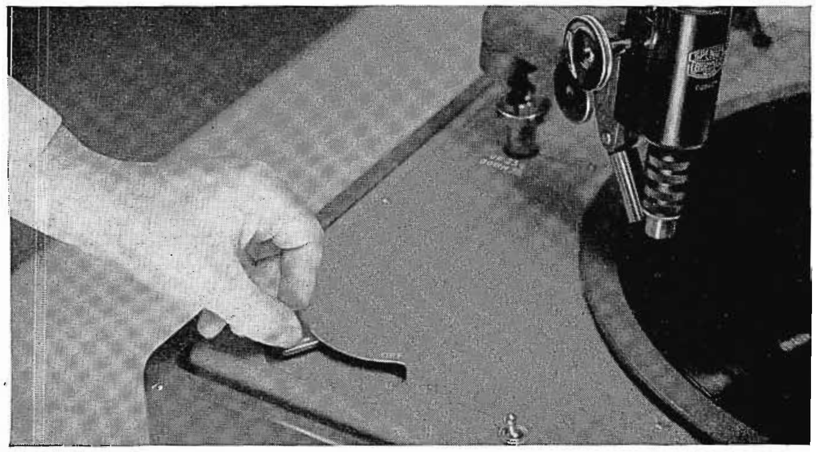
RECORDING PROCEDURE IS SIMPLE AND EASY



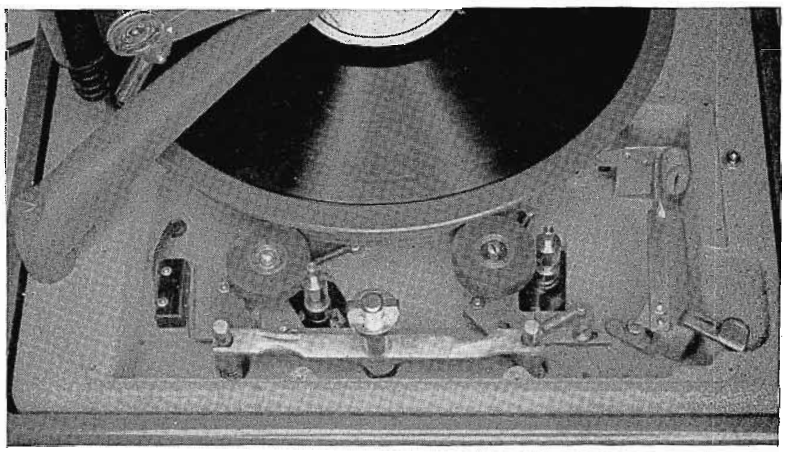
SPEED-CHANGE is simply accomplished by operating the control knob shown here. "UP" is 33⅓ RPM—"DOWN" is 78 RPM. With MI-11860 drive pulleys 45 RPM can be obtained—"DOWN" and 33⅓ RPM "UP". Or MI-11861 will provide 78 RPM—"DOWN" and 45 RPM "UP".



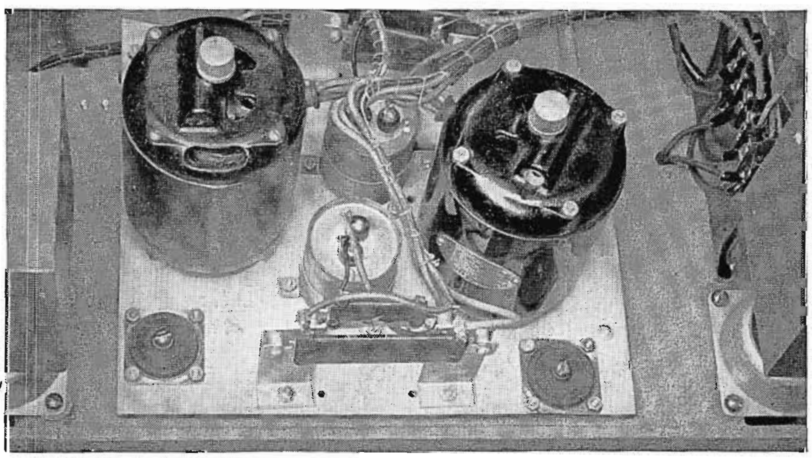
OFF—In the "OFF" position a brake shoe is applied to the turntable rim, and rubber idlers are moved away from both the drive wheel and turntable rim.



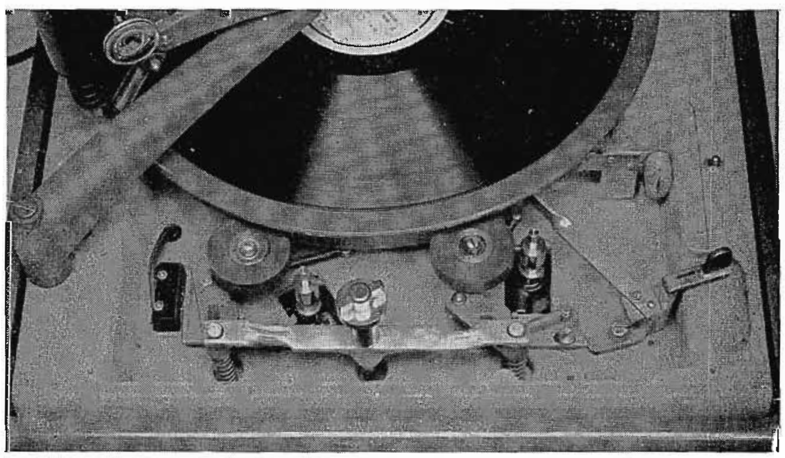
A SINGLE "OFF-ON" lever controls both synchronous turntable drive motors. In "OFF" position, a brake brings turntable to quick stop.



ON—In "ON" position, the brake shoe moves away from turntable rim and rim and rubber idlers are now in active contact with drive wheel and turntable rim.

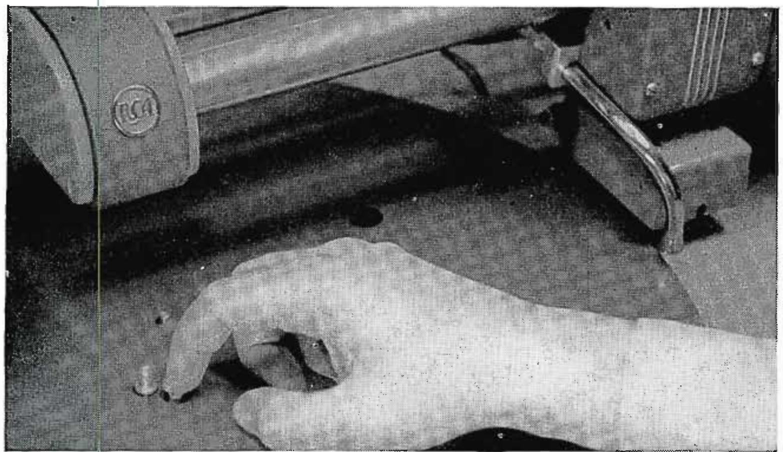


TWO SYNCHRONOUS MOTORS hysteresis type, are coupled to wheels which rim-drive the turntable through sturdy, rubber-idler rollers.

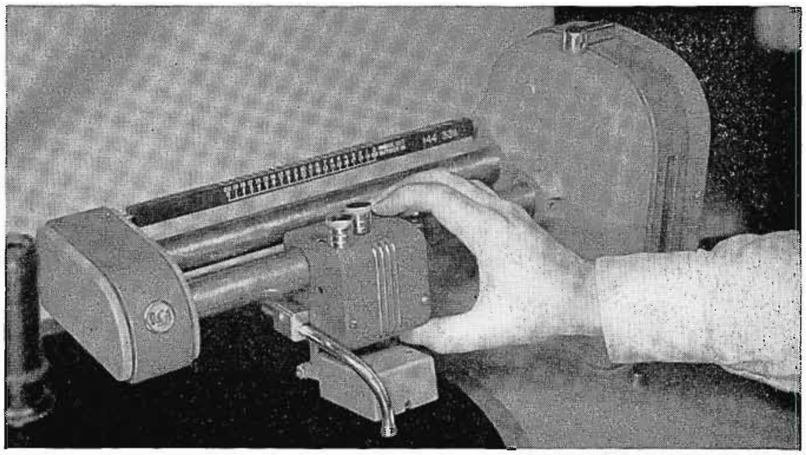


OFF—With speed change knob "UP", rubber idlers are moved vertically to low-speed position of drive wheel (note drive wheel has "lo- and hi-speed" shoulders of different diameters). Changing the drive pulleys permits speeds of either 45 and 33⅓ or 78 and 45 RPM.

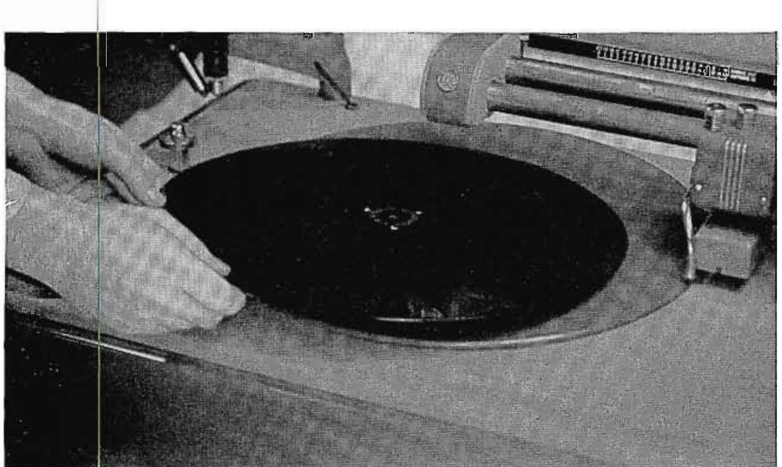
TO PERFORM — FINE GROOVE OR STANDARD



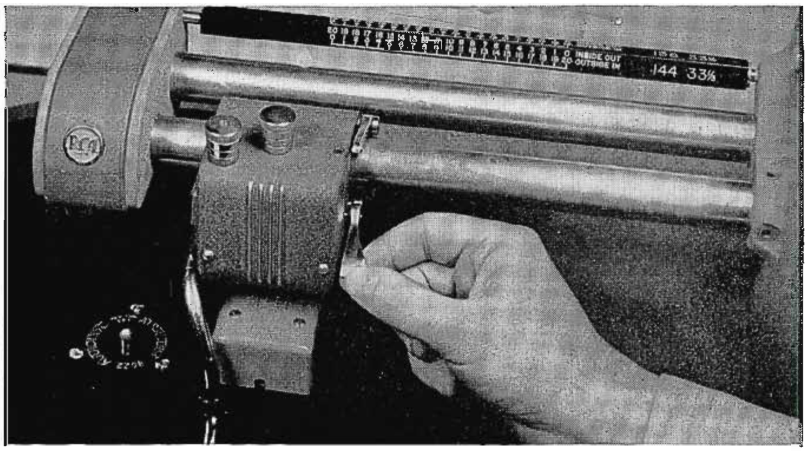
RECORD-DRIVE PIN comes up into position when this plunger-release button is pressed. Pin sinks into platter for records without driving holes.



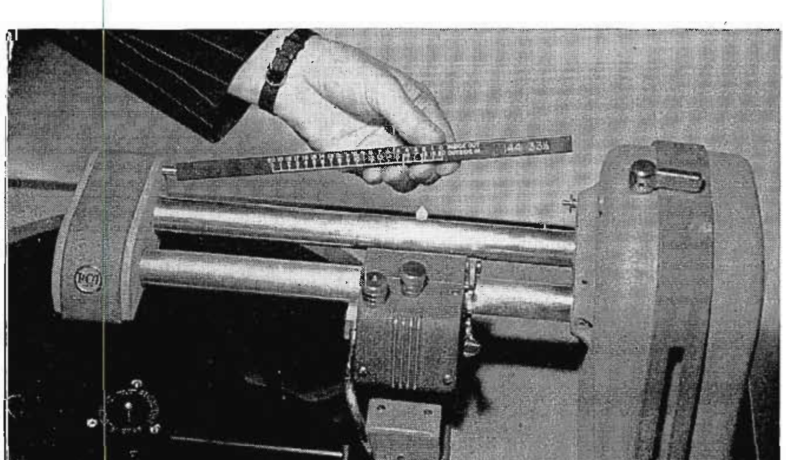
CARRIAGE LEVER is being pressed to allow movement of recorder-head horizontally over the record to desired "cutting" position.



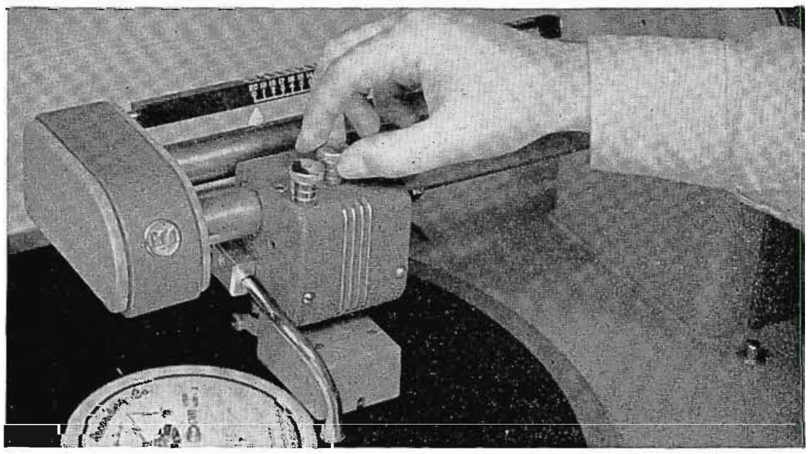
ANY TYPE BLANK may be used with the single driving pin provided. Here, recording blank is placed in position.



RAISING AND LOWERING the cutter head is easily done by this lever which permits raising the "to rest" position or a gentle lowering to the recording position. The "Flat" cutter and the mounting position minimize cutter bounce.



CALIBRATED TIME SCALES for 96, 104, 112, 120, 128, 136, 144 and 152 ("inside-out", "outside-in", at 33⅓ or 78 RPM are provided. Here, proper scale to agree with "pitch" setting is inserted. When the fine groove kit MI-11882 is used the time scales are doubled.



ANGLE AND DEPTH OF CUT are conveniently and precisely controlled by the two knobs atop the carriage. (In above, angle of cut is being adjusted.) The angle remains the same but the depth of cut is less for fine groove recording.

cording where a 2.5 or a 3.0 mil stylus is used for playback purposes, the groove depth and width should be greater. Thus the principle of maintaining contact below surface of disk is still retained.

Tracing Distortion and the Innermost Diameter

When the outside diameter is fixed by selection of the disk size, the starting diameter is thus essentially fixed too. The pitch or number of grooves per inch, for a particular playing time then depends upon the innermost diameter. In determining the innermost diameter, consideration should be given to reproduction. The reproducer or pickup uses a rounded tip of a finite radius, and when the recorded wavelengths became short and comparable to the size of the playback tip, difficulty in tracing the path of the recording stylus occurs. The resulting effect is known as tracing distortion, and it may reach serious proportions near the inside of the disk where the wavelengths are short.

Tracing distortion has been studied theoretically by Hunt and Pierce[3] and also by Hunt and Lewis.[4] RCA has spent considerable time and effort in studying the problem and good results in correlating theory, practice and measurements have been obtained. Frequencies of 400 and 4000 cycles when combined and used as an intermodulation test signal[5, 6] have been found valuable for such studies. Some of the results of the investigation are shown in Fig. 8 and these can be used in determining the innermost diameter for the 12-inch fine groove lacquer. Listening tests over a wide range system by trained observers have shown that distortions exceeding 10 percent intermodulation (based upon test frequencies of 400 and 4000 cycles) are evident so that the 10 percent value was selected as a design limit. It can be seen from Fig. 8 that 10 percent modulation is reached at 6.5 inches diameter for 33⅓ rpm and 4.9 inches diameter for 45 rpm when using a 1.0 mil playback tip and a peak recording level of 5.55 inches a second (approximately 14 cm. a second). This recording level is believed to be representative of the peak levels normally encountered in transcription recording. It can also be observed in Fig. 8 that existing standards for 33⅓ rpm transcriptions and 78 rpm recordings permit distortions far exceeding 10 percent at the inner diameters. This type of distortion (known as tracing distortion) is particularly noticeable at the inside of some 78 rpm recordings where the recorded level is high. The 45 rpm system was designed so that 10 percent intermodulation was not exceeded even at the innermost recording diameter and a diameter of 4.9 inches was selected for the last music groove.

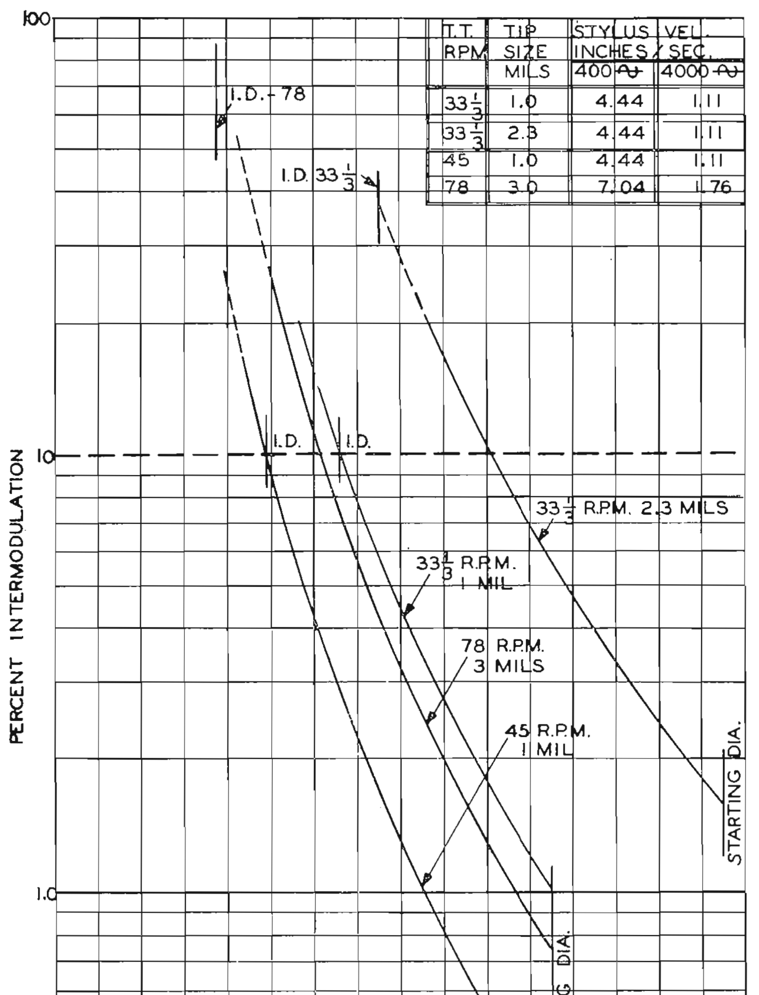


FIG. 8. Curves illustrating Percent Intermodulation for different turntable speeds, playback tip sizes and recording diameters.

Number of Grooves Per Inch

Having thus determined the value of the innermost recording diameter (that does not exceed 10 percent intermodulation) the number of grooves per inch can be calculated. These are given for turntable speeds of both 45 and 33⅓ revolutions a minute. The total number of Grooves, (G) for 15 minutes will be:

$$(45)\ G = 15 \times 45 = 675$$
$$(33\tfrac{1}{3})\ G = 15 \times 33\tfrac{1}{3} = 500$$

The usable playing radius (PR) available is:

$$(45)\ PR = \frac{11.5 - 4.90}{2} = 3.3 \text{ inches}$$

$$(33\tfrac{1}{3})\ PR = \frac{11.5 - 6.5}{2} = 2.5 \text{ inches,}$$

where 11.5 is the starting diameter and 4.5 and 6.5 are the finishing diameters in inches.

[3] J. A. Pierce and F. V. Hunt, "On Distortion in Sound Reproduction from Phonograph Records," Jour. Acous. Soc. Amer., Vol. 10, pp. 14-28, July 1938.

[4] W. D. Lewis and F. V. Hunt, "A Theory of Tracing Distortion in Sound Reproduction from Phonograph Records," Jour. Acous. Soc. Amer., Vol. 12, pp. 348-365, Jan. 1941.

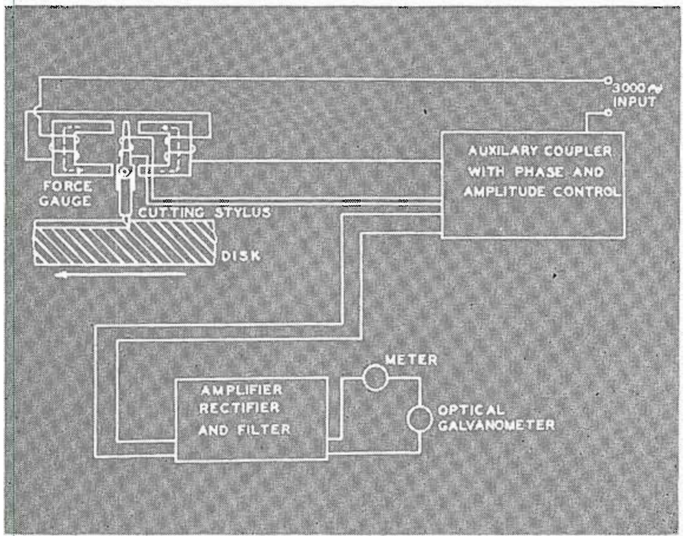


FIG. 9. This "setup" diagram illustrates how the Force Gauge is used for cutter bounce measurements.

The number (n) of grooves per inch will therefore be:

$$(45)\ n = \frac{675}{3.3} = 204$$

$$(33\tfrac{1}{3})\ n = \frac{500}{2.5} = 200.$$

In order to allow a few blank grooves at the beginning and ending of the recording this number should be increased to 208 for either 45 or 33⅓ rpm.

The pitch (p) would therefore be:

$$p = \frac{1.00}{208} = .0048 \text{ inches.}$$

If we maintain the groove width as shown in Fig. 5, the "land" (material between the grooves) will be .0025 inches. For ease of adjustment in recording, the depth of cut can then be adjusted so that (for a stylus that cuts a groove having a 90° included angle) the width of the groove will be equal to that of the land.

A greater number of grooves per inch can be used and many fine groove records are cut with as high as 275 to 300 grooves to the inch. When the playing time is such that close spacing is unnecessary, it is advantageous to cut a slightly wider and deeper groove so that better contact is assured between groove and reproducer tip.

RECORDER DESIGN FEATURES

Cutter Bounce

There are several design features that have been incorporated in the 73-B recorder that make it particularly suited for both normal and fine groove recording. These features are the results of studies[7] made years ago to improve the operational characteristics of the recorder. The recording head MI-11850-C was changed from the "vertical" to the "flat" type, and the pivots about which it rotates raised. These changes were made in order to minimize "cutter bounce", a form of oscillation that occurs at some low frequency, depending upon the mass of the recording head and the effective stiffness of the system.

The vertical motion due to bounce cuts a groove of varying width and depth, and in extreme cases the cutting tip may leave the disk entirely. Naturally, a groove of varying depth does not promote a good pickup tracking, and, of course, no groove at all omits some modulation.

Force Gauge

In order to study cutter bounce, a simple device was constructed to permit measurement of the force at the tip of the stylus while cutting a blank groove. The pole piece and armature of a recording head was rotated 90° from its normal position. This permitted movement of the armature in a direction tangent to the groove, as shown in Fig. 9. The stylus, of course, was mounted so that the cutting surface remained in its normal plane. The deflection of the stylus was measured electrically. A 3000 c.p.s. field supply was used, and any movement of the stylus induced a 3000 c.p.s. voltage in the armature coil which was proportional to the displacement.

For steady forces which vary at a very low rate, a direct-current meter was used to measure the rectified 3000 c.p.s. voltage. For variations at a higher rate, a galvanometer was used to indicate the modulation after the 3000 c.p.s. carrier had been filtered out.

Bounce Measurements

Vertical oscillation or bounce was readily encountered as evidenced by the results shown in the oscillograms of Fig. 10. Means were then studied for minimizing it.

Since the bounce is an oscillating condition, it can be suppressed by introducing resistance into the mechanical system. Fig. 10(a) shows a recording of the vertical oscillation at 78 revolutions per min-

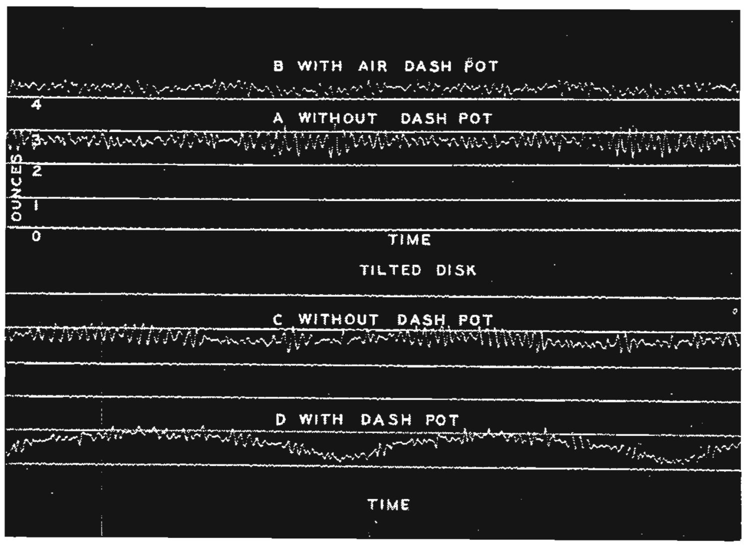


FIG. 10. Oscillograms showing cutter bounce and the improvement obtained with an air, dash-pot.

[5] H. E. Roys, "Analysis by the Two Frequency Intermodulation Method of Tracing Distortion Encountered in Phonograph Reproduction," RCA Review, Vol. 10, No. 2, pp. 241-269, June 1949.

[6] M. S. Corrington, "Tracing Distortion in Phonograph Records," RCA Review, Vol. 10, No. 2, pp. 241-253, June 1949.

[7] H. E. Roys, "Force at the Stylus Tip While Cutting Lacquer Disk-Recording Blanks," Proc. IRE, Vol. 35, No. 11, pp. 1360-1363, Nov. 1947.

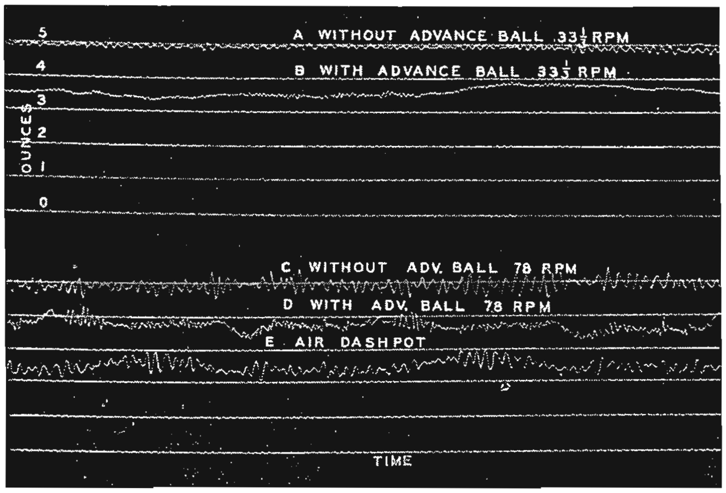


FIG. 11. The use of an advance ball reduces the amplitude of oscillation but also introduces some irregular variations.

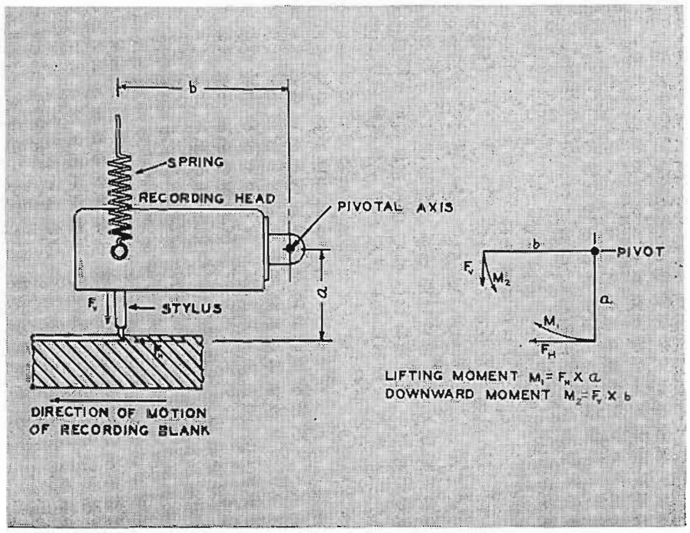


FIG. 12. Diagram showing the forces and components acting on the Recording Head.

ute, and Fig. 10(b) shows how it was reduced by means of an air dashpot. The dashpot is effective, but suffers a disadvantage when the disk is tilted due to warpage or turntable wobble.

If enough resistance is used to reduce the oscillation effectively, it may cause the recording head to act sluggishly on warped disks and cut a groove of varying depth. Fig. 10(d) shows the force variation with the dashpot on a 16-inch-diameter lacquer disk which was tilted 0.025 inch to simulate the motion produced when the blank is warped. The once-around variation in force, due to the tilt, is plainly evident. It is interesting to note that the average force without the dashpot (Fig. 10(c) shows almost no variation, thus illustrating the self-regulating action of the recording head even with the disk tilted.

Since the dashpot had some disadvantages, an advance ball was tried. Figs. 11(a) and (b) show the cutting forces measured at 33⅓ rpm without and with the advance ball, and Figs. 11(c) and (d) show the same tests at a turntable speed of 78 rpm. The galvanometer beam was shifted for each trace so that its position with respect to the ordinate "Force" scale is only relative. The force scale was included to show the magnitude of the force variations being measured. The frequency of oscillation is raised and the amplitude of oscillation is decreased, but the force now varies considerably due to the fact that the self-regulating action of the head has been sacrificed by using the advance ball, which holds the stylus at some predetermined depth independent of hardness of the lacquer.

Perhaps the best way to use the advance ball is to adjust it so that it barely touches the disk, and so that it clears entirely when the recording head is raised by hard spots but does not dig in too deeply when cutting softer portions. In this way the self-regulating action of the cutter is partially retained, the beneficial action in reducing bounce is partially retained, and the protection of the stylus tip from damage (due to dropping or recutting the same groove) is wholly retained.

Recorder Action

The oscillograms, with the recording head suspended freely, show the average force to be nearly constant; low-frequency variations due to hard spots or record warpage are not evident. The horizontal force, F_1 of Fig. 12, at the stylus tip while cutting, creates a moment M_1 about the pivotal axis which tends to raise the recorder. Opposing this is the downward moment M_2 created by the vertical force F_2 also acting about the same axis. F_2 is measured with the stylus clear of the record but with the stylus at the same height relative to the pivot as when cutting the groove. During cutting, equilibrium is attained when the two moments are equal, and the depth of cut is regulated by adjusting the vertical force by spring or counter-weight adjustment. Data taken with a sharp-edged cutting stylus show these two moments to be equal. The product of the horizontal and vertical forces, F_1 and F_2, by their effective distances from the pivotal axis, a and b, resulted in $M_1 = M_2$, showing that the record material does not exert a vertical force on the stylus.

When a sapphire stylus is used, having a burnishing edge for polishing the groove side walls, some additional force to accomplish this action is required. With this stylus, the downward-acting moment M_2 was found to exceed the lifting moment M_1. The difference is due to the upward-force reaction on the cutting stylus exerted by the record material. In other words, the moment which provides the downward force must overcome the lifting moments due to the horizontal cutting force, plus a pressure to force the stylus into the record material. Taking the difference of M_2 and M_1 and dividing by b, the horizontal distance between the pivotal axis and stylus tip, gives this force, which is an appreciable part of the total vertical force. In other words, the total or resultant force exerted on the stylus by the record is inclined to the horizontal at a considerable angle.

Pivot Location

Experiments indicate that the height of the pivotal axis above the surface of the disk is important, and if too low, oscillation occurs, which results in variations in depth of cut. Fig. 13 illustrates the variations in the width of the groove experienced with a tilted disk as the pivot height was changed. The decrease in the width variation with increased pivot height is believed to be due to several practical factors which perhaps may best be illustrated by the following example. If the pivot point is only 0.25 inch above the cutting plane, a cutting force of 2.4 ounces (for a groove about 5 mils wide) results in a lifting moment of 0.6 inch-ounce. If b, Fig. 12, is 2 inches, the vertical force for balanced moments is then only 0.3 ounce. With a recording head having an effective weight of 5 ounces about the pivotal axis, the frictional force at the pivots and between mechanical linkages used for raising and lowering the recorder may be of the same order of magnitude as this balancing force. Likewise, the additional vertical force required for burnishing, when a sapphire is used, may be greater, and so result in a depth regulation which is only partially due to the cuttng force at the stylus tip. When a spring is used for groove-depth adjustment, the design should be such that small variations in extension of the spring, due to the rise and fall of the recorder because of record warpage or turntable wobble will not alter the vertical force appreciably and change the depth of cut. In the 73-B design using a suitable spring and raising the pivot height to 1 inch increased the vertical force to 1.2 ounces and greatly improved the controlling action due to the cutting force. Satisfactory results were then obtained without the aid of an advance ball or dashpot.

Lacquer Hardness Variation

Measurements were made of the variation in lacquer hardness by using an advance ball with the gauge. Fig. 14(a) shows the cutting-force variation on the outside of a 16-inch disk, and 14(b) shows the results obtained near the center of the same disk. Part of the once-around variation may be due to warped disks, although every effort was made to reduce such an error by using a long arm between the recording head and its pivot bearings. Any unevenness of the surface would also cause some variation, for the advance ball could not be located closer than about ⅛ inch from the cutting tip. This unevenness probably accounts for some of the difference noted between the measurements made on the outside and on the inside of the disk, for the disk surfaces are noticeably more wavy near the edge. These variations are not too serious, however, as good recordings can be made with such disks. As an example of what extreme variations may be encountered in disks of the very inexpensive class, the results obtained with a paper-base disk are shown in Fig. 15.

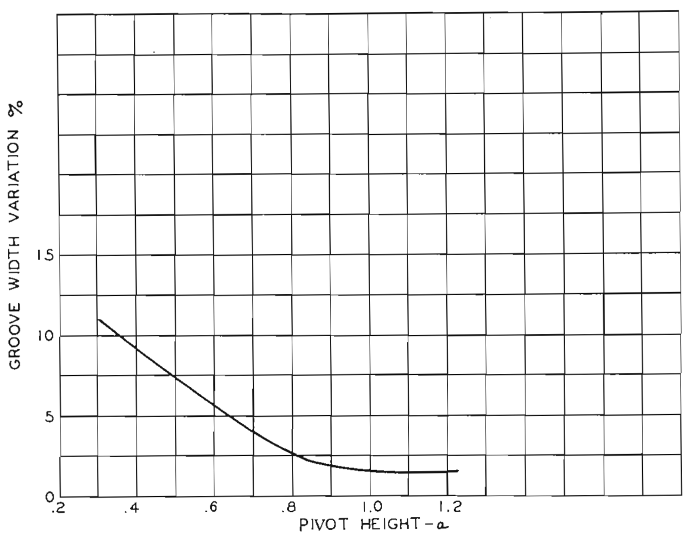


FIG. 13. Curve showing Groove Width Variation with Pivot Height.

FIG. 14. Oscillograms of Lacquer hardness variations when recording a 16-inch blank.

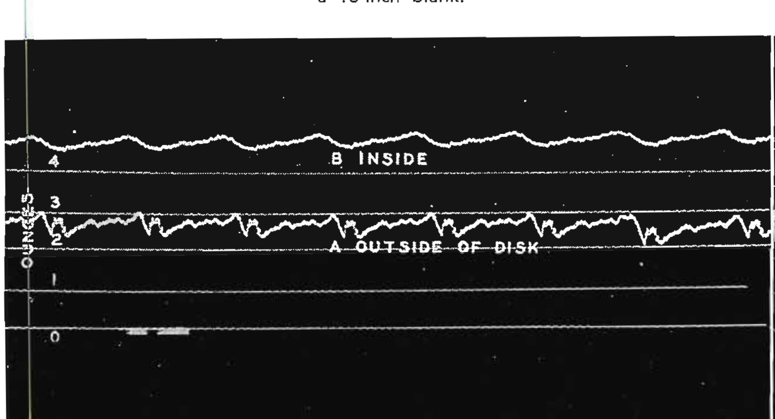


FIG. 15. Lacquer hardness variations obtained while recording with a coated paper base disk.

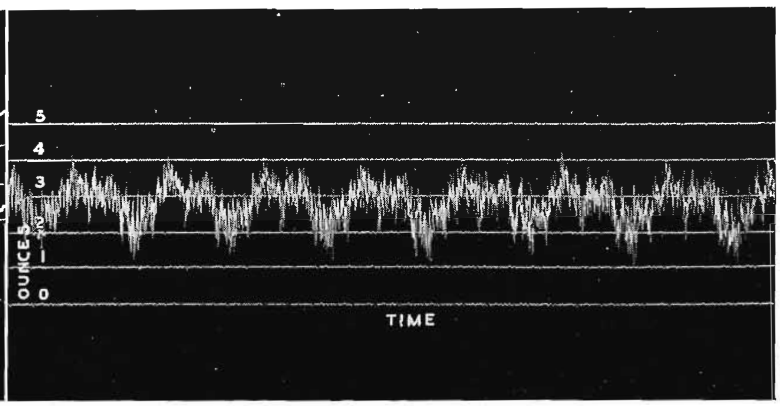


FIG. 1. Closeup view of WOW-TV showing the tower which supports the three-section Super Turnstile Antenna. The antenna has an effective height of 590 feet above average terrain. The location of the microwave relay receiver can be seen at the 270-foot level in the tower. Remote control equipment in the transmitter room permits 360° rotation as well as vertical tilt of the dish.

FIG. 2. WOW-TV is located at 35th and Farnam Streets, the highest point in central Omaha. Landscaping of surrounding grounds was done in a way to permit programs to be televised outside the building.

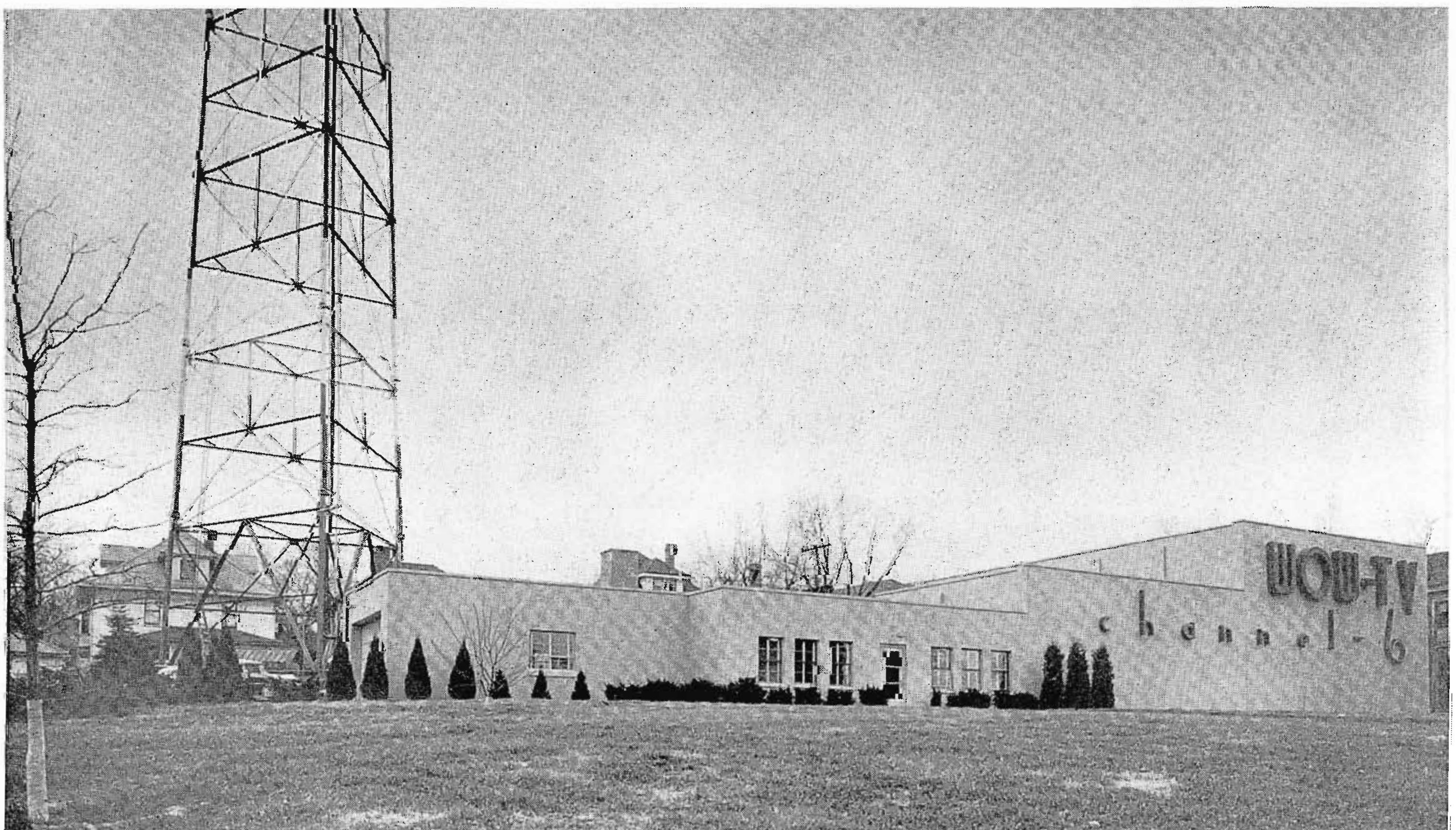
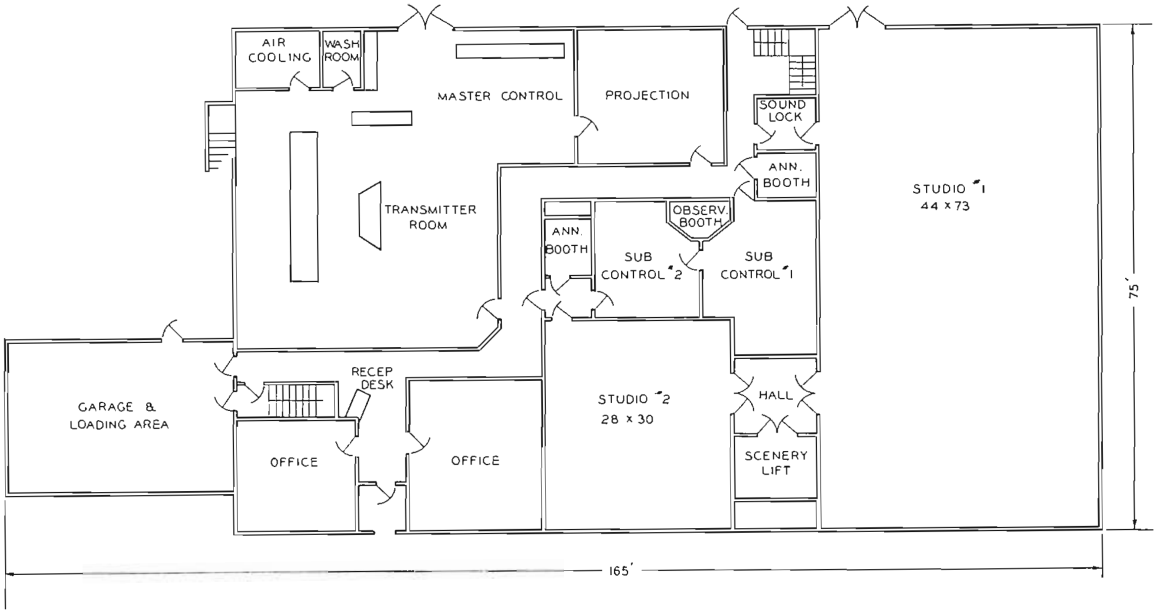


FIG. 3. Floor plan layout of WOW-TV. Facilities consist of two studios with separate control rooms, projection room, combined transmitter room and master control. An artists' lounge, dressing rooms, workshops and photo processing rooms are located in the finished basement of the building.



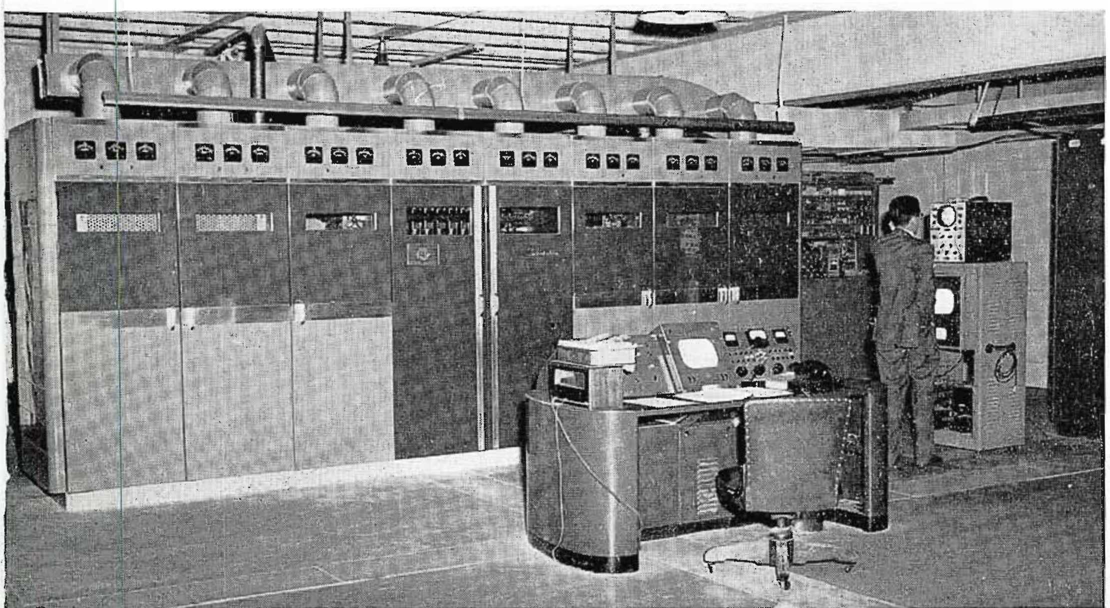


FIG. 4. View of the RCA 5 KW TV Transmitter and control console. Mr. W. J. Kotera, observing the oscilloscope, is Chief Engineer of WOW-TV.

WOW-TV, Omaha, Nebraska

by GLENN FLYNN
Operations Supervisor

August 29, 1949, 11:00 A.M., saw the inauguration of regular commercial television service in Omaha, Nebraska, with the opening of WOW-TV. But, to the engineering staff of WOW, Inc., this was the climax of three years of planning, training and research, working toward T-Day for the Midwest.

During December of 1946 WOW purchased two complete RCA field camera chains and associated equipment. An extensive training program was set up in cooperation with Creighton University of Omaha, and closed circuit experiments were carried out in engineering, programming and production. As a result, WOW-TV began commercial operation with a well-trained staff. An ambitious program schedule has been carried out since T-Day with emphasis on live studio programs and field pickups.

The engineering staff is headed by Joseph Herold, Technical Supervisor of WOW, Inc., who also acts as Manager of Television. William J. Kotera is Chief Engineer. Ten full-time engineers are on the staff.

The WOW-TV building, located on the highest point in central Omaha, was designed exclusively for television. The building is 165 by 75 feet, with 20,000 feet of floor space. Provision has been made to permit automobiles, trucks, and other large objects to enter the studio. Landscaping has been so arranged that programs may be televised outside the building. Private parking facilities also are available.

A Truscon tower supports the RCA three-bay turnstile antenna. The antenna has an effective height of 590 feet above average terrain. Effective radiated power of the visual transmitter is 16.2 kilowatts, the aural transmitter 8.5 kilowatts.

WOW-TV is RCA-equipped throughout. The transmitter, a TT5A, has operated with a minimum of failures. Sync gener-

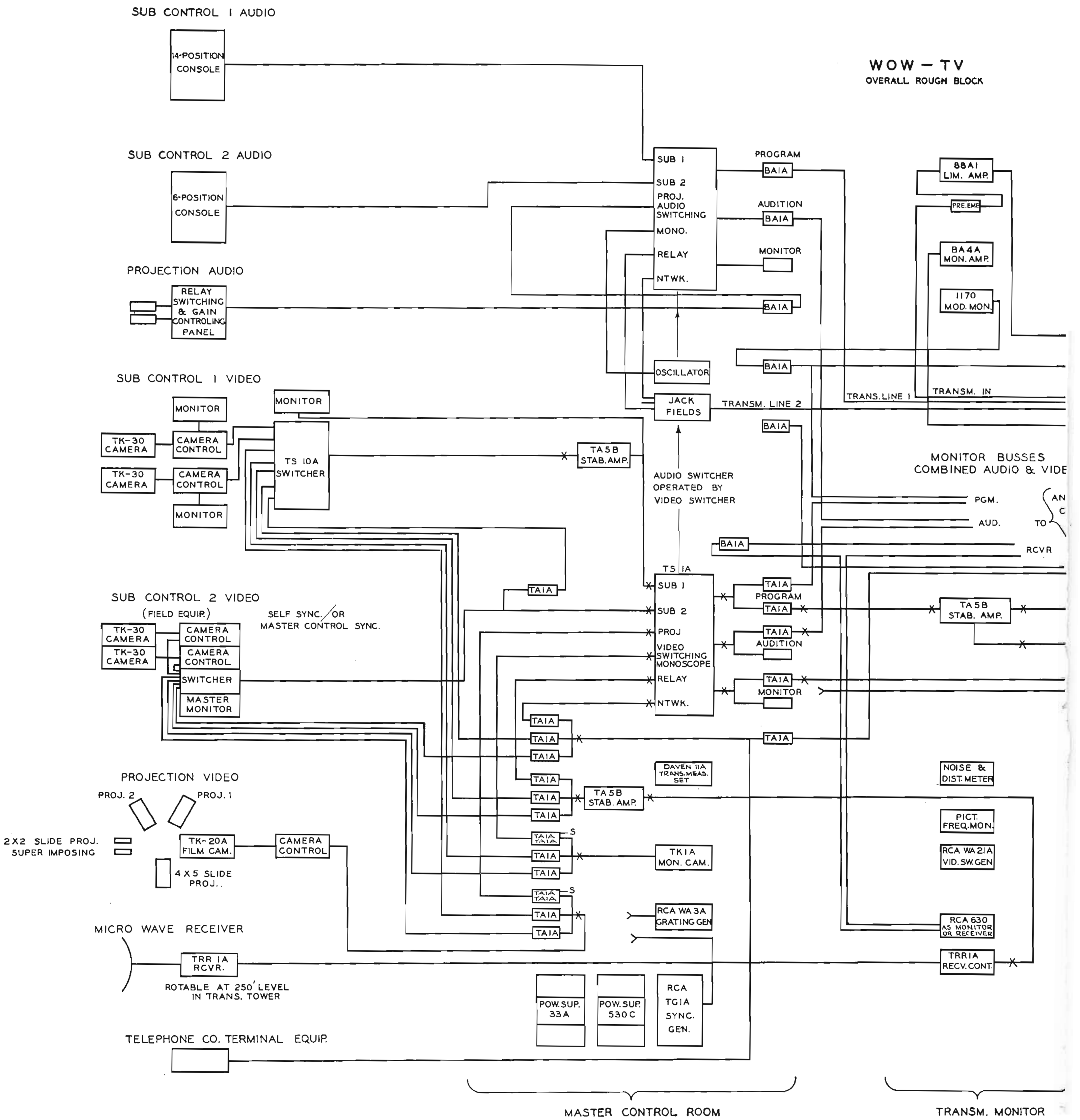


FIG. 5. Overall block diagram of WOW-TV showing TV program sources and how they are carried through sub-control and master-control positions to the transmitter. The 120-mc. intermediate frequency signals from the 7000-mc. relay receiver are brought down the tower to the transmitter room by a 3⅛-inch coaxial line.

Special Switching System Designed By WOW-TV Engineers

ator, camera power supplies, stabilizing amplifiers, monoscope, and audio and video switching equipment are contained in nine racks in Master Control, adjacent to the transmitter.

Television engineers B. L. Dunbar and Glenn Flynn designed the master control and studio switching and signalling system throughout the building. An audio switching panel was designed for master control operation, to be used in conjunction with the RCA video switcher. Provision has been made for simultaneous switching of video and audio from Studios 1 and 2, projection room, relay receiver, monoscope or network. Auxiliary audio input keys have been incorporated in the switcher to permit substituting studio audio for the normal audio from projection, relay, etc. As an example, the normal audio from monoscope is tone. By pre-setting the auxiliary audio key, announcements from the studio can be combined with monoscope video. Rehearsal and on-the-air lights for studios and control rooms are automatically energized by the switcher. These lights act as warning and go-ahead indicators. Also, they indicate program and rehearsal origination throughout the building.

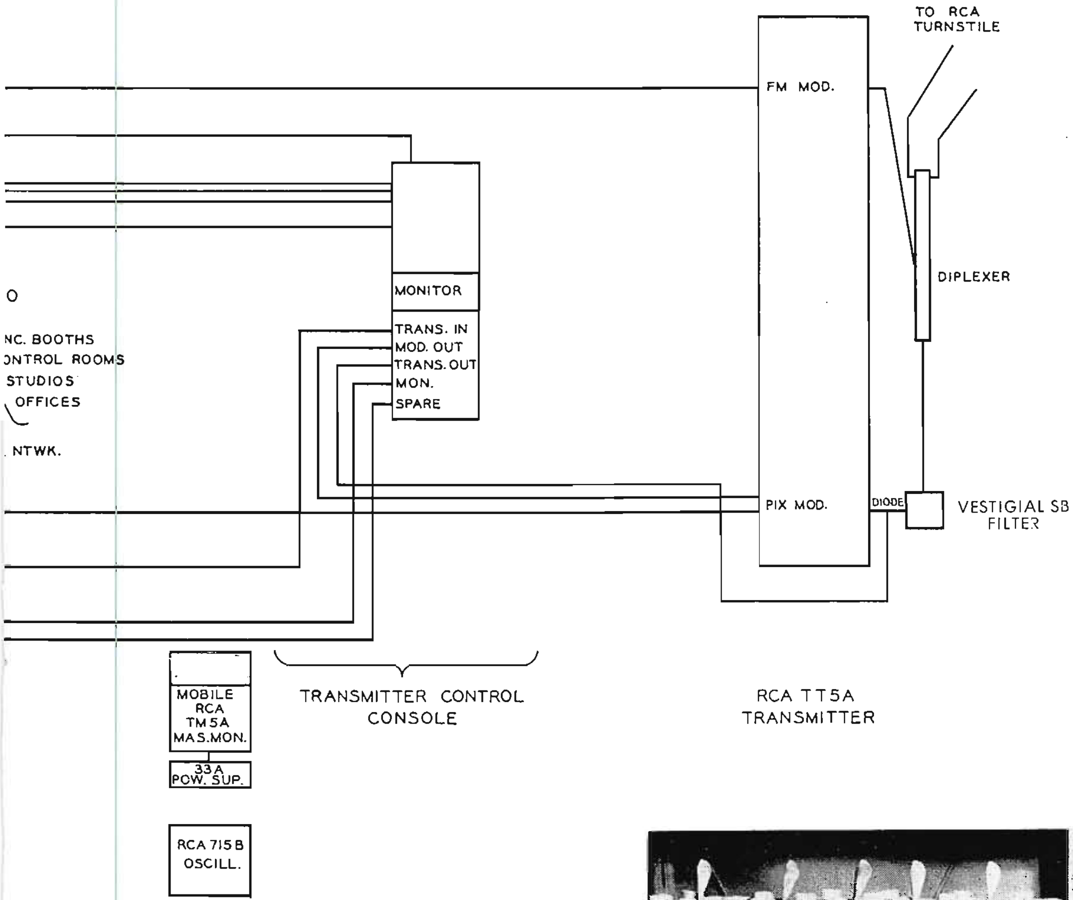


FIG. 6. Below are the audio and video switching panels which are located in master control. In the left-hand rack is the audio switcher described above; the right-hand rack contains an RCA TS-1A Video Switcher and patch panel.

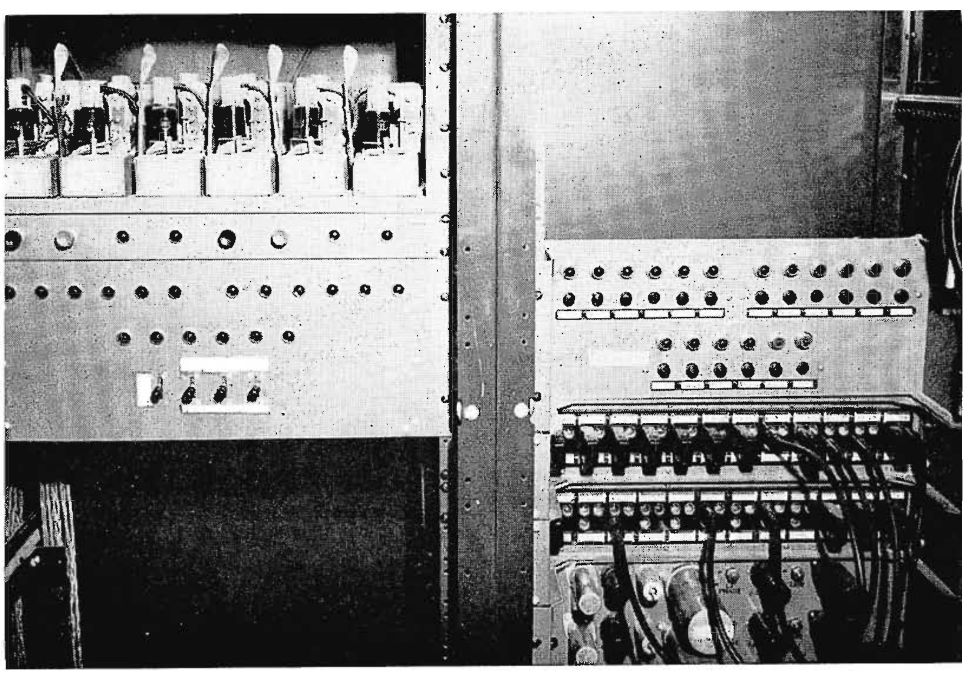
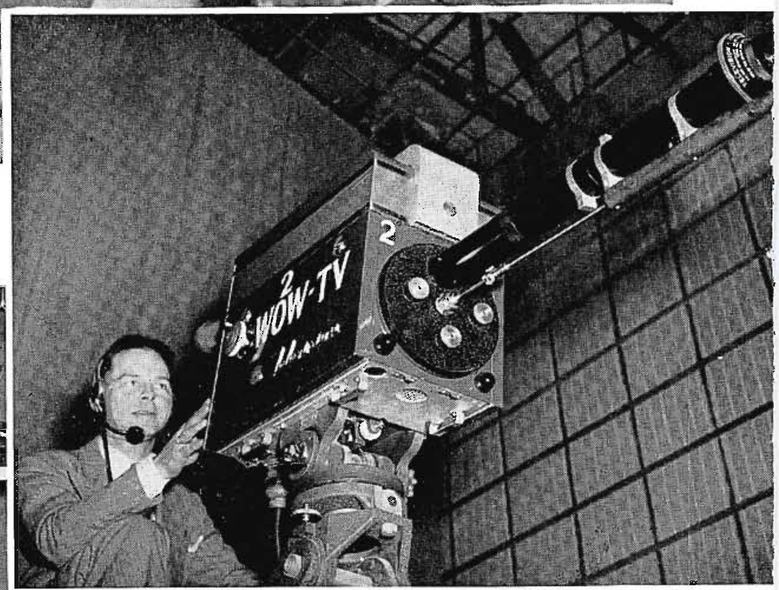


FIG. 7. Two views of pickups being made in Studio 1. Above photo, WOW-TV noon-hour program. Below, set used for "WOW Calling," daily program simulcast on WOW and WOW-TV. Inset shows Engineer Dick Peck at the camera with a Zoomar lens.



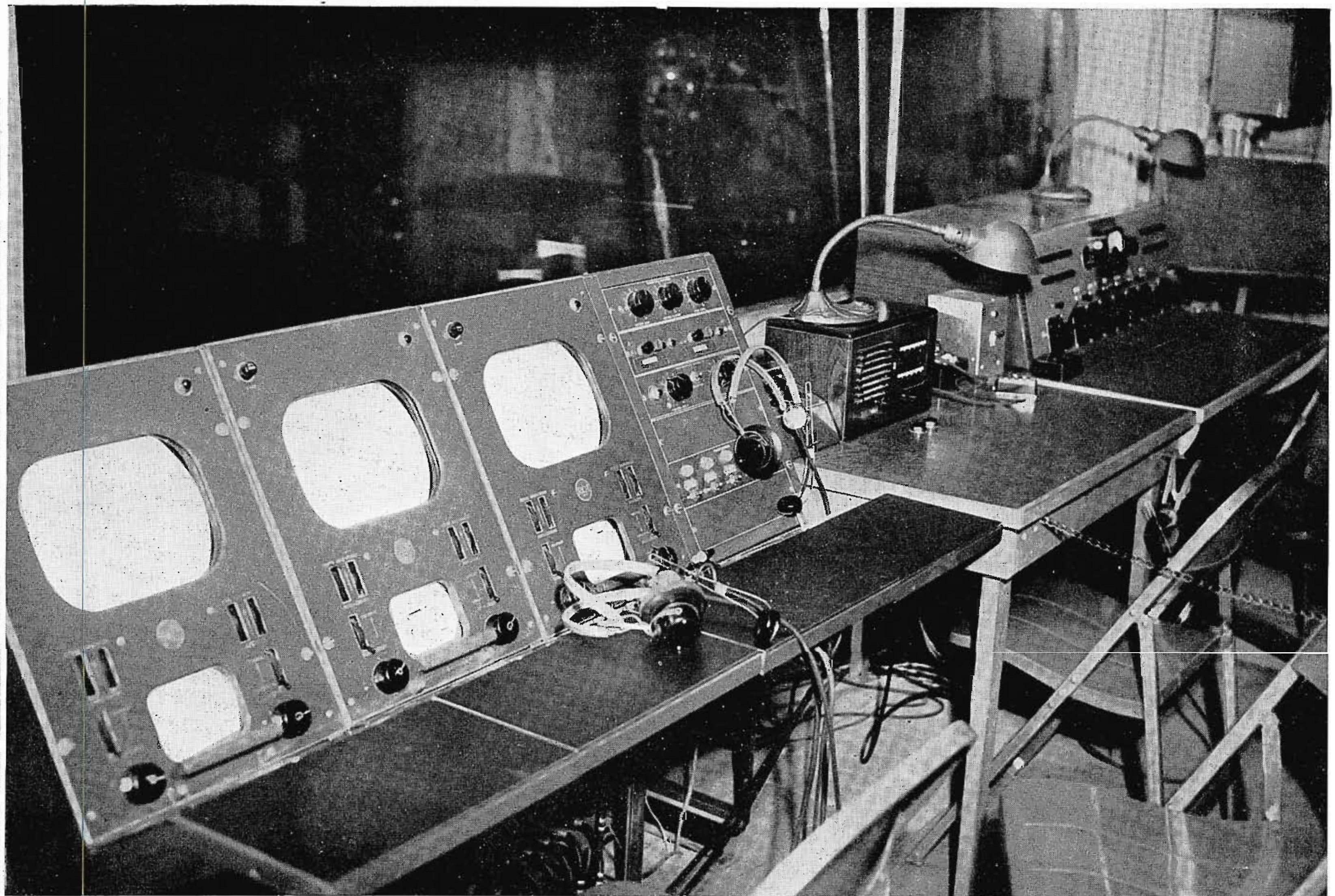


FIG. 8 (above). Audio and video console in Sub-1 control room. Units left to right are TK-10A Camera Controls (two left hand units) and TS-10A Switching System. Center panel is for remote control of sync generators, projectors and stabilizing amplifiers.

WOW-TV Studio 1

Most of the programming at present is from Studio 1, with two RCA TK10A Cameras in use. Camera controls plus switching and monitoring equipment are in service in the control room associated with Studio 1. An RCA 76C Consolette, augmented by additional microphone switching keys, provides the audio. RCA 77D Microphones are used throughout the studios. When Studio 2 is in operation the TK30A Field Cameras are put into service, and the field control equipment is moved into the Sub 2 control room.

FIG. 9 (right). W. W. Watts, Vice President-in-Charge of RCA Engineering Products Department, discussing the RCA industrial Videcon Camera with Mr. Joseph Herold of WOW at the recent NAB Convention in Chicago. Mr. Herold is Technical Supervisor of WOW, Inc., and also Manager of Television.

FIG. 10. WOW-TV crew covering a football game at the University of Nebraska Stadium, Lincoln. TV signals are relayed back to WOW-TV as shown by diagram on opposite page.

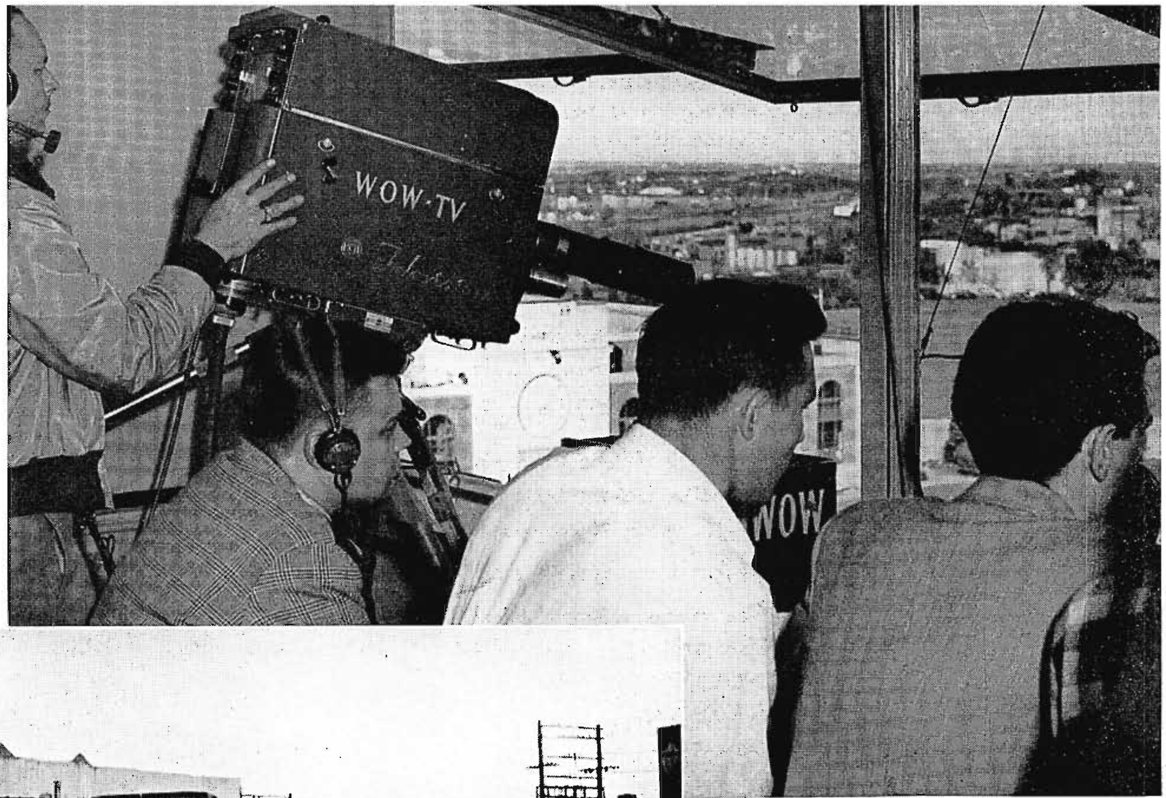


FIG. 11 (left). WOW-TV Mobile Unit is used for many local telecasts. Other photos (Fig. 13) show how field pickup gear is stored and transported in the vehicle.

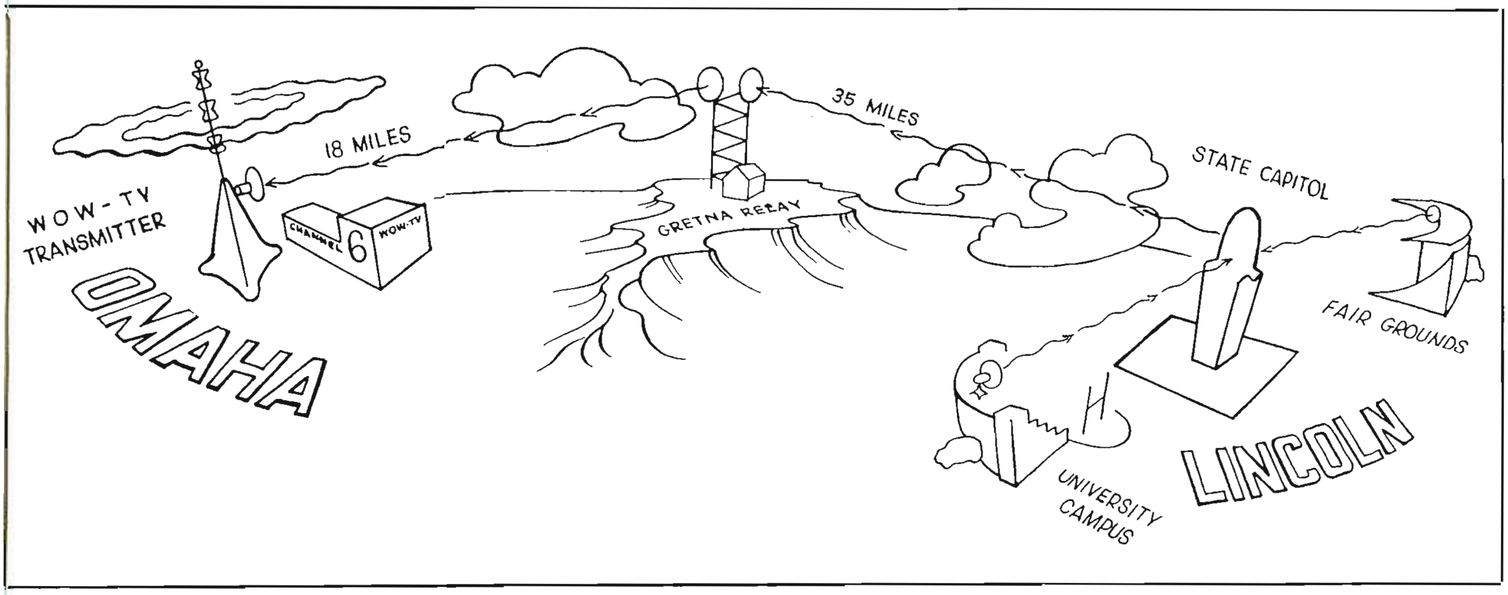


FIG. 12. Diagrammatic view of the microwave relay link set up between Lincoln and Omaha, by WOW engineers. The sixty miles between Lincoln and Omaha is covered in three links.

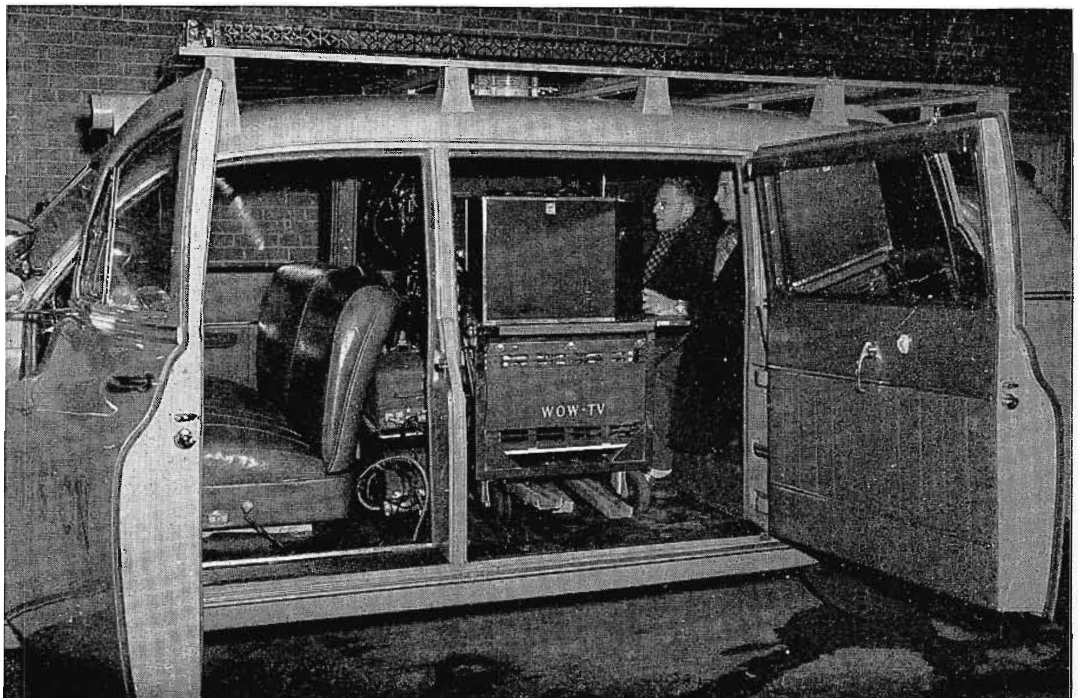
Microwave Relay Links

During the fall of 1949, WOW engineers installed a three link relay system between Lincoln, Nebraska, home of Nebraska University, and Omaha. By means of this relay, all of the home football games were carried by WOW-TV. The relay has been kept in operation throughout the winter for the pickup of programs of interest from Lincoln. Two 7000-megacycle links plus one 2000-megacycle link are used to cover the sixty miles between Omaha and Lincoln.

WOW-TV personnel are now making plans for arrival of direct network television to Omaha, scheduled to begin September 30.

Mobile Unit

One of the achievements of which WOW-TV engineering is especially proud, is relaying of field programs. An average of two pickups per week have been handled without the loss of any program time. The TV mobile unit, designed by WOW engineers, is a compact unit providing all facilities necessary for pickup of television programs in the field. (See Fig. 13.) The roof of the car provides space for two tripods, one for a camera, the other for the relay transmitter and reflector.



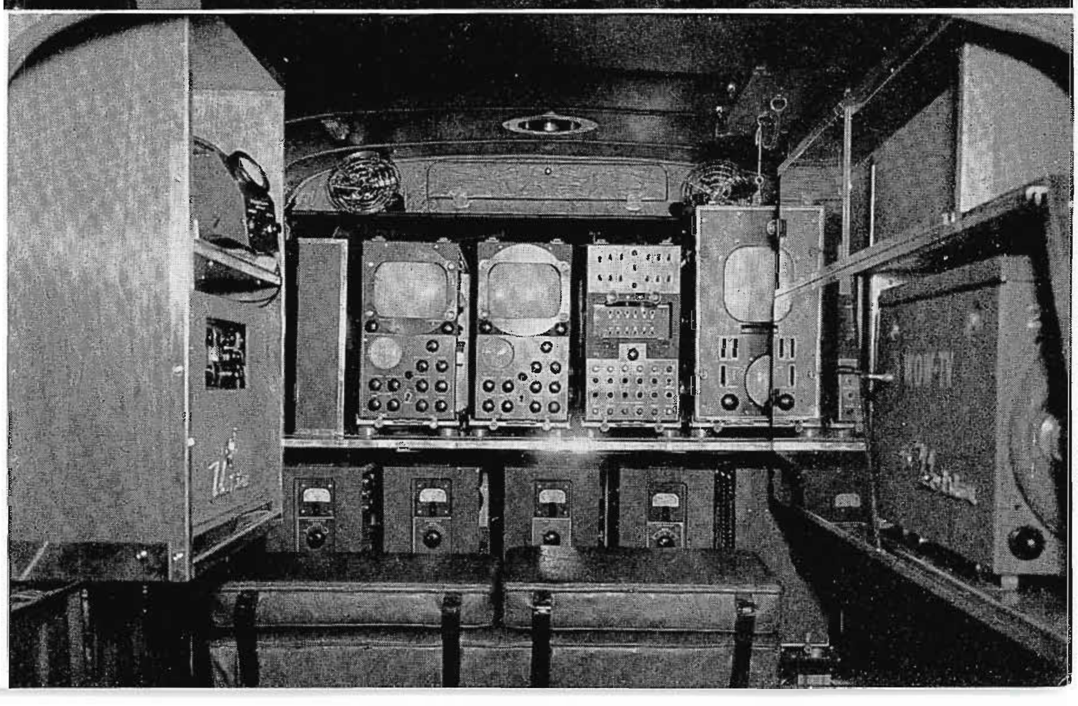


FIG. 13 (right). Two RCA field camera chains, sync generator, switching system and master monitor are mounted on a four-wheel dolly that can be wheeled in and out of the mobile unit by means of removable steel tracks. Compartments on the walls provide for two field cameras, two view finders, audio equipment and relay transmitter control.

FIG. 14. A parade being telecast as it passes WOW-AM studios in Omaha. Cameramen are WOW-TV Engineers, Mr. Maller and Mr. Glanton.

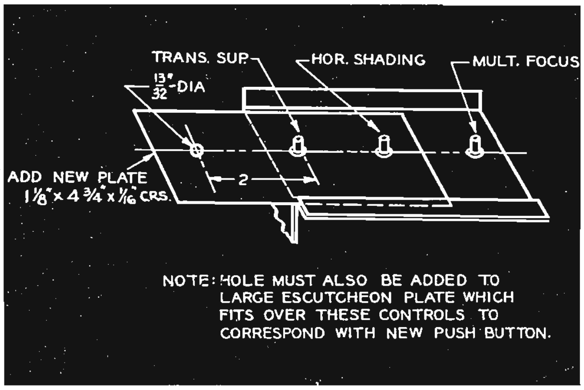


FIG. 1 (above). Sketch showing location of Target Key for Studio Camera Control.

NEW PARTS LIST

QTY.	DESCRIPTION
1	RESISTOR, 820 OHMS, 1/2 WATT.
1	RESISTOR, 8200 OHMS, 1/2 WATT.
1	RESISTOR, 6800 OHMS, 1/2 WATT.
1	NON-LOCKING PUSH BUTTON KEY, MALLORY TYPE 2003 OR EQUIV.

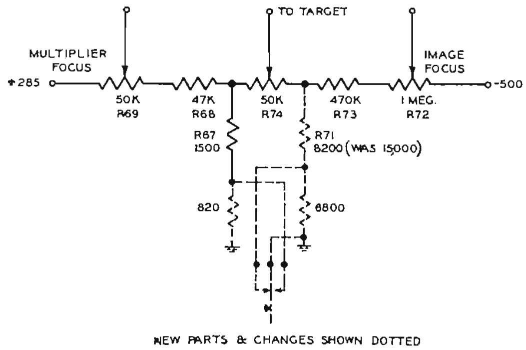


FIG. 2 (above). Diagram of circuit changes required for Studio Camera Control modification.

HOW TO MODIFY RCA CAMERAS FOR SETTING CORRECT TARGET VOLTAGE

By J. H. ROE
Television Terminal Engineering

Proper adjustment of an image orthicon camera is a difficult and complicated procedure which, amazingly enough, has been mastered successfully by a large percentage of the operating personnel in television stations. This fact is obvious from the constantly improving technical quality of studio and remote pickups on the air. The ability to achieve suitable adjustment of a camera chain is an art which has to be learned by continued practice. Some clearly defined rules can be laid down, but in the end the quality of the result depends on the skill and judgment of the operator.

Among those controls for which it is difficult to provide ready yardsticks for adjustment, is the target voltage control. Considerable misadjustment of this voltage does not cause any startling degradation of the picture, but correct adjustment is essential for obtaining the best signal-to-noise ratio, the best reproduction of tonal range (or gray scale), and a minimum of apparent overshoot in the signal. It is the purpose of this paper to describe a simple circuit change which can be incorporated in all RCA image orthicon camera equipments to provide a ready means for setting the target voltage accurately. It might prove helpful to refer to H. N. Kozanowski's article, "How to Get the Best Picture Out of Your Image Orthicon Camera" (Broadcast News, No. 54).

In a recent issue of "RCA Tube Tips" (February 1950, No. 73), there is a discussion of the proper value of target voltage for the RCA 5820 tube which indicates that the range from 1.8 to 2.2 volts positive with respect to cutoff is the most desirable one. This same range is suitable

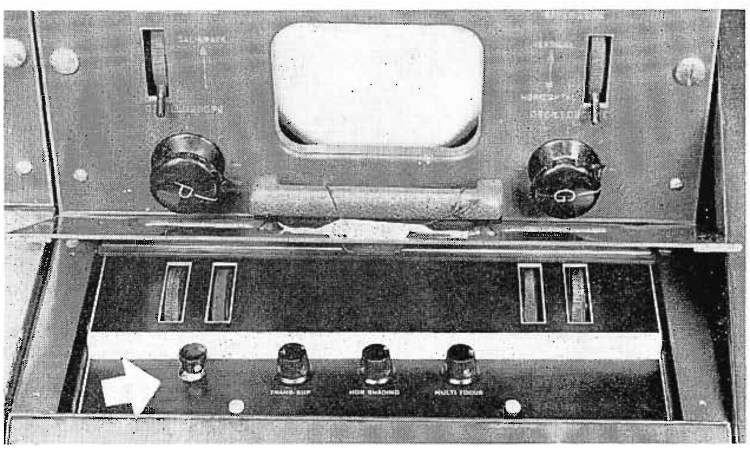


FIG. 3 (above). Hinged cover of Studio Camera Control is raised to show location of new target control key.

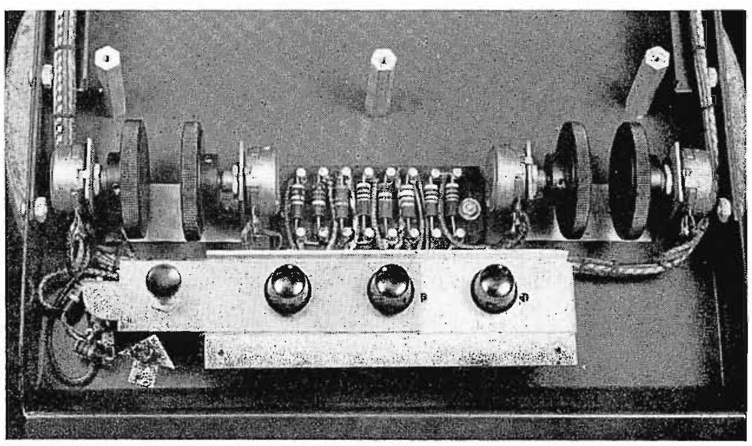


FIG. 4 (above). Escutcheon plate removed from Studio Camera Control to show mounting of new key.

for the other types also; RCA 5769, 5655, or 5826, all of which may be in use in television stations. The important point brought out is that this voltage should be measured with respect to *target cutoff*, not with respect to ground. Cutoff voltage itself may be different in different tubes of the same type. Therefore no absolute reference (such as ground) can be used.

The most logical solution to supplying the correct voltage is to provide means for determining where target cutoff is, and then means for adding to that value an increment in the range of 1.8 to 2.2 volts. Though this may sound complicated, the result can be achieved without a meter, and with simple and inexpensive components added to the present control.

Figs. 1 and 2 illustrate the changes for the studio equipment and Figs. 5 and 6 the changes for the field equipment. The photographs of Figs. 3, 4, 7 and 8 show the equipment after circuit changes have been made. Changes for the two types of equipment are not identical because of a difference in the original control circuits.

Briefly, the new circuits function as follows. A key is pressed and the target control is adjusted until the picture on the monitor kinescope just disappears, or is cut off. Releasing the key then adds an increment of about 2 volts to the cutoff value. This procedure assumes, of course, that initial adjustments of other controls have been made to obtain a picture of some sort. If, after this, the lighting on the scene is changed appreciably or if the lens iris is readjusted, it may be necessary to repeat the procedure by pressing the key again and resetting for target cutoff. After adjusting the target as described, it may be necessary to readjust the beam current to a value which just discharges the high-lights in the picture and the amplifier gain to give the correct output level. In general, the target control should not be used as means of controlling the discharge of high-lights. Once set by the method described, the target voltage should not be changed by more than a small amount, always keeping within the prescribed range. The push-key provides a quick way for rechecking the target voltage at any time.

Figs. 4 and 8 show suitable positions for mounting the push-key and other components in either field or studio equipments.

Addition of this new control can be made quite easily and it should be well worthwhile. It will take the guess-work out of setting the target control and thus assure more uniformity in picture quality.

FIG. 5 (at right). Sketch showing target key location for Field Camera Control.

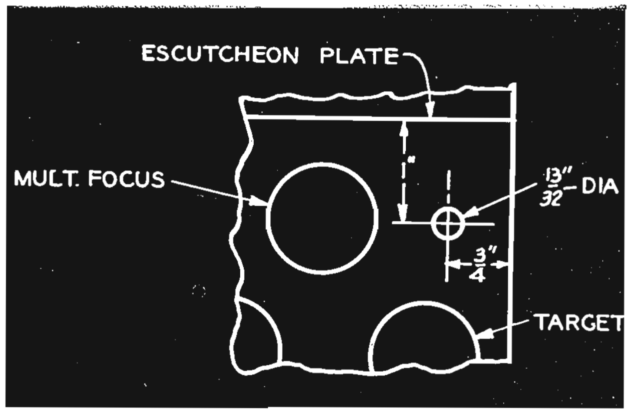
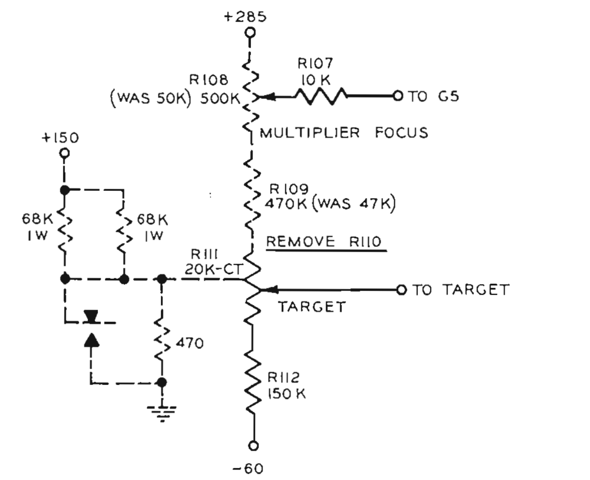


FIG. 6 (at right). Circuit changes required for installing key in Field Camera Control.



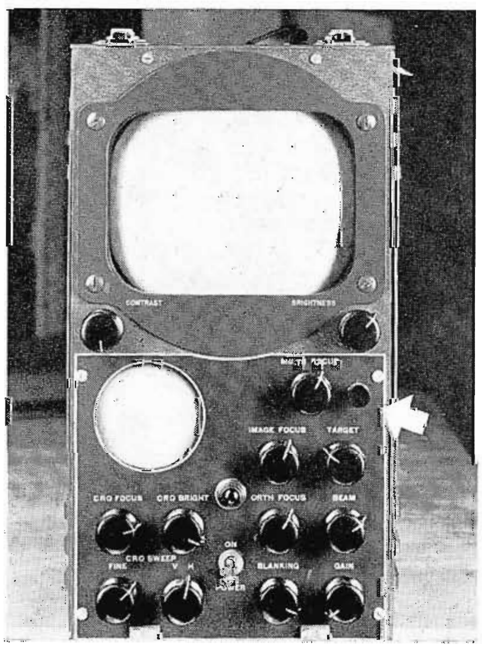
NEW PARTS AND CHANGES SHOWN DOTTED

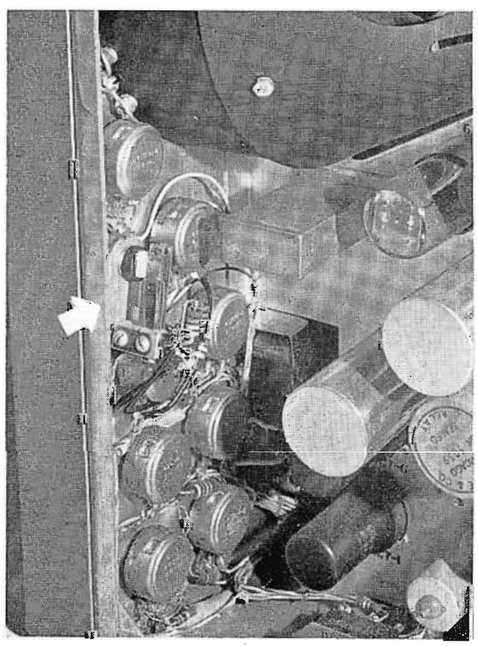
NEW PARTS LIST

QTY.	DESCRIPTION
1	ALLEN-BRADLEY TYPE-J, POTENTIOMETER, 500K, 2 WATTS, RCA STOCK NO. 52442
1	RESISTOR, 470K, ½-WATT
2	RESISTOR, 68K, 1-WATT
1	RESISTOR, 470, ½-WATT
1	NON-LOCKING PUSH-BUTTON KEY MALLORY TYPE 2003 OR EQUIV.

FIG. 7 (left below). Front view of Field Camera Control with target key installed.

FIG. 8 (right below). Rear view of Field Camera Control showing position of new key and components.





Bill Pilgermayer, RCA photographer, caught this group of professional engineers and attorneys in front of the transmitter building before they dispersed to inspect KC2XAK facilities.

CONSULTING ENGINEERS AND ATTORNEYS ATTEND UHF SYMPOSIUM AT KC2XAK, BRIDGEPORT

More than fifty consulting engineers and radio attorneys on June 28 attended a UHF Symposium conducted by RCA and NBC at Bridgeport, Connecticut. The visitors had an opportunity to see in operation the transmitting facilities of KC2XAK, NBC's experimental UHF TV station, as well as visit locations where the regular UHF broadcasts are being picked up by modified RCA TV receivers.

Considerable interest was shown in the equipment which day-by-day is providing valuable data on UHF propagation characteristics, supplementing tests begun two years ago in New York and Washington. RCA and NBC engineers were on hand to answer questions concerning the equipment and to discuss results of tests to date.

Raymond F. Guy, host during the day-long program, welcomed the delegation at the Success Hill transmitter site, and personally conducted the tour. He also addressed the group at a luncheon held in Bridgeport, summing up his observations on the behavior of UHF signals. Talks were also given by RCA engineers, Owen Fiet, who described the KC2XAK antenna system; T. M. Gluyas, who gave pertinent details on the transmitter; and Howard Laessle, representing the RCA Service Company, who discussed receiver antenna requirements.

The KC2XAK transmitter, RCA Commercial Type TTU-1A, has a power output of 1 KW, and is operating on the 529-535 megacycle channel. The output is fed by 3-inch coaxial lines to an RCA Type TFU-1A, slot-type antenna which has a gain of approximately 20. (Technical details on the transmitter and antenna were published in BROADCAST NEWS, Vol. 57.) On the day of the Symposium KC2XAK had rolled up some 2000 hours of operation, (with very little lost air time due to breakdowns). One day-engineer and one evening man (neither with previous UHF experience) handle the transmitter without difficulty. TV programs are received via microwave relay from NBC's channel 4, Station WNBT, 54 miles away, and rebroadcast on the 530 mc UHF channel. The NBC transmitter site has been visited by several AM broadcasters since it began operation in December 1949.

There are 88 modified UHF receivers located strategically in the Bridgeport area, some with built-in converters, others with external converters. Plans call for continued operation of the station with receivers moved to different locations, for a better knowledge of what factors determine the quality of a receiving location.

One outstanding fact was evident to those in attendance, that the picture received from the KC2XAK transmitter was as good quality as the VHF picture received directly from WNBT in New York.

(Continued next page)

THOSE WHO ATTENDED

ENGINEERS

BEN ADLER....Adler Engineering Co., N. Y.
PAUL BERGQUIST....Glenn D. Gillet & Assoc., Washington
LELAND J. BURNETT, JR. ....Adler Engineering Co., N. Y.
B. C. COFFMAN....Paul Godley Co., N. J.
JULIUS COHEN....George C. Davis, Washington
JOHN CREUTZ ....Washington
GEORGE C. DAVIS....George C. Davis Co., Washington
WALTER L. DAVIS....George C. Davis Co., Washington
WM. C. ELLSWORTH....WRS, Inc., Washington
MILLARD M. GARRISON....Chambers & Garrison, Washington
GEORGE E. GAUTNEY....Gautney & Ray, Washington
PAUL F. GODLEY....Paul Godley Co., N. J.
PAUL F. GODLEY, JR....Paul Godley Co., N. J.
GEORGE E. HAGERTY....WRS, Inc., Washington
ANDREW F. INGLIS....McIntosh & Inglis, Washington
ALFRED E. KEEL....Washington
JOHN J. KEEL....Washington
J. GORDON KEYWORTH....Williamstown, Mass.
RUSSELL P. MAY....Washington
JAMES C. McNARY....McNary & Wrathall, Washington
NEAL McNAUGHTEN....NAB, Washington
PHILIP MERRYMAN....WLIZ, Bridgeport, Conn.
JOHN A. MOFFETT....Wm. L. Foss, Inc., Washington
ALBERT F. MURRAY....Washington
DALE POLLACK....Dale Pollack Lab., New London, Conn.
JOHN RADO....Dale Pollack Lab., New London, Conn.
GARO W. RAY....Stratford, Conn.
HOMER A. RAY, JR....Gautney & Ray, Washington
OSCAR W. B. REED, JR....Jansky & Bailey, Washington
ROBERT M. SILLIMAN....Silliman & Barclay, Washington
CARL E. SMITH....United Broadcasting Co., Cleveland, Ohio
ALFRED STROGOFF....Adler Engineering Co., N. Y.
CHARLES S. WRIGHT....A. D. Ring Co., Washington

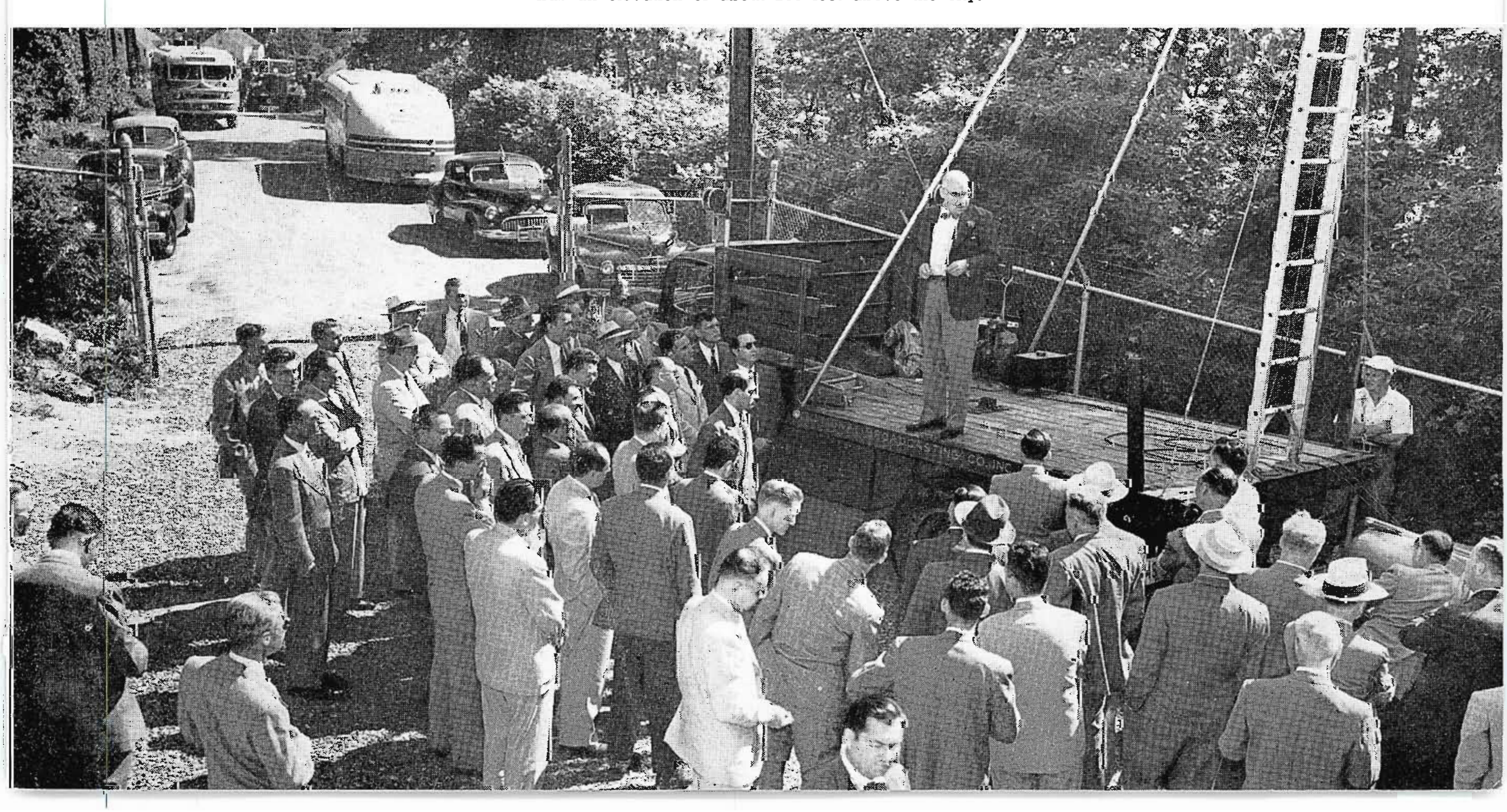
ATTORNEYS

WM. J. DEMPSEY....Dempsey & Koplovitz, Washington
THOMAS N. DOWD....Pierson & Ball, Washington
CHARLES F. DUVALL....Fisher, Wayland, Duvall & Southmayd, Wash.
R. RUSSELL EGAN....Kirkland, Fleming, Green, Martin & Ellis, Wash.
KELLY E. GRIFFITH....Kirkland, Fleming, Green, Martin & Ellis, Wash.
NORMAN E. JORGENSEN....Krieger & Jorgensen, Washington
WM. C. KOPLOVITZ....Dempsey & Koplovitz, Washington
JAMES A. McKENNA, JR....Haley, McKenna & Wilkinson, Washington
NEVILLE MILLER....Miller & Schroeder, Washington
RUSSELL ROWELL....Spearman & Roberson, Washington
HARRISON T. SLAUGHTER....Pierson & Ball, Washington
ABE L. STEIN....A. L. Stein, Washington
CLAIR L. STOUT....Dow, Lohnes & Albertson, Washington
STEPHEN TUHY, JR....Washington
VINCENT B. WELCH....Welch, Mott & Morgan, Washington
VERNON L. WILKINSON....Haley, McKenna & Wilkinson, Washington

OTHERS

E. S. CLAMMER....RCA Victor, Camden, N. J.
DAVID BAIN ....RCA Victor, Camden, N. J.
OWEN FIET....RCA Victor, Camden, N. J.
A. FISCHER....RCA Victor, Camden, N. J.
M. L. GASKILL ....RCA Victor, Camden, N. J.
T. M. GLUYAS....RCA Victor, Camden, N. J.
RAYMOND F. GUY....NBC, N. Y.
HOWARD LAESSLE....RCA Service Co., N. Y.
C. M. LEWIS....RCA Victor, Camden, N. J.
W. E. PILGERMAYER....RCA Victor, Camden, N. J.
DANA PRATT....RCA Victor, Camden, N. J.
J. A. RENHARD....RCA Victor, Washington
JOHN SEIBERT....NBC, N. Y.
E. C. TRACY....RCA Victor, Camden, N. J.
J. E. YOUNG....RCA Victor, Camden, N. J.
ARTHUR WILD....RCA Department of Information, N. Y.
ROCKY CLARK....Post Pub. Co., Bridgeport, Conn.
WM. ELLIOTT....WLIZ, Bridgeport, Conn.
BRUCE ROBERTSON....Broadcasting, N. Y.
AL WEINSTEIN....Radio News Bureau, Washington

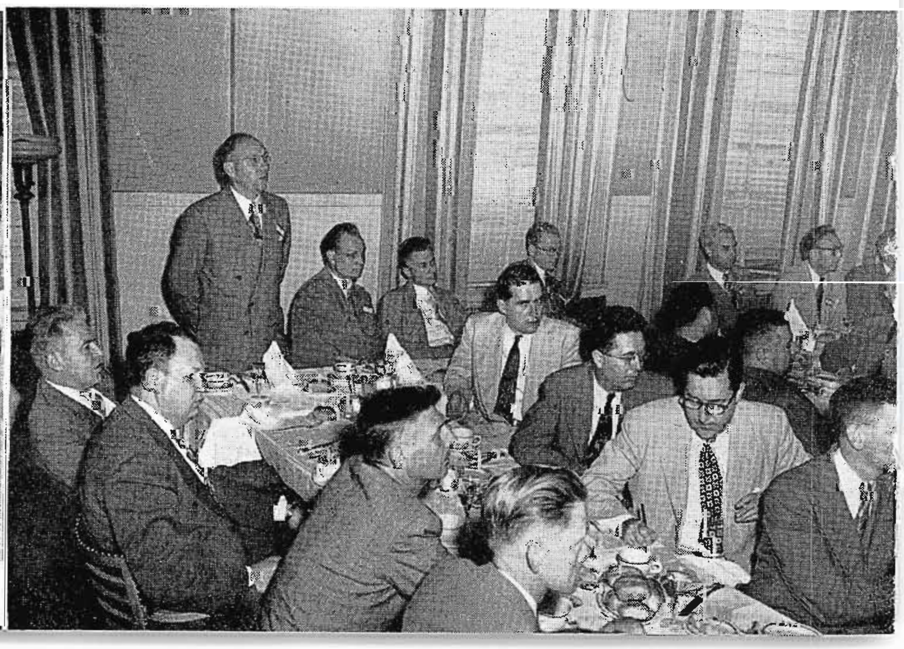
Raymond F. Guy, Manager of Radio and Allocations Engineering, NBC (standing on truck), welcomed the visitors to Success Hill a moment after they had stepped from busses in background. Success Hill, site of NBC's experimental UHF television station, is three miles from Bridgeport and has an elevation of about 200 feet above the city.



(Left photo above). The Cape Cod cottage which houses the transmitter is quite small, and certainly not designed to accommodate such an influx of visitors. However, the eminent engineers and attorneys were keenly interested . . . spent more than an hour viewing and discussing equipment and facilities. Group in right photo examines the transmitter console.

(Above). Howard Laessle, RCA Service Co. engineer, describes a type of parabola receiving antenna, one of several types employed at receiving sites in the area. (Below) Mr. Laessle demonstrates one of the modified RCA receivers being used in UHF tests.

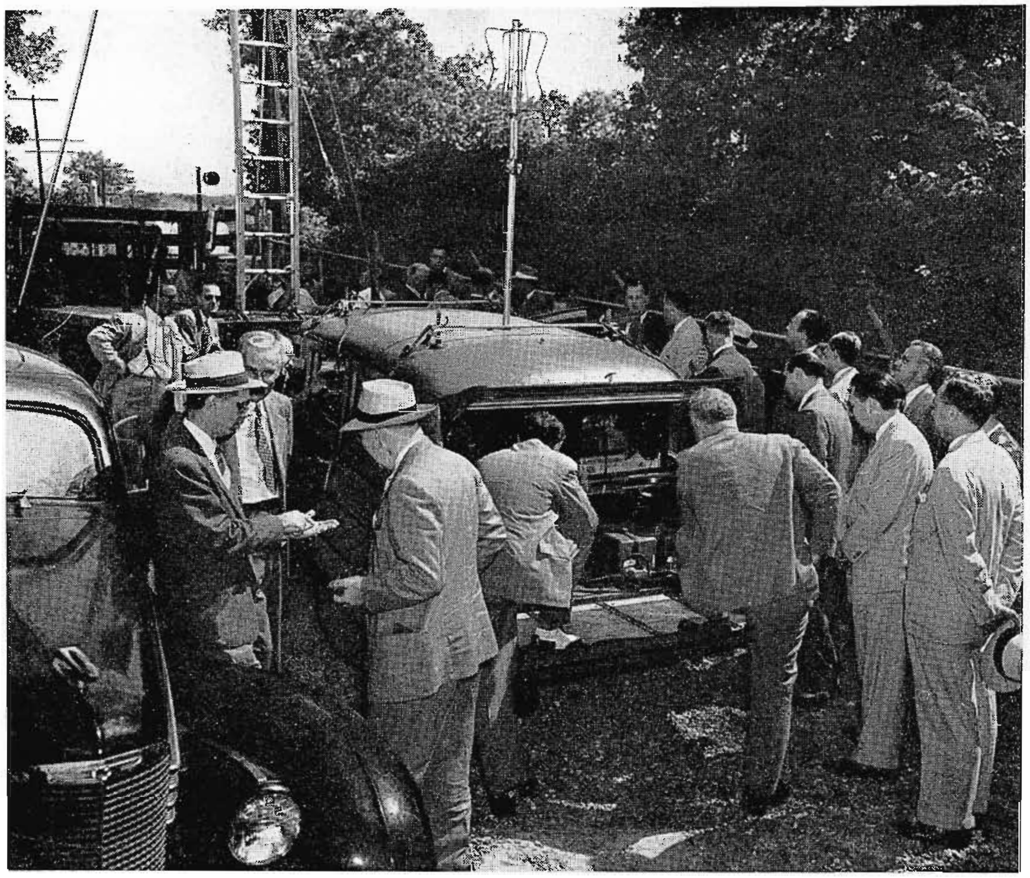
(Above). Engineers inspect spare tripler and power amplifier cavity-resonator tank assemblies. (Below) T. M. Gluyas, RCA engineer, describes design features of the RCA TTU-1A UHF Transmitter in operation at KC2XAK.



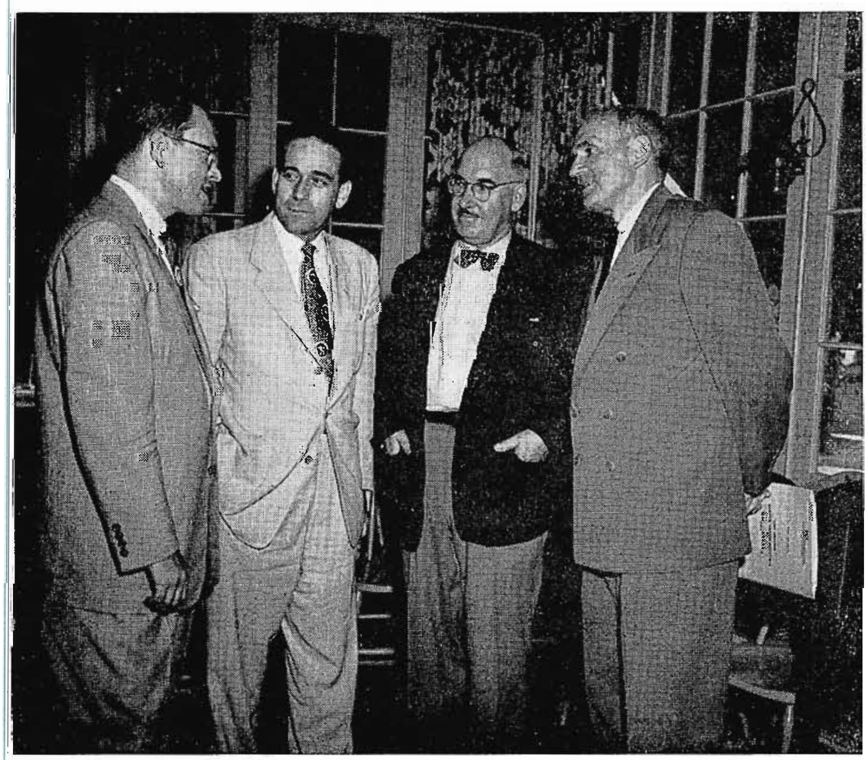
"UHF Caravan"

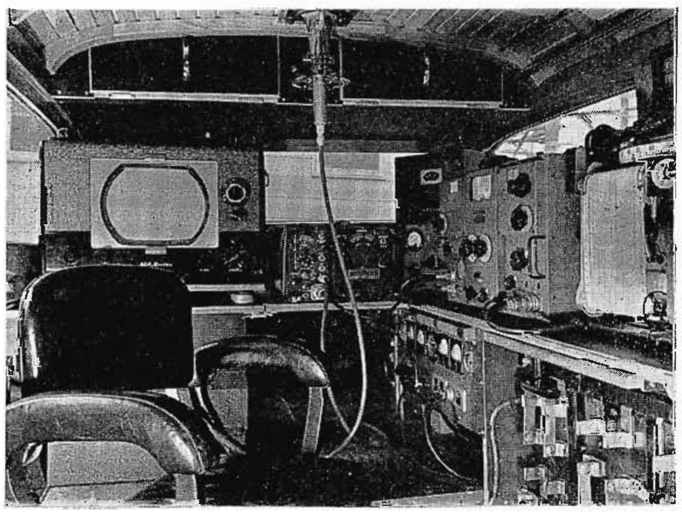
Of particular interest to the visiting engineers was the "UHF Caravan," the mobile test equipment used by NBC in making field surveys.

Two vehicles are in use during the tests, a truck with a ladder that supports a batwing TV receiving antenna, and a station wagon which contains the test equipment and a second TV receiving antenna. Test equipment includes a modified RCA UHF field intensity meter, an APR-4 search radar receiver, altimeter, recorders, and telephone communications equipment. One antenna is connected to the field intensity meter and the other is connected to the search receiver. The outputs of these instruments are fed to separate recorders. In making surveys, separate recordings are simultaneously made from the two antennas, at their respective heights, (10 feet and 30-46 feet) and correlations are obtained from the recordings. The altimeter, of course, gives indications of elevation; and telephone equipment permits communication with the KC2XAK station for a constant check on transmitter power output and barometric pressure.



Visiting engineers and attorneys inspect the "UHF Caravan" used by NBC in making field surveys of the UHF TV signal. Two vehicles are used. Station wagon in foreground contains a modified RCA Type WX-1A UHF Field Intensity Meter, recorders, altimeter, telephone communications equipment and a Super-Turnstile type receiving antenna mounted at a 10-foot height. Correlations between this antenna and one mounted on the truck at a 30-foot height (on the ladder in the foreground) are made from the recordings on each antenna. Photo below is a view inside station wagon. Receiver at left has built-in converter which feeds the 21 mc receiver i-f stages.





View inside station wagon, part of NBC UHF Caravan. Equipment, left to right: modified RCA receiver, radar receiver, field intensity meter and recorders (see text).

(Left photo). At one of the receiver locations in a nearby country club are, left to right, C. M. Lewis, RCA Field Sales Manager; Neal McNaughten, Engineering Director of NAB; Raymond F. Guy, Manager of Radio and Allocations Engineering, NBC and President of I.R.E.; and Judge Neville Miller, former President of NAB.

UHF TRANSMITTING FACILITIES OF KC2XAK

Small Residential-Type Cottage Houses Complete TV Station

The entire TV equipment for KC2XAK is housed in a Cape Cod Cottage which measures only 25 by 34 feet. The first floor of the building is partitioned off into the transmitter room, a lavatory, office, and kitchen (see Fig. 2). The basement contains a large size workshop, storage space, hot water heater and water pump. There is still additional space in an expansion attic which is not being used at present.

Judicious arrangement of equipment in the transmitter room contributes to efficient station operation, and provides plenty of walk-around room. A workbench built into one corner of this room is convenient to the operating engineer. The 1 kw transmitter and monitoring racks are installed in an L-arrangement to further facilitate one-man operation. Heat generated in the transmitter and racks is expelled through warm air ducts above the equipment, visible in Fig. 3. The sideband filter and diplexer are mounted overhead, and thus do not occupy floor space.

Inset photo on opposite page shows the slot-type UHF transmitting antenna. Unusually high gain in this antenna provides an effective radiated power of about 14 kw. At the base of the antenna in the upper part of the tower can be seen the de-icing equipment for this antenna. The de-icing operation consists of blowing warm air up through the cylindrical antenna. The warm air escapes at the top around the beacon.

FIG. 1. Shown at right is the transmitting antenna, self-supporting 210-foot tower and transmitter building of the Bridgeport satellite station. Inset is a closeup view of the tower and the 40-foot UHF antenna. The parabola near the top is used to pick up the 2000 mc. signal from WNBT. Below this parabola is a larger one, specially-built to receive the WNBT Channel 4 signal.

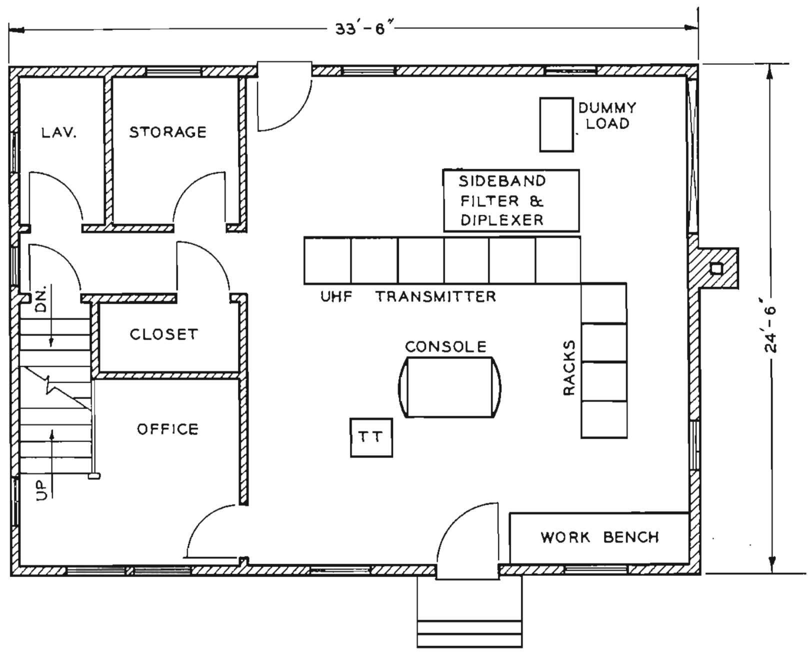


FIG. 2 (above). Floor plan layout of KC2XAK equipment. Though the building is quite small, there is adequate space for storage, office and lavatory facilities. There is also plenty of walk-around space in the transmitter room. The sideband filter and diplexer are actually mounted overhead behind the transmitter.

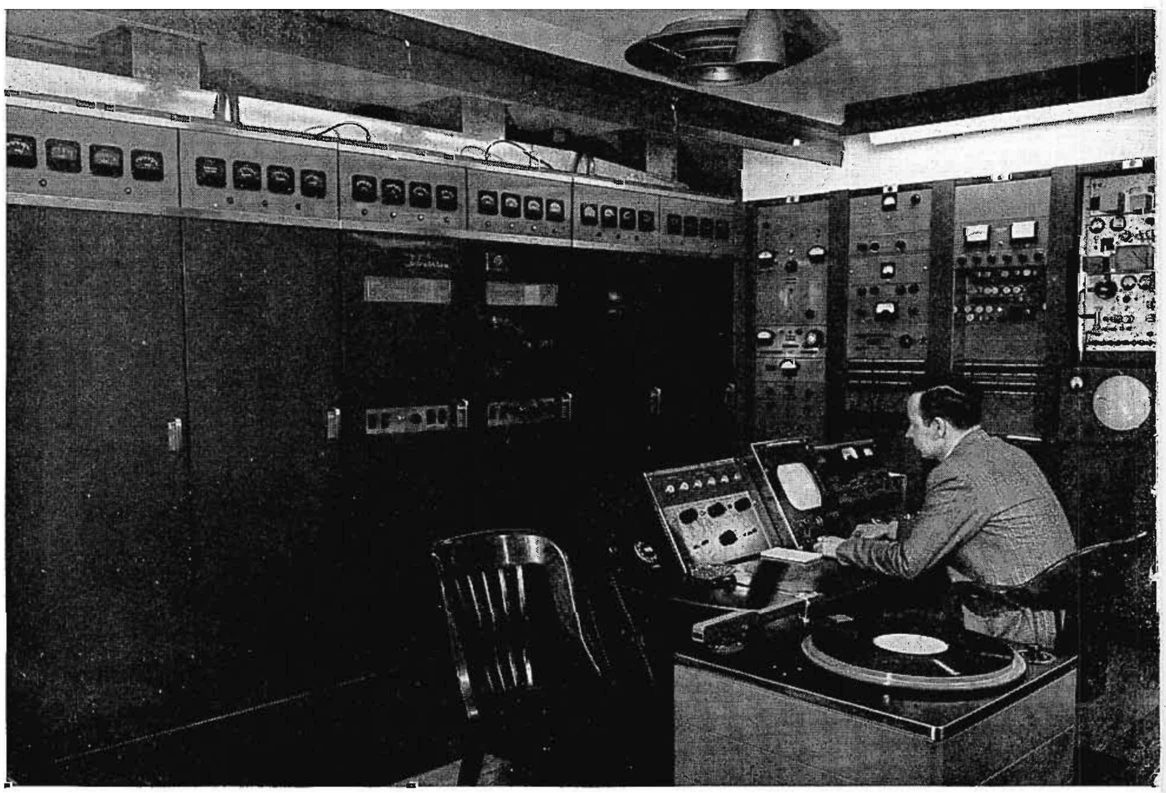
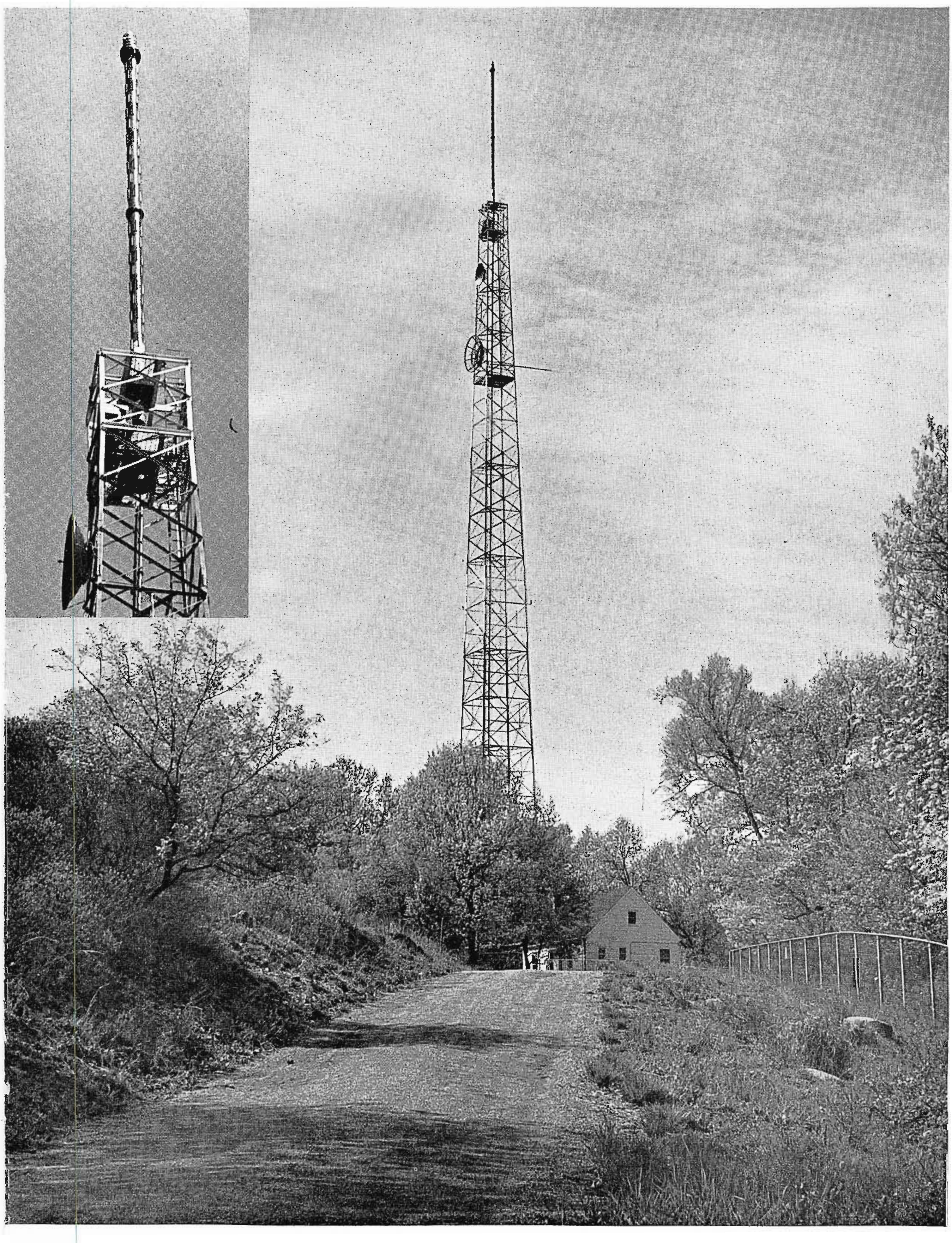


FIG. 3. View inside the transmitter room showing the RCA UHF transmitter, control console and monitoring racks. Transmitting equipment requires little floor space and rivals commercial TV installations in appearance. Seated at the console is Victor Bary, Senior Station Engineer, NBC.



WGAN ANNOUNCER-TURNTABLE SETUP

by R. W. HODGKINS
Chief Engineer
Guy Gannett Broadcasting Services
Portland, Maine

It is certainly a rare individual in the broadcast engineering fraternity who has not been the target of acid criticism and caustic remarks from the announcing and production end of the business; especially in reference to equipment used by the announcers in day-to-day work. This dark moment in the life of an engineer seems to come immediately after producing a labor of love and devotion expressly designed to increase the efficiency of the station and generally to make the announcer's lot in life more pleasant. Here at WGAN, we feel that we have licked this problem and are attempting to pass along a digest of our trials and experiences in producing what we rather proudly consider a good end result in announcer turntable control.

Trial No. 1

At the outset of operation in 1938 we simply asked the program department in which room they intended to place the turntables. From that major starting point, what the announcers got to work with revolved entirely around what engineering wanted to achieve in the way of circuit performance. The first pair of turntables placed in operation at WGAN were the familiar RCA 70 series models of that period and which, incidentally, *are still in operation at WGUY, our Bangor, Maine outlet.* Needless to say we provided a rather complicated set of key switches to allow monitoring and switching to other circuits, and also installed a standard VI meter of that period; all of which created a final confusion of switches and dials calculated to undermine the morale of the most hardy announcer.

The shortcomings of the installation were immediately apparent although it took several months for engineering to admit grudgingly that this "jewel" might not shine in all its facets. It was physically bad with respect to copy placement and distance from turntables. Also it was too complicated for the announcer who, in all fairness we finally admitted, had more duties than turning up the mixers and watching a VI meter. Here again a basic mistake in judgment was perpetrated when a VI meter was allowed on the panel of the mixer controls. To be exact it had three major faults: First everyone covered it over with papers. Secondly, during the periods it might be visible, the man operating the turntables paid about as much attention to it as he would to last week's racing form. Thirdly (and this problem we found to be recurrent, like disease) the man on duty would deliberately run the needle over against the pin on every record claiming that Charley or Bill could not hear him up in Squeedunk.

Trial No. 2

This unhappy state of affairs resolved itself rather unexpectedly when it was decided to move the turntables to another room. Here at last was the golden opportunity to correct our past errors, but little did we know, or suspect, that we were about to enter on the most painful stage of our tribulations. In an effort to silence the objectors in the program department, and in what we considered an outstanding display of fairmindedness, a joint approach by both engineering and program groups was conceived.

First of all (on the insistence that surface area was needed for transcriptions) a large flat affair with the announcer's control in the middle was devised. In retrospect it seems that it would have served a more useful existence for arranging buffet lunches, but for better or worse we constructed it.

The turntables, with pickup arms removed, emerged through square holes in the surface of the table to form a flush top. The arms were mounted on the table top with the announcer's control in the center, and with plenty of space in all directions for piling up records and transcriptions. The whole affair was constructed of wood and plywood with a linoleum top. The VI meter was omitted from this undertaking and has never been used in any subsequent installation; the adjustment of the level being taken care of by the control room engineer.

It was not long before we began to have trouble with this masterpiece. In fact we had just barely time to congratulate ourselves on how well we had done. The first thing that was discovered was that the plan of laying the records on the available area was somewhat of a booby trap. The distances over which the announcer attempted to reach were so great that fatigue soon set in and the records were piled on the floor. The layout was physically much too big. Also the pickup arms began dancing across the record surface when a person walked too heavily, or slammed the door. All sorts of schemes were tried to prevent this, but to no avail. In general the setup was just plain awkward. In an attempt to remedy this, we began what might be called the "sawing up process".

Trial No. 3

Drastic difficulties require drastic treatment. With this axiom in mind a consultation was held and a decision made to amputate part of our monster. First, we sawed off each end and swung it around at an angle in an attempt to bring the tables nearer the announcer's reach. This still left a lot to be desired so after another lengthy consultation it was agreed to dispense with part of the seldom used record area. This brought the turntables nearer the announcer, but there seemed to be some difficulty in deciding about the relative positions of the announcer's controls and the turntables so a third dissection was completed.

By this time the structural members of the table showed evidence of the radical changes and began to weaken and the whole affair definitely needed to be replaced or rebuilt. We retired defeated from this skirmish by doing away with the cut up remnant of our original table and by restoring the pickup arms to their rightful place on the turntables where RCA in its engineering wisdom decided they should be. *There they have stayed ever since.*

Trial No. 4

By now we were beginning to get a glimpse of what we wanted to achieve. Again we held a joint conference and our first useful product began to evolve. In this next version we made a simple plywood table with enclosed sides and an opening for the announcer's knees. The top was not made rectangular but rather was cut with the sides at an angle such that the rear of the table was longer than the front. When the turntables were brought up to each side the announcer had the pickup arms within easy reach. A sloping front control console, with a support for copy just above the mixers, was provided. This was built of wood except for the front panels. The whole affair hinged back for service from underneath. In this unit we simplified the controls to a minimum and provided for starting the turntable motors from the key switches

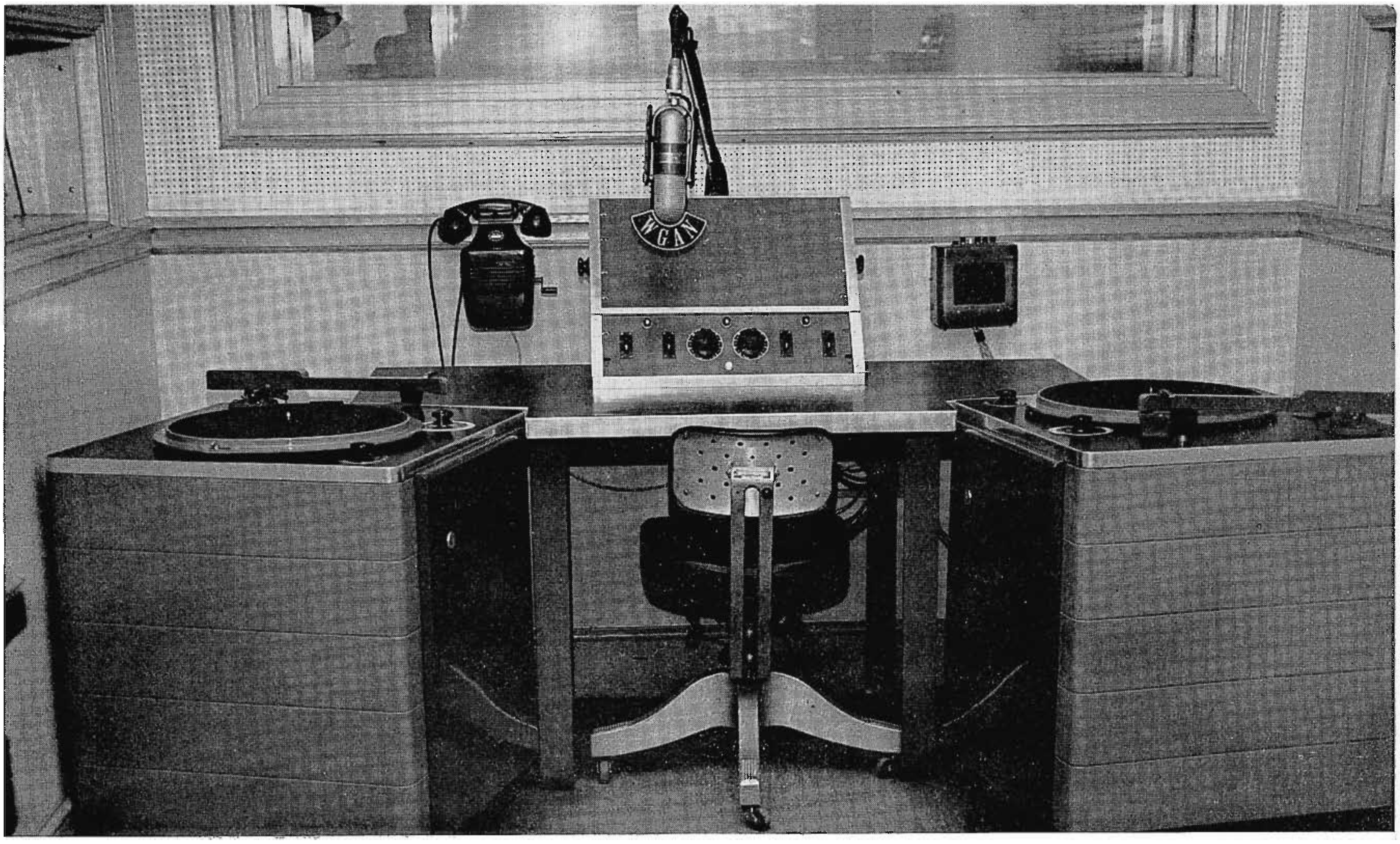


FIG. 1 (above). The "announcer-turntable" setup at WGAN utilizes two RCA 70-D's with central control turret located between them.

which connected the turntable audio output to the mixer.

This starting circuit was accomplished in an unorthodox manner by bringing the 115 volt AC leads right up to the key switch contacts. No apologies have been made for this obvious breach of commonsense. All that can be said is that it works with absolutely no trouble from stray pickup.

Also a suspended microphone was provided, as well as a cuing speaker and key switches for cuing. One switch for each table accomplished this by starting the table and connecting it to the mixer in the down position or starting it and connecting to the cuing amplifier in the "up" position.

The shortcomings of this setup were not in complaints by personnel as before. We entered a phase of breathing easier in this respect. The principal trouble was structural and lack of refinement. The wood construction got the usual "Tom Sawyer" treatment and was soon initialed and picked away at by wood doodlers until the outward appearance was shabby. The accessibility from underneath for servicing was not all that was to be desired, and the foot room beneath the table was still too confining. But there was no question in our minds concerning the fact that we had advanced a long way from our starting point.

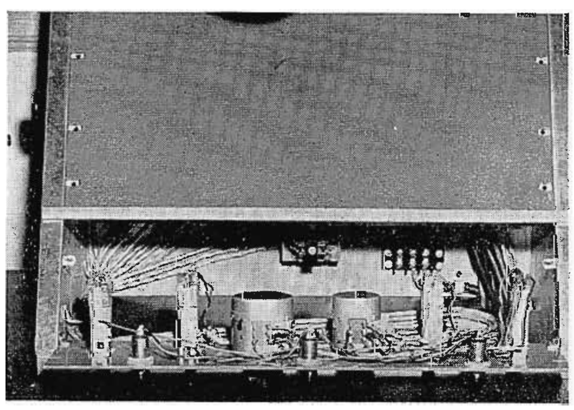
Trial No. 5 — The Final Design

The present units, which are shown in the photographs, were made as a result of building and moving to new studios. Once we were given the go ahead for design of new quarters we tackled the question of announcer's controls from the point of view of achieving a final standard unit. The result speaks for itself. It was decided to use an all metal console to overcome the disfigurement problem. The mixer control panel underneath the copy shelf is hinged for front of panel servicing and the whole assembly was made complete with its own terminal strips and is not a part of the table. The table was made as open underneath as possible by using a plywood top of inch and a quarter stock and steel supporting legs. Linoleum was again used as a cover. A Dazor microphone support was added and has proven its worth. Cuing pots instead of switches were utilized and a change to high level mixing was effected. Preamplifiers in the base of each turntable are used to raise the level of the turntable output before being fed to the mixer. This simplified things in a number of ways. The cuing amplifier was less costly because of the lower required gain and the fear of extraneous pickup associated with low level wiring was reduced. Also two speakers have been provided with controls on the sides of the console. One is a monitor speaker with six busses to chose from and the other is the outgoing program to the transmitter. Both of these speakers are silenced by the microphone key switch. From left to right the controls are: Dummy switch for any future ideas, left motor control switch, left mixer, right mixer, right motor control switch, microphone key switch. Speaker volume controls are on the sides of the console.

As a part of this setup we have provided circular celluloid templates cemented around each filter position switch on the turntables which read: Transcription library, 78 RPM records, and WGAN electrical transcriptions.

In conclusion it can be fairly said that this type of announcer control has truly undergone an evolutionary process here at WGAN. The ideas which were retained and made a part of the final unit have come from the program and engineering departments jointly.

FIG. 2 (below). Front panel of the WGAN control unit tilts forward to provide access to components.



EMPIRE STATE TELEVISION

"Multi-Station" Television Tower Work Progresses

Another important step forward in the development of the multiple television tower to be erected atop the Empire State building was celebrated July 27, from a crow's nest platform suspended 1250 feet above the street. The ceremonies marked the beginning of construction of the 217-foot tower.

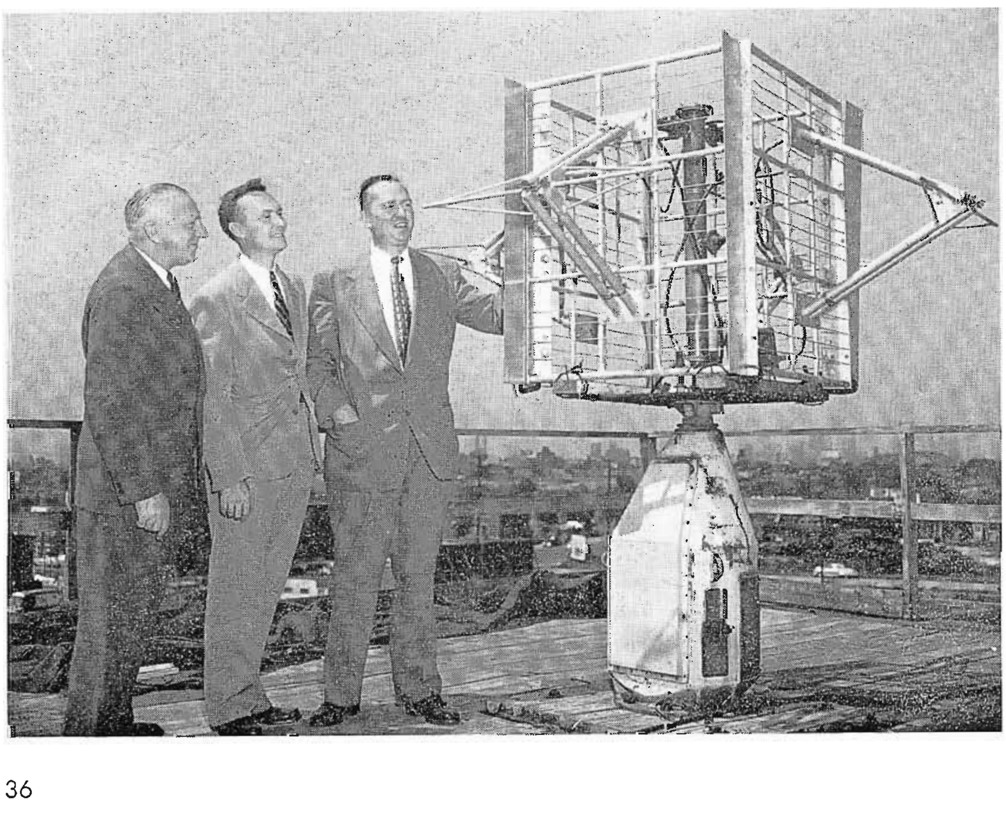
Brigadier General David Sarnoff, who participated in activities, stated that: "Five television broadcasters, rising above competitive differences, will transmit their signals simultaneously from one high tower. . . . Because of New York's many tall structures, this location—high above the others—represents an outstanding advantage for telecasters and the public alike."

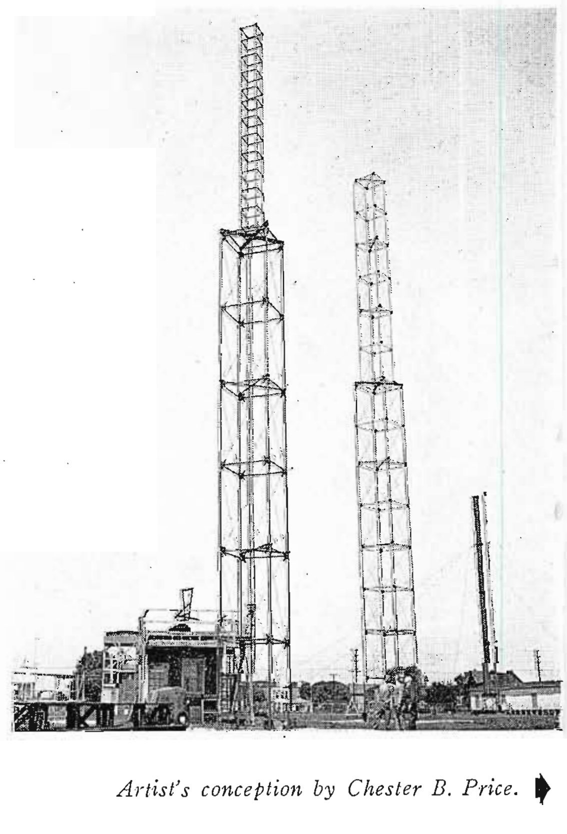
The new television structure will become an integral part of the Empire State building, bringing the overal height to approximately 1500 feet. The Empire State, Inc., is in charge of erecting the specially engineered structure which will accommodate five TV antennas and three FM antennas. Emergency TV antennas will be located on the mooring mast of the building. Engineers of the RCA Engineering Products Department are erecting five full scale antenna towers in Camden as a part of the engineering, test and development work. Antennas consist of RCA supergain types for Channels 2, 5, 7, and 11, and a special RCA superturnstile for Channel 4. The separate emergency TV antennas, as well as the FM antennas, will also be included in the experimental work.

Watching Mayor William O'Dwyer drive a gold-plated rivet into the Empire State foundation structure during the "start-of-construction" ceremonies are (left to right in foreground): David Sarnoff, Chairman of the Board, Radio Corporation of America; Lawrence Lowman, Vice President of CBS; Mark Woods, Chairman of the Board of ABC; and Dr. Allen B. Dumont (in background) President, Dumont Labs.

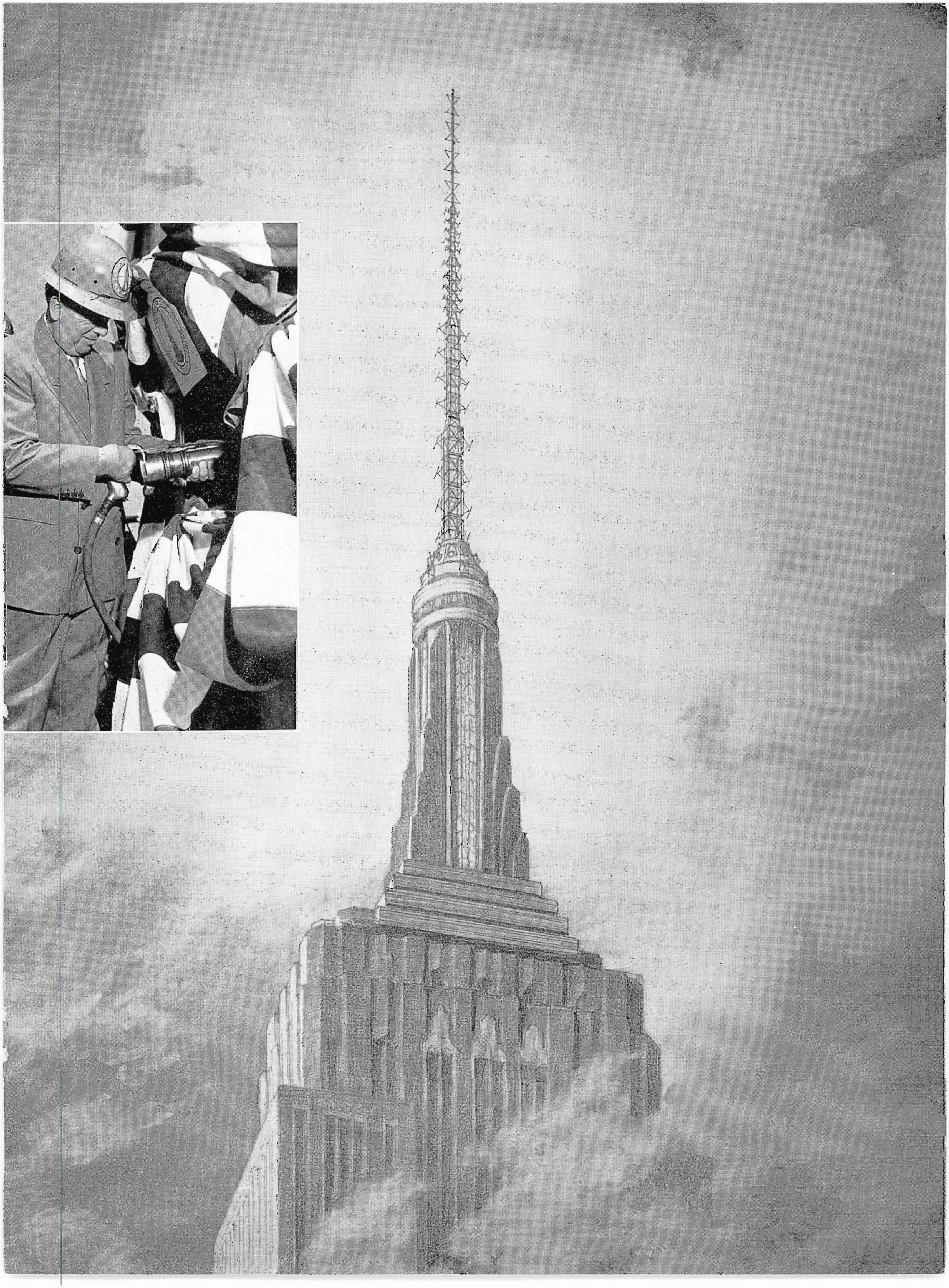
AT LEFT (BELOW). Shown inspecting one of the supergain antenna elements during engineering tests at Camden are: Al Josephsen, RCA Engineering Products Dept. Representative, who has acted as co-ordinator for the Empire State Project; Wayne Masters, Chief Consultant; and Dr. Frank G. Kear, of Kear and Kennedy, representing Empire State, Inc.

AT RIGHT (BELOW). Shown during construction are developmental antenna towers used in conducting engineering tests and measurements.





Artist's conception by Chester B. Price.



HOW TO PLOT TV STUDIO LIGHTING

By

CAPT. W. C. EDDY

Television Associates, Inc.

and

H. DUSZAK

RCA Television Equipment Sales

Introduction

In planning the proper Television Lighting for initial installations or for the redesign and modification of studios—light distribution is obviously a most important factor. In this respect, the "light plotters" described here should prove to be useful and informative *time savers* in making the necessary calculations.

The "light plotters" may be used as overlays on your studio floor plan (scale ¼ inch = 1 foot) to permit instantaneous computation of the *actual light output* from one or more fixtures *at any distance from the source.* Use of multiple plotters will further permit analysis of key light to back light ratios, as well as overall studio illumination.

The plotters described here illustrate the many advantages of the "one-man" controllable lighting fixtures wherein one fixture can do the work of many old-style fixed lights. Packaged studio lighting equipment (see ad on subsequent pages) is available. High-intensity fluorescent banks, high-intensity spots and incandescent banks may be supplied for delivering controllable light energy up to 200 foot candles.

We suggest that you make a close check with these light plotters on a floor plan of your own studio, and compare the light output of these "TV" designed units with what you measure on the studio floor. Light Plotters, as well as additional information or assistance for planning studio lighting, may be obtained by contacting your nearest RCA Field Representative or writing to RCA Broadcast Equipment Sales, Camden, New Jersey.

How to Use Light Plotters

The Tele-Lite and Fluorescent Light Plotters are designed to give you a quick method of computing the quantity of light in foot candles available over the entire useful area of any controllable light fixture. By adding the overlapping figures when two or more plotters are used, the combined light output of two or more lighting units may be computed.

1. Place the center point of the Light Plotter over the location of the fixture on a studio plan drawn to the scale of ¼ inch to 1 foot, using Tele-Lite Plotters for incandescent fixtures, and the Fluorescent Plotters for fluorescent lights. Align the base line with the plane of the light unit, and read in foot candles the amount of light one unit will provide in your studio over any radial within the usable beam of the light. The examples shown below apply to the use of actual plotters rather than the illustrations which are not to scale.

Example: Fluorescent Light Plotter, Fig. 2: On the 0° line at 10 feet, you read 70 foot candles, and on the 25° line at 8 feet, you read 98.5.

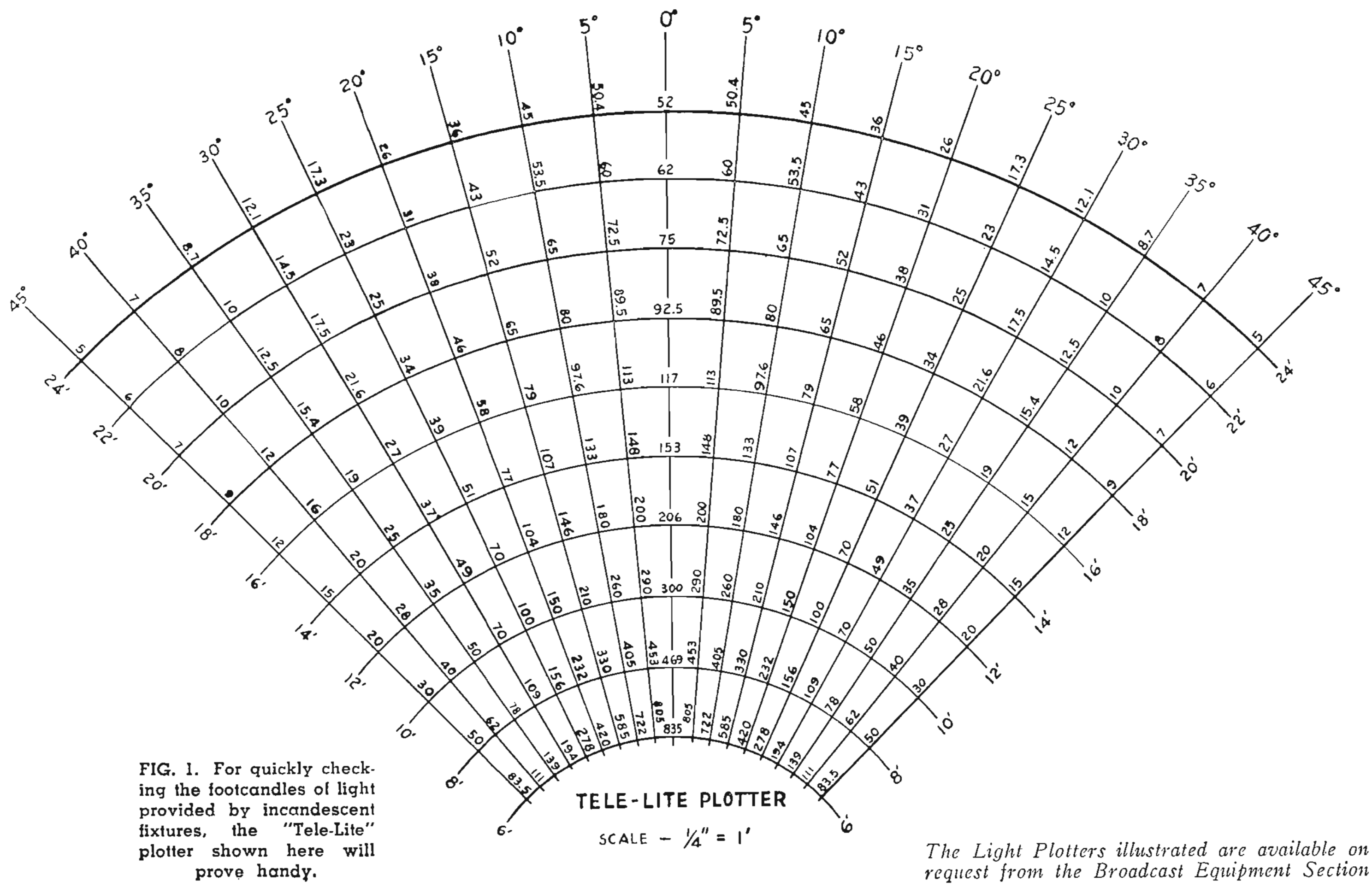


FIG. 1. For quickly checking the footcandles of light provided by incandescent fixtures, the "Tele-Lite" plotter shown here will prove handy.

The Light Plotters illustrated are available on request from the Broadcast Equipment Section

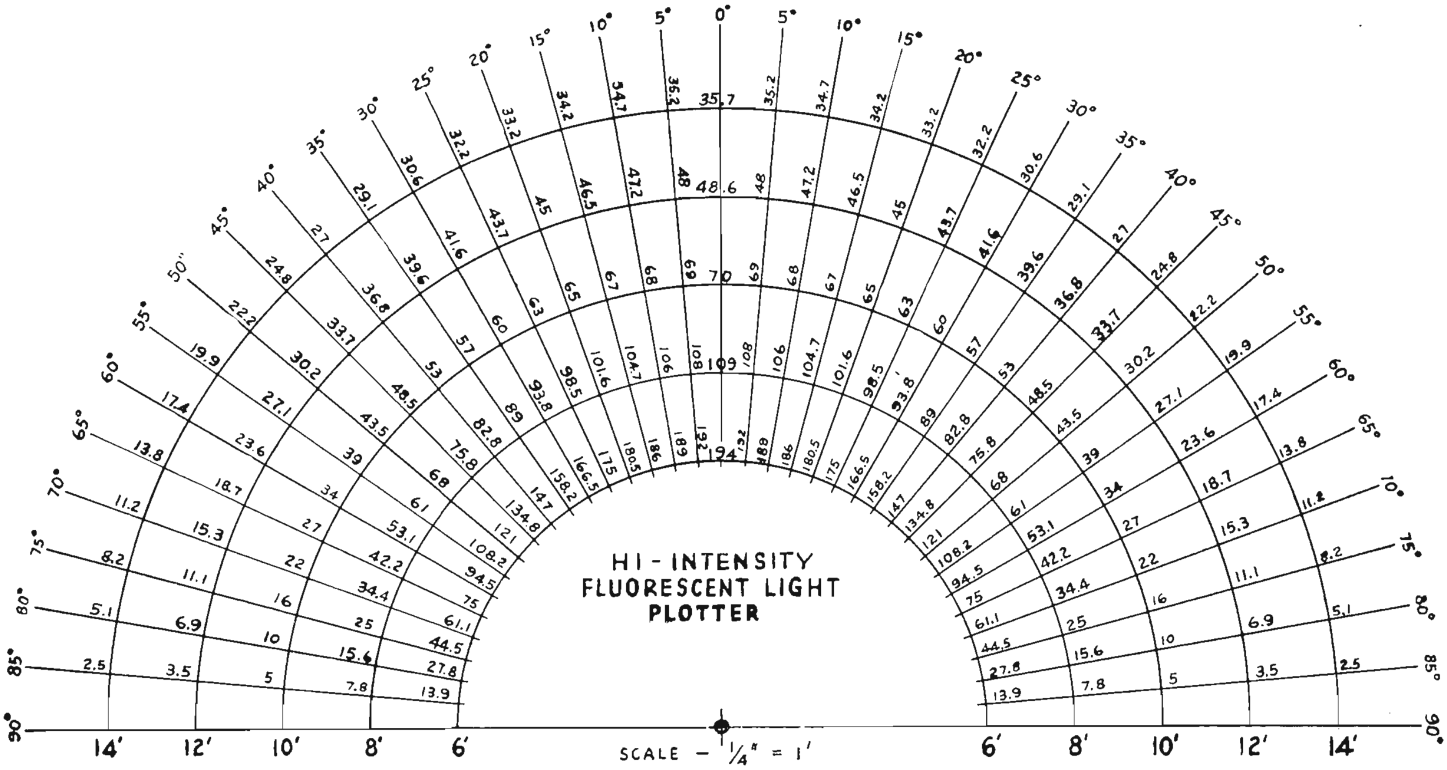


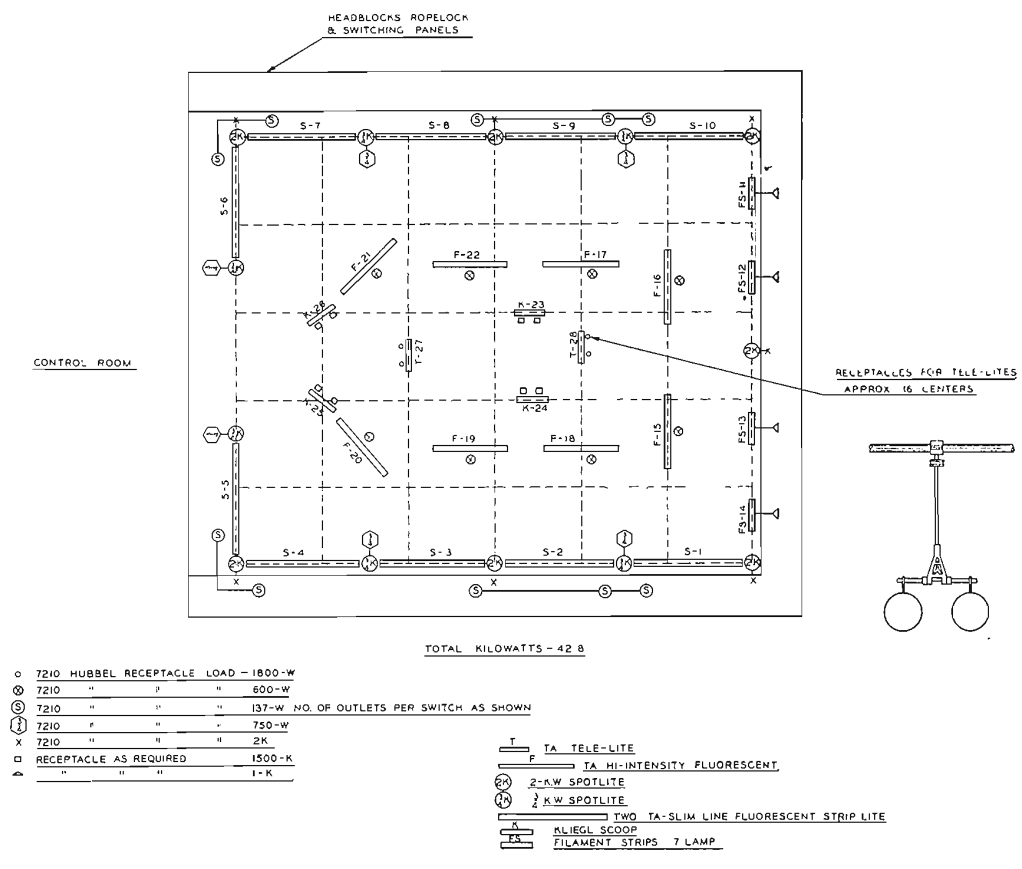
FIG. 2 (above). This light plotter can be used for checking the light output provided by fluorescents.

2. Place the center of the proper light plotter over the indicated position of the lighting unit, as in 1 above. Place another plotter of the correct type in the position of an adjacent light fixture, and rotate both plotters to correspond with the planned position for the lights. Then read the combined output of the two lighting units effective at any given point in the area merely by adding the figures in the two or more squares which cover that point. Obviously, allowance must be made for the decrease in light intensity which will be evident when high-hanging fixtures are aimed downward at an angle, so that the path traveled by the light is actually longer than would be shown on the floor plan view of the studio.

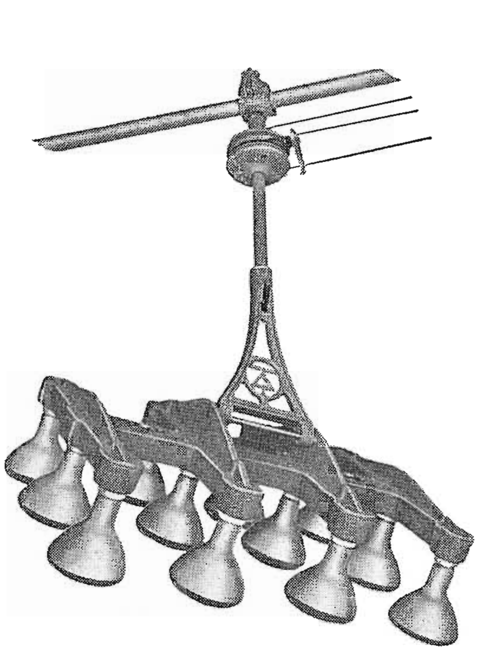
Example: Assuming two fluorescent lights at 8 foot centers on the same axis are being checked, place #1 plotter over the indicated position of the first light, and #2 plotter over position of second light. At a point on the #1 plotter at 35° right on the 12 foot line, read 39.6; at this same position on plotter #2, read 69, the sum of which, 108.6, gives the effective footcandles of light at this point.

Now rotate the #2 plotter 20° to the right. At the same check point as before, the #1 plotter still reads 39.6, and the #2 plotter now shows 63, giving a new total for the point of 102.6 footcandles.

FIG. 3 (below). Sample floor plan showing typical arrangement of lights to provide adequate studio illumination.

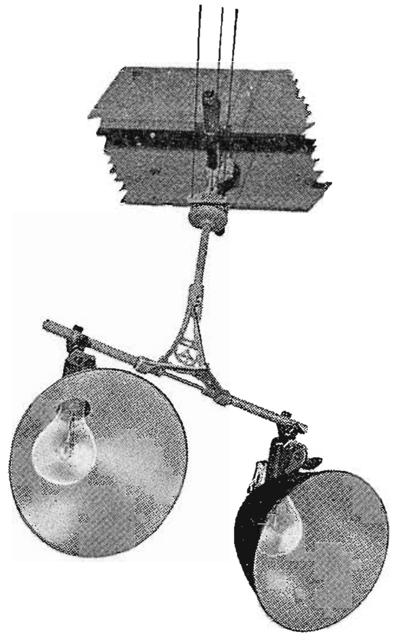


EVERYTHING IN LIGHTING—



Incandescent Lamp Bank, Type TL-5A

The standard 12-lamp light source for normal studio operation. Ideal for slow fades. Provides equal light distribution on "douses." Maximum load per circuit, 3 kw; Per unit, 6 kw. Single cast aluminum-grille construction. Rotates 360 degrees. Tilts 170 degrees. Noiseless controls.

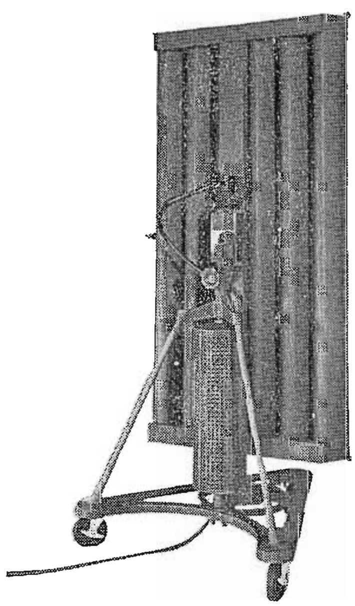


Rotatable Lamp Mount, Type TL-15A

With extension bars for mounting individual or multiple flood lamps. Control spindle can rotate 360 degrees—tilt 170 degrees about the point of support.

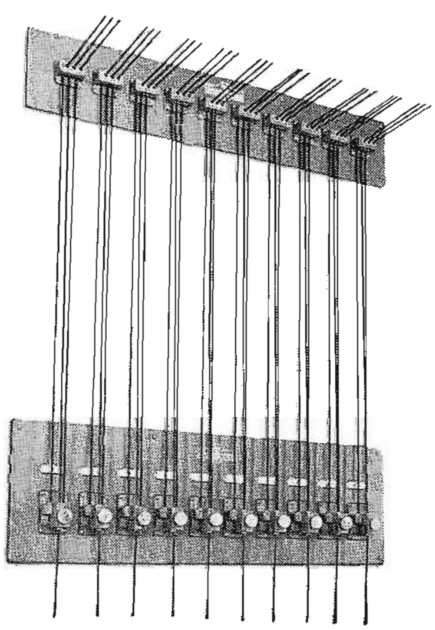
Fairleads, Type TL-32A

A practical way to guide mechanical control lines to control board without noise. 170-degree tilt and 360-degree angle of rotation around its point of support provides maximum flexibility for mounting anywhere. Equipped with quick-release gridiron clamp. Nine chromed bushings reduce control-line friction.



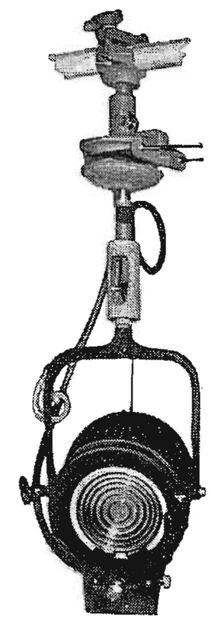
High-Intensity Light Dolly, Type TL-26A

The ideal mobile floor unit that puts high-intensity side illumination where you want it. Uses the TL-1A High-Intensity Fluorescent Bank. Rotates the bank from horizontal to vertical position; tilts it through 90 degrees. No high-voltage floor cables, because lamp ballast is right on the dolly.



Light-Control Panel, Type TL-31A

Includes ten headlocks and ten rope locks for controlling ten light banks. Available in single units or on ready-to-operate panels, as illustrated.



Spot-Light Fixtures, Type TL-10A—TL-11A

Standard control spindle for use with a Mole-Richardson or Oleson 2-kw Solar Spot, or a 750-watt Baby Spot. Rotates 360 degrees. Tilts 170 degrees about its point of support.

—FOR TV STUDIOS...

New silent-control lighting equipment enables you to "tailor" the lighting system to fit your studio —correctly, without expensive experimenting.

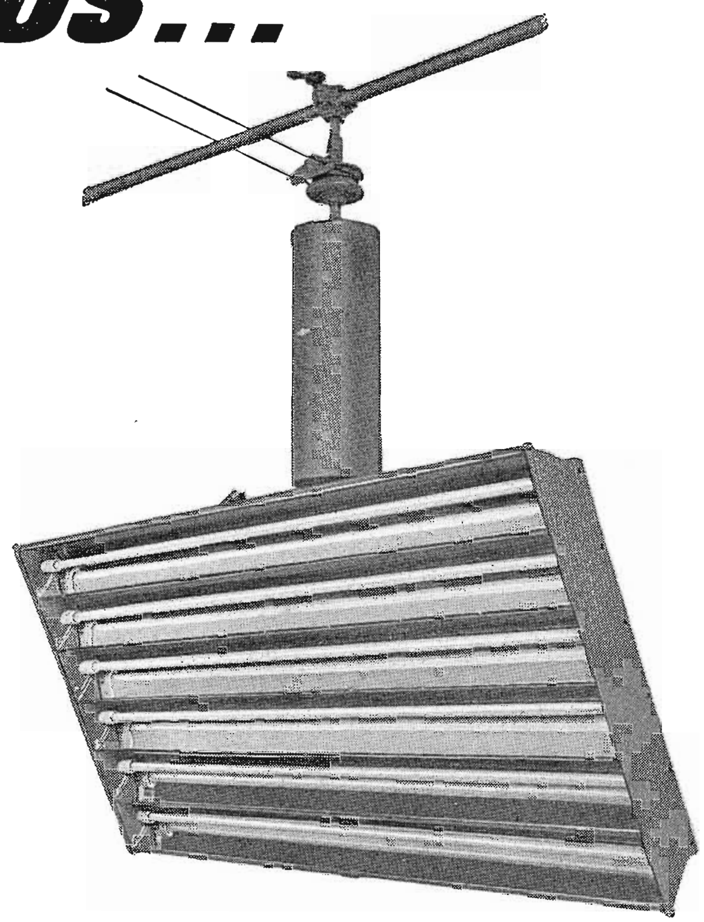
AVAILABLE for the first time—a complete line of studio-tested lighting equipment from a single manufacturer. Available for the first time—packaged studio lighting systems to match the response curves of modern studio cameras.

Combining high-intensity fluorescent banks, high-intensity spots, and incandescent banks for handling any studio set-up, RCA lighting systems are capable of delivering more than 200 foot candles of light energy. All lights can be rotated 360 degrees horizontally and 170 degrees vertically. All lights are designed for pyramid-mounting on studio ceilings. All lights are mechanically controlled through silent-operating fairleads that terminate in a central control board.

With this lighting equipment you can swing each light for basic work, modeling, or back lighting. You can direct each light to more than one acting area. You can "dim" by tilting, rotating, or cutting off half banks—and without upsetting light distribution. All equipment and wiring is off the floor. No ladder hazards or expensive catwalk installations. No danger of burning artists or technicians.

Here is the system that delivers correct illumination with as little as two-thirds to one-half the usual amount of equipment—and with proportionate savings in power. No more experimenting for the individual studio. No more junking of extensive lighting installations.

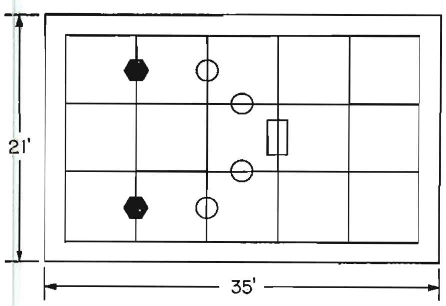
For help in planning your studio lighting—correctly—simply call your RCA Broadcast Sales Engineer. Or write Dept. 19IA, RCA Engineering Products, Camden, N. J.



High-Intensity Fluorescent Bank, Type TL-1A

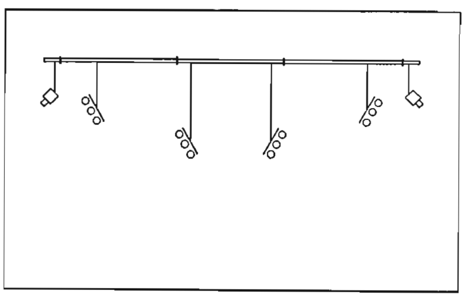
Assures optimum light response from TV studio Image Orthicon cameras. Uses six 3500-4500 Kelvin slim-line tubes. Only 600 watts connected load. Includes noise-free, double-rubber cushioned, built-in ballast units; heavy-duty jumper cord connections; instant start high-voltage striking circuit. Uses pre-focused individual alzac parabolas. Rotates 360 degrees. Tilts 170 degrees. Noiseless controls.

TYPICAL TV STUDIO-PROVED FLOOR PLANS AND CEILING ARRANGEMENT FOR RCA LIGHTING SYSTEMS

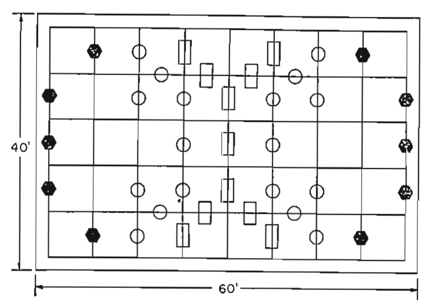


For a small interim-type studio, 21 feet x 35 feet. This plan more than meets the minimum lighting requirements of 200 foot candles and a contrast range of 2-to-1.

NO. REQD.		SYMBOL
1	HI-INTENSITY FLUORESCENT BANK	▯
4	INCANDESCENT FLOOD-LITES	○
2	CONTROLLABLE SPOT-LITES	●



Cross-sectional view of a TV studio, showing RCA's inverted pyramid-type of lighting. This system delivers unobstructed light to every point in the studio.



For the average-size studio, 40 feet x 60 feet. This plan more than meets the minimum lighting requirements of 200 foot candles and a contrast range of 2-to-1.

NO. REQD.		SYMBOL
11	HI-INTENSITY FLUORESCENT BANKS	▯
18	INCANDESCENT FLOOD-LITES	○
10	CONTROLLABLE SPOT-LITES	●

TELEVISION BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

The "WPIXlock"

Simple Phase Shift Amplifier Developed By WPIX Engineering Staff Locks Synchronizing Generators Together For Fading Between Studio And Remote Programs

By

THOMAS E. HOWARD

Chief Engineer, WPIX, New York

For the WPIX Engineering Staff

The WPIX phase shift amplifier is an effort on the part of the WPIX Engineering Department to lock synchronizing generators together, so that switching may take place between the field, studio, or film programs, without the attendant momentary breakup of picture in the home receiver and to permit the superimposing of film, or studio programs over those of the field, without the relative motion between the two pictures, which would occur if the master control and field synchronizing generators were operating from separate master oscillators.

This condition has been approximated in the past by obtaining coincidence between the 60 cycle components of the synchronizing signals. By having the vertical intervals of the field generator phased approximately with the master control generator, it is possible to minimize the picture breakup or roll in the home receiver, when switching from field to master control, or vice versa. Superimposing, or lap dissolving, between studio and field, however, is impossible, since the instantaneous phasing of the two horizontal intervals is not constant. The desirability of coincidence between synchronizing generators has been covered elsewhere.

At WPIX two approaches were taken to the problem. One was to make the field generator the slave and the other was to make a slave generator at master control.

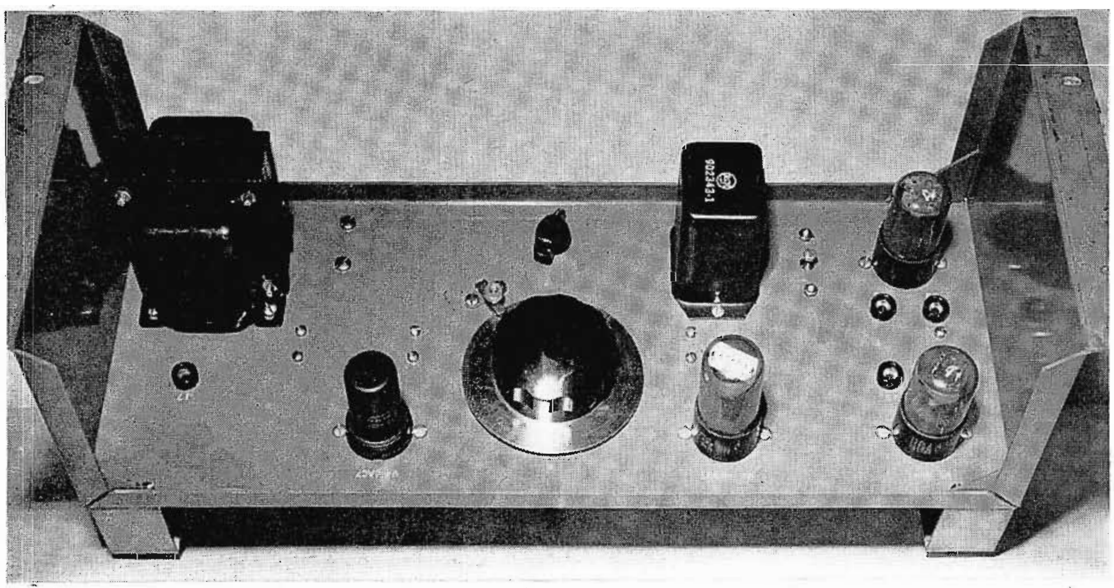


FIG. 1. The WPIX Phase Shift Amplifier or "WPIXlock" is shown here mounted on a standard "bathtub" type chassis.

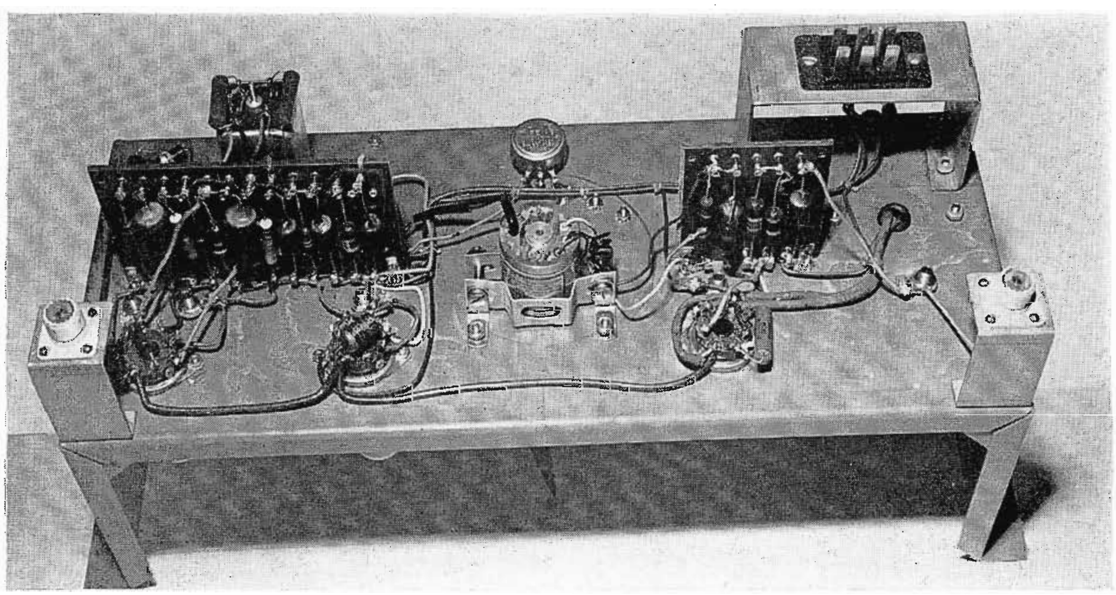


FIG. 2. Resistors, capacitors, terminal boards and small components are all mounted at the rear of the chassis.

There was also to be a minimum amount of modification to the sync generators and from an operations standpoint the system was to be reliable. The switching system at WPIX leaves almost no possibility for program failure.

The following not insurmountable difficulties are met when trying to lock the field generator with an off-the-air signal from master control.

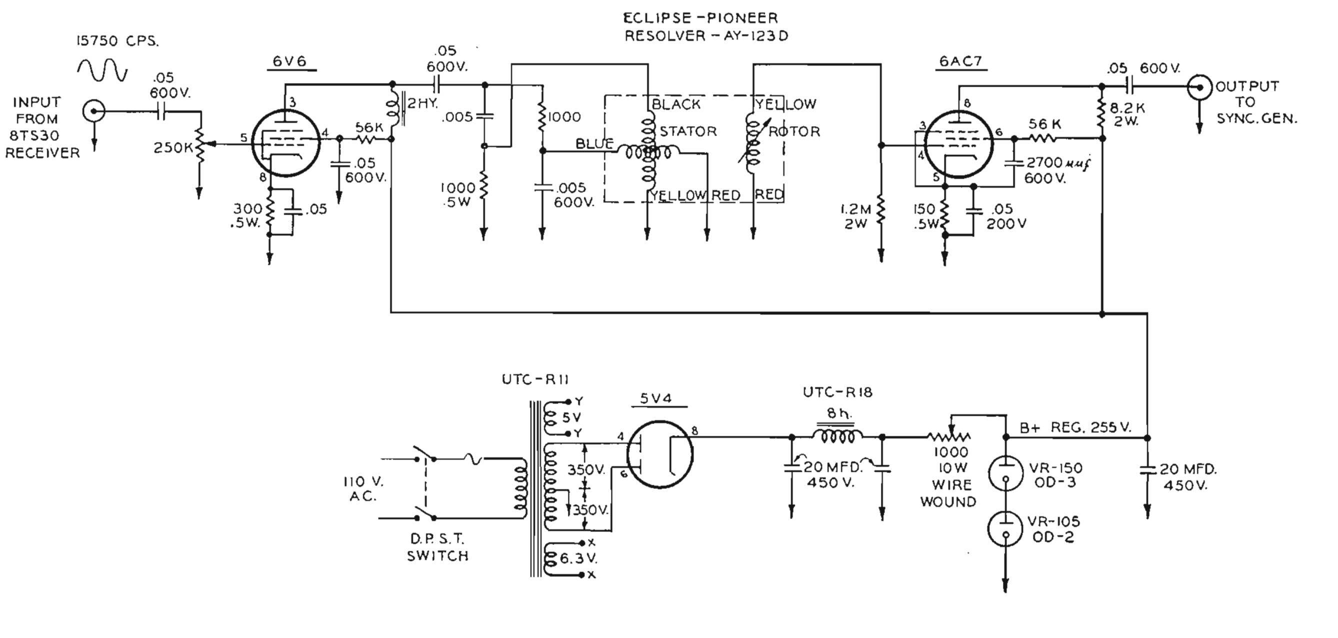
1. Synchronism is lost if there is an interruption of the received signal.
2. The "Off-the-Air" signal is called upon to deliver a constant phase driving pulse to the phase shifter. This means a receiver with a strong, reflection free, interference free signal. This is difficult at some remote locations without an elaborate antenna installation, especially in New York City.
3. The program preceding must not be from another remote source.

The disadvantages of making the master control generator the slave are as follows:

1. The remote generator may be locked to a 60 cycle power line, which may be nonsynchronous with the power line feeding the synchronous projector motors in the film studio.
2. Assuming that the remote and studio power is synchronous, the vertical blanking interval at the remote must be phased to accommodate the film application pulse.

FIG. 3 (above). At the left of the Hudson River is one power system, and at the right is another.

FIG. 4 (below). Schematic circuit diagram of the WPIX remote type phase shifter.



In the WPIX primary area there are two power systems as shown in Fig. 3. In general, all power east of the Hudson River is one system and west of the Hudson another. WPIX is an independent station, with no network programs, and by being able to make either the master control, or the remote generator, the slave, full station camera facilities can be used with any program.

Some circuits heretofore published replaced the sync generator master oscillator with a 31,500 cycle per second sine wave from some type of continuous phase shifter. At WPIX it was found that either a 15,750, or a 31,500, cycle waveform could be fed to the sync generator crystal oscillator in place of the crystal itself to "lock" the master oscillator. Although there seemed to be very little difference between 31,500 cycles and 15,750 cycles per second, some "pairing" was noticeable with 15,750 cycles as may be noted in Fig. 9.

The first sync phase shifter at WPIX was one that was used in conjunction with an RCA 8TS30 receiver. By using the receiver "jeeped", or off the air, either a studio sync generator, or a remote generator, could be controlled. The circuit for this unit and the connection to the 8TS30 receiver are shown in Figs. 4 and 5 respectively. The output of the phase shifter was fed in place of the crystal in the sync generator crystal oscillator, as shown in Fig. 6.

The phase shifter used with the receiver, Fig. 4, consists of V1, an amplifier, a synchro used as a continuous phase shifter and V2, a voltage amplifier. The unit has a self contained power supply. Considerable success marked the use of this unit, both in the field and in master control. Fig. 11 shows how the original unit was used in the field and Fig. 10 shows its use in master control.

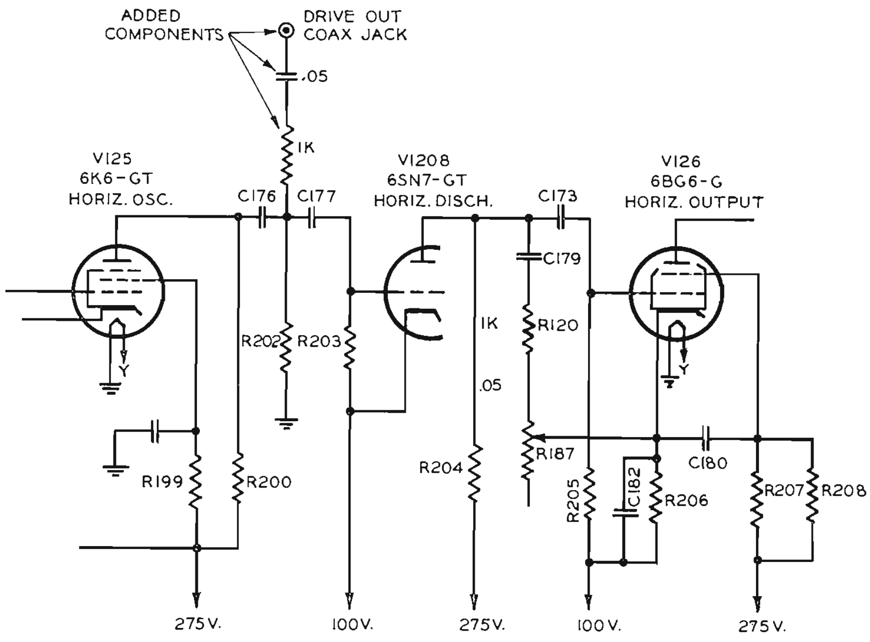


FIG. 5 (above). Modifications made with the RCA 8TS30 Receiver to bring 15,750 cycle information to the remote phase shifter.

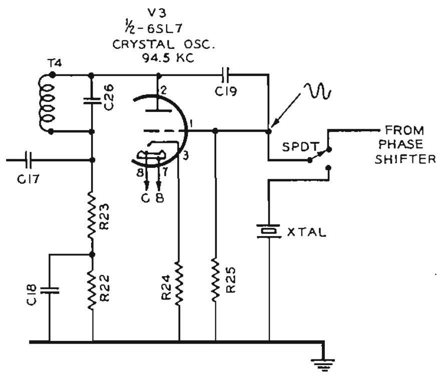


FIG. 6 (at right). All RCA sync generators at WPIX are modified so that the phase shifter can be substituted for the crystal.

In an effort to eliminate the receiver in master control and with the thought in mind that "the fewer tubes the better", a master control sync generator phase shifter was built. The input to this phase shift amplifier is a normal 2 volt composite

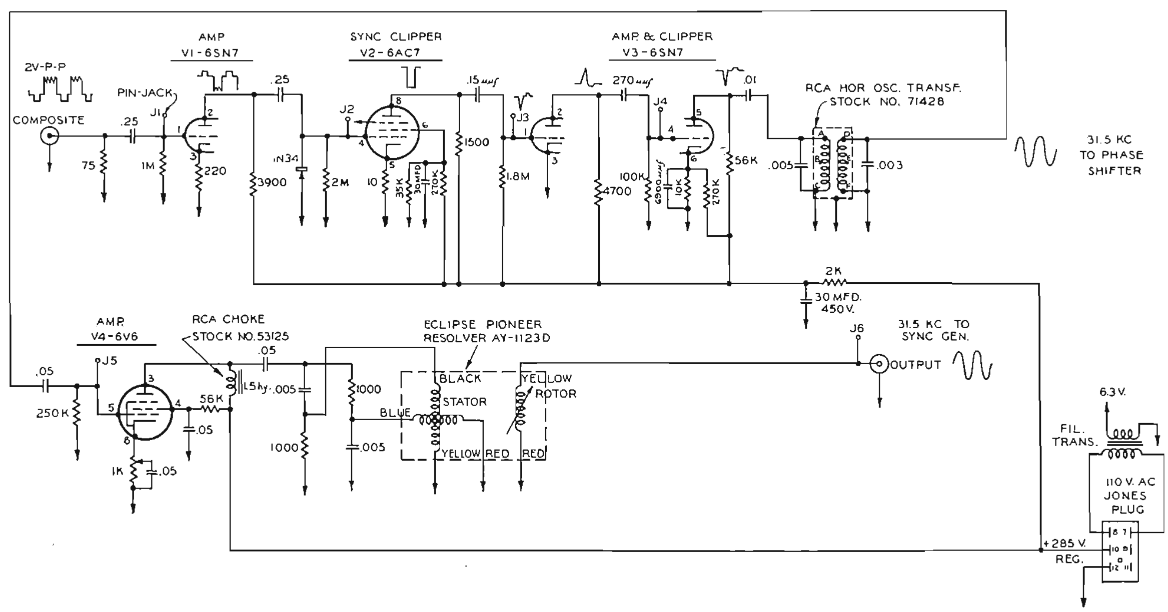


FIG. 7. Circuit diagram of the WPIX Phase Shifter as used for master control (input is a 2-volt composite signal).

peak to peak video signal with negative sync across 75 ohms. See Fig. 7 for diagram.

This signal is fed into the grid of V1 (6SN7) where it is amplified and reversed in polarity. The signal is then fed into the grid of V2 (6AC7) sync clipper amplifier. A germanium crystal rectifier was placed in the grid circuit of this tube to help set the DC level of clipping constant. The output of this stage is a large negative pulse.

This pulse is then differentiated by the RC network (15 mmf-2 megs) at the grid of V3, also a 6SN7. Limiting of the differentiated rear edge takes place in this tube by virtue of its drawing grid current. (Positive grid swings cause small changes of plate current while a negative grid swing will cause the plate current to change considerably.)

This clipping action is repeated in the second half of V3 with the result that on the plate of V3 there are pulses representing the leading edges of all horizontal, equalizing and serration pulses. The repetition rate is 15,750 cps, except during the vertical interval, when there are 18 pulses at 31,500 cps. These pulses are injected to a double tuned circuit tuned to 31,500 cps. The. tuned circuit rings twice between the 15,750 cycle pulses and once between the 31,500 cycle pulses. Damped sine waves of 31,500 cps appear and are fed to the grid of the 6V6 sine wave amplifier (V4) which feeds the phase shift network.

The phase shift circuit consists of a standard *synchro* with two stator coils at right angles and a single rotor coil. The 31,500 cps sine wave is applied to each stator 90 degrees out of phase due to a phase shift network, thus resulting in the continuous 360 degree phase shift necessary for complete time coincidence between sync generators. The 90 degree phase shift network is composed of two .005 mfd capacitors and two 1000 ohm resistors, and is a well known method of obtaining phase shift. The *synchro* used is an Eclipse Pioneer type AY-1123-D, Autosyn Resolver. This *resolver* has the advantages of being compact, not requiring special shielding and of being set in ball bearings so that it turns easily.

The output 31,500 sine wave is fed in place of the crystal in the crystal oscillator in the RCA sync generator.

With the switch in the Xtal position the generator can be locked to an incoming signal, however, in the other positions the generator is normal.

FIG. 8. A double pole, double throw switch was added to the WPIX field sync generators to reverse phase of the 60 cycle power line feeding the "locked-in" circuit.

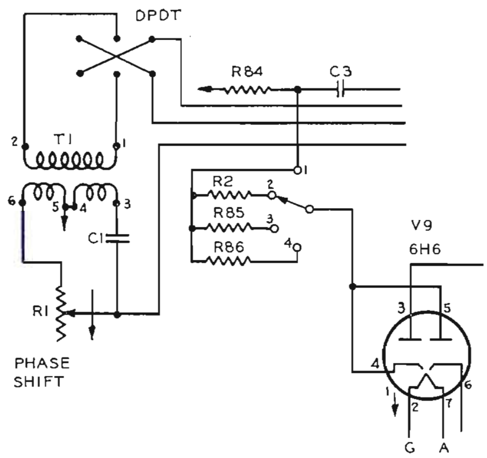
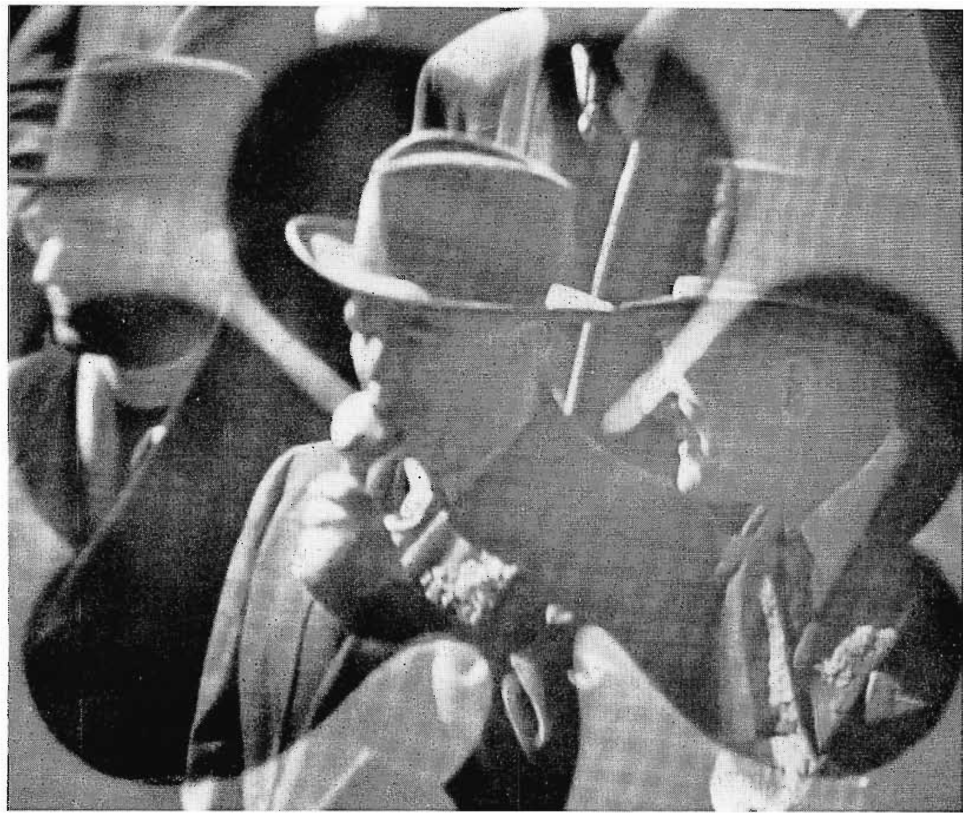


FIG. 9. "Off-the-monitor" picture of Mayor O'Dwyer during 1950 St. Patrick's Day parade.



Operation

In practical operation of both units, the video operator turns the resolver dial so that the vertical and horizontal sync may be seen moving across the face of a cross swept monitor (i.e. one locked or driven by the master control sync generator, whose picture tube grid is being modulated by the remote signal). The resolver dial is turned until the vertical and horizontal sync intervals coincide with that generated by the remote sync generator. This operation requires many turns of the resolver, but it is relatively fast to adjust, since the inertia of the resolver is high and one spin of the dial causes the rotor to turn 40 or 50 times. When the unit is used in the field, the master control operator gives instructions for the phasing of the remote generator over the PL.

The big advantage of the "driven" type sine wave, being fed to the sylsen in the master control phase shifter, is that the energy being fed into the ringing circuit during the vertical (31,500 cps) interval is greater than during the horizontal period (15,750 cps). This makes the voltage out of the ringing circuit greater during the vertical interval. This causes a slight amount of phase modulation during the nine line vertical interval.

Experiments are being made to eliminate this phase modulation and, if they prove fruitless, the ringing circuit may have to be replaced by a driven oscillator.

Fig. 10 shows a diagram of the way the phaser works into the WPIX master control. An RCA distribution amplifier gives the video outputs necessary for this operation. It may be advantageous for the remote to run slightly more than normal video setup.

There is small chance of a program failure due to the phase shifter, since at any time the composite remote signal can be switched to the transmitter. The second sync generator can be switched in instantaneously. In the field the sync generator master oscillator will run free in case there is a receiver failure.

Before using the master control sync generator locked from the phase shifter, the remote sync generator must phase its vertical interval to take care of the film projectors. This operation is worked out over the PL's between master control and the remote.

A 60 cycle phase reversing switch has been installed into the WPIX remote sync generators (Fig. 8) to speed up this phasing. The power around New York City is normally 3 phase 4 wire and it is never known which phase the generator is plugged into, or which way the AC plug is polarized. Whenever possible, the master control generator is locked with the remote generator.

A great many of the sponsors of remote programs at WPIX do quite a bit of superimposing over the remote event, as part of the commercial. If all of this is done in the field, art work must be carried to the remote, light must be provided and, not least of all, space to place the art work must be available. At times an extra camera has been used just to take care of the art work. With the generators locked together, the art work can be left at the studio.

Fig. 9 is an off the monitor picture made during the 1950 Saint Patrick's Day Parade, with New York's Mayor O'Dwyer

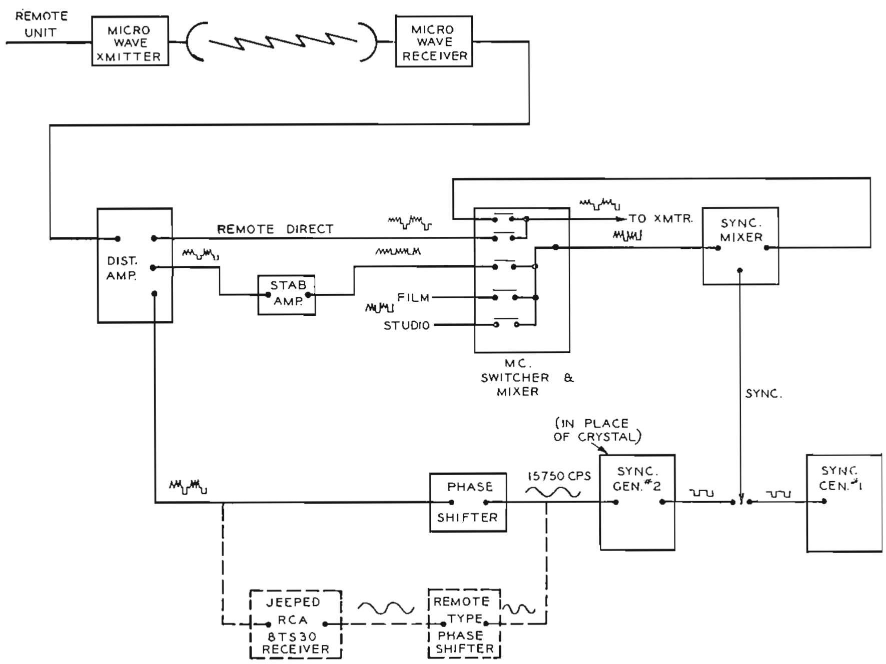


FIG. 10 (above). The video switch in WPIX master control leaves minimum chance of video failure due to locking of sync generators. The added portion shows how remote type phase shifter operates in master control.

shown standing in a Shamrock, which was a slide on a film camera in master control, superimposed over the remote picture. The program was sponsored by R & H Beer and it was a natural for the announcer to refer to a high-stepping, colleen, drum majorette as marching in the R & H Shamrock.

A unit of this type could be invaluable to a station on a network, since the local spot could be superimposed over a network program such as a non-sponsored sporting event.

"WPIXlock" and Grating Generator Facilitate Pulse Width Measurements

Measuring pulse widths (those whose duration is a small percentage of the horizontal sweep interval) is often-times a rather tedious and difficult process. The normal method is by use of an oscilloscope having triggered sweep facilities in order that the pulses might be spread out to an appreciable width on the CRO screen. Also either a built-in or separate unit is required which usually provides pulse markers separated by 1 microsecond. By superimposing these markers over the pulses on the oscilloscope the pulse width is thereby measured. This process has some very decided disadvantages. Primarily it utilizes a type of oscilloscope not normally found in stations operating on a limited Engineering budget. Secondly there is no easy way to calibrate the marker pips to ascertain that they hold at the 1 microsecond separation. Thirdly, it is usually a long process to drive the oscilloscope and to adjust the sweeps so that the pulse widths to be measured (especially those occurring within the vertical sync period) are stretched out properly on the CRO screen. Finally, when markers do not fall at the start of the pulses there is the need for continuous interpolation which gives rise to inherent error in the measurements.

The RMA specifications as to pulse widths are specified in all instances as a percentage of the horizontal interval, such as .04H, 08H, etc. Why not, then, use a unit which will supply marker pips separated by a specific percentage of H, easily calibrated, and then superimposed over the pulses NOT VIEWED ON AN OSCILLOSCOPE BUT RATHER ON THE KINESCOPE where all pulses are spread out

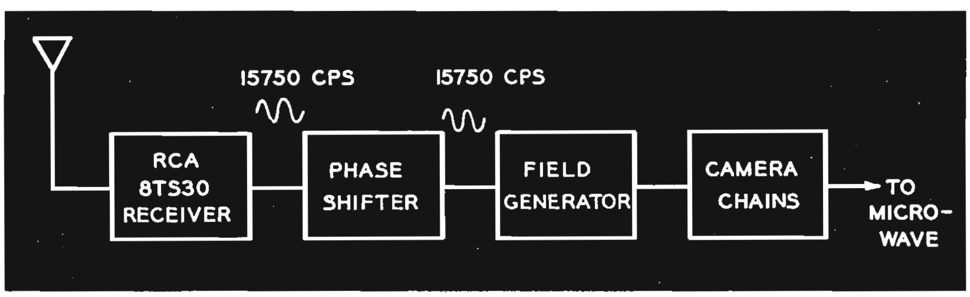


FIG. 11 (below). The synchronizing signal from the master control generator is picked off the air by the RCA 8TS30 Receiver and used to control the field generator.

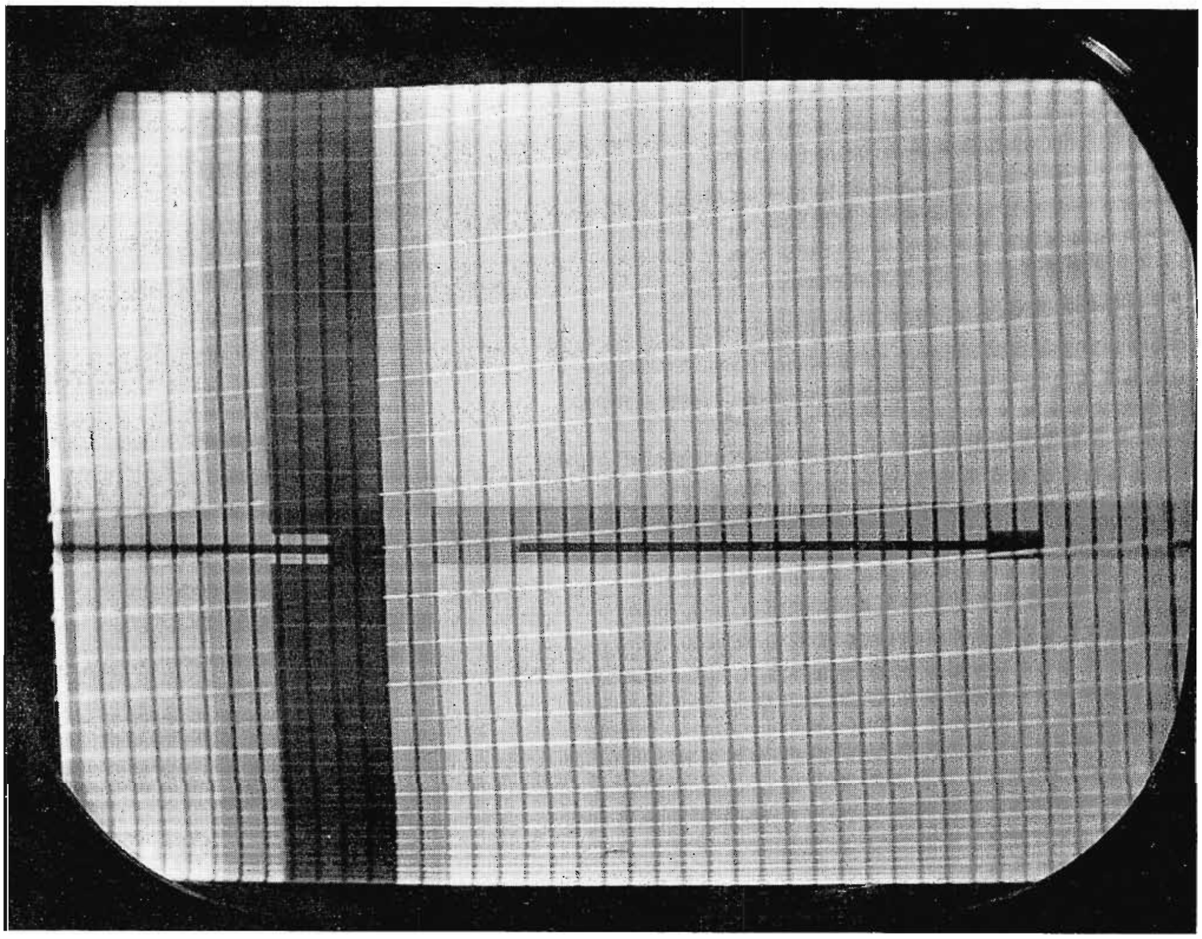


FIG. 12. Kinescope picture showing how bars generated by a Grating Generator may be used to facilitate pulse-width measurements.

very conveniently. Since a grating generator is invariably a normal piece of gear utilized in any television plant let us utilize the bars as generated by this unit as the markers. All that is required is that we devise some method whereby we can easily calibrate the unit. If we drive the kinescope sweeps normally with our local generator driving pulses and then view super-sync on this kinescope, bringing up the brightness reveals the serrrated vertical pulses and equalizing pulses occurring during vertical retrace time. Superimpose the grating generator on this picture (merely by mixing the grating generator output with the supersync we are viewing) and using only the vertical bars adjust their separation so that 25 bars occur between the start of any two successive vertical serrated pulses. Since this interval is time established by the sync generator as ½H, by putting 25 bars within this interval we find that the distance between any two bars is ½H × 1/25 or .02H. This is a very convenient value as we find in nearly all cases pulse widths are specified in an integral number of .02H intervals, or at most an integral number of .01H intervals. 50 bars would give .01 spacing but this number of bars is difficult to count and to work with. With the bars set for .02H spacing it is a simple matter to count the number of bars occurring within the serrated vertical interval as we are viewing it on the kinescope and this interval can be adjusted to the proper width. Equalizing pulses, likewise, can be measured as they, too, appear on the raster. Similarly by half-speeding the kinescope sweeps the pulse widths can be measured during the horizontal interval. By adding blanking from some film or camera chain we can also measure horizontal blanking and porch widths. The one drawback at this point is that the first two bars as generated by the grating generator are of different spacing which gives rise to an error in the width of blanking as measured by the number of bars falling within this interval.

With the advent of the phasing unit developed at WPIX two difficulties encountered in measuring pulses as just described are alleviated, namely difficulties arising from the non-linear spacing of the first two bars formed and the possible difficulties in half-speeding the Master Monitor. Drive the station gear with sync generator #2 and feed a film or camera chain, mixed with super sync to the master monitor, along with the grating generator output. Drive the master monitor and the grating generator from sync generator #1 and when this generator is displaced in phase from sync generator #2 by the proper amount by means of the phasing unit we can view both the entire vertical interval and the horizontal period simultaneously on the kinescope. By so doing we have moved these intervals away from the non-linear first two bars of the grating generator and all measurements are taken with proper bar intervals and without the need for further half-speeding of the monitor. Also, by means of the phasing unit, we can move the viewed intervals to any point on the kinescope (the bars, however, will stay stationary) so that any pulse we wish to measure will have a grating bar at the very start of the pulse. Indeed if the bars have been set properly we will automatically have a bar start at the very beginning of each equalizing pulse, each vertical serrated pulse, and at the start of the horizontal sync pulse. Thus we can very easily read all pulse widths and porch widths directly off the kinescope by merely counting the number of bars within the pulse intervals.

"RADIOMIKE" COVERS REMOTES FROM HELICOPTER

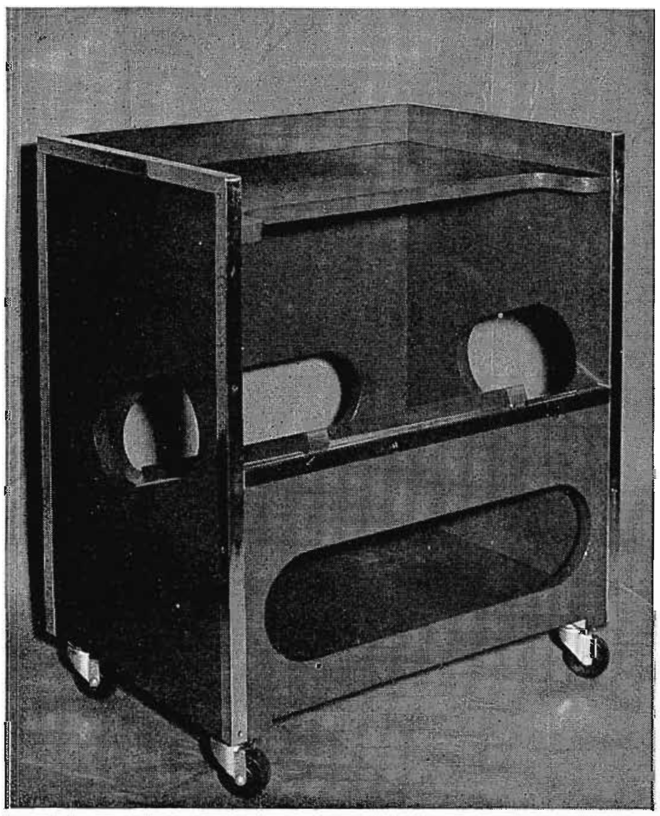
FLYING HIGH in the Hiller Helicopter, Paul Bunyon Network's General Manager Les Biederman does a selling job to Traverse City, Mich., townspeople with the new RCA radiomike. From his lofty perch Mr. Biederman found good coverage over a two-mile area while the plane hovered 200 feet above ground. Michigan's WTOM Traverse City, WATT Cadillac and WMBN Petoskey, are Bunyon stations.

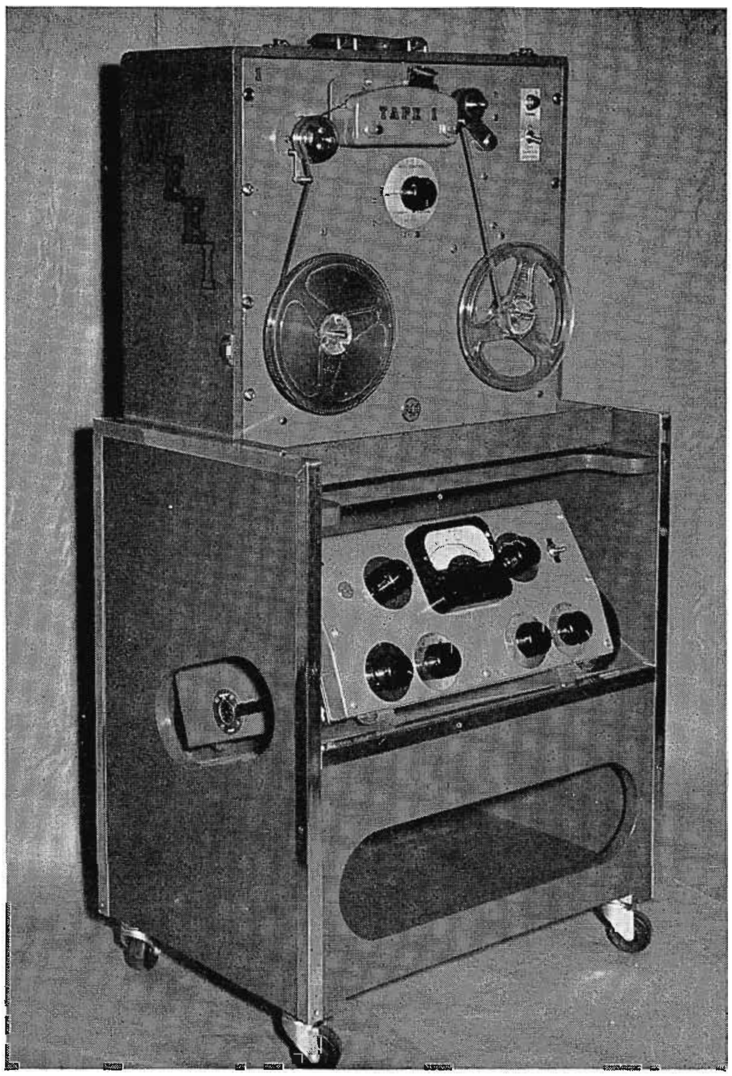
UNIQUE TAPE RECORDER CONSOLE AT WEEI

WEEI (CBS), Boston, Mass.

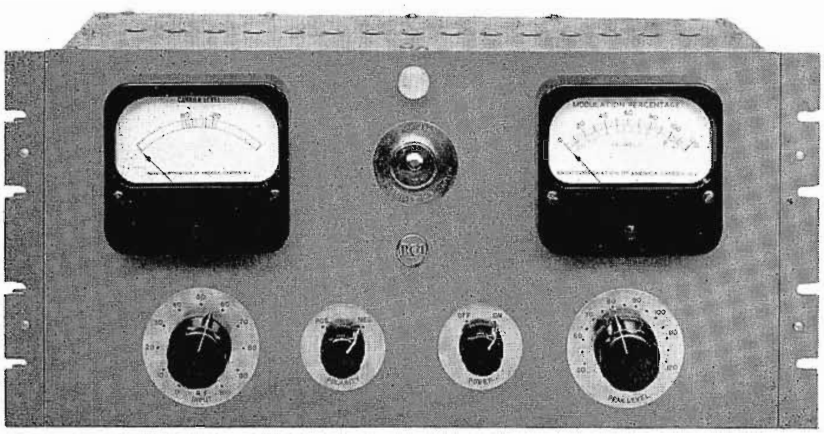
FIG. 1 (at right). WEEI's RCA Tape Recorder shown mounted in a special movable table designed by A. E. Teachman, WEEI Technical Supervisor. Recorder Unit is mounted on top and amplifier unit below with all controls accessible.

FIG 2 (below). View of the completed Recorder Console with recording equipment removed. Note that sturdy casters are used. All plugs and receptacles of the amplifier unit are easily reached through porthole provided. A storage space at the bottom is available for extra reels, records, etc.





New AM MODULATION MONITOR, TYPE BW-66E NOW AVAILABLE FROM STOCK



Here Are a Few Features of the New Instrument:

- OPERATES AT LESS THAN ONE WATT R-F POWER (0.35 WATT IN 75 OHMS).
- INDICATES BOTH NEGATIVE AND POSITIVE PEAKS IN PERCENTAGE MODULATION AND IN DECIBELS.
- MEASURES CARRIER AMPLITUDE SHIFT WITH MODULATION.

The RCA Type BW-66E is an Amplitude Modulation Monitor of new design which gives continuous direct-reading indications of percentage modulation. It is designed for use with broadcast transmitters operating in the frequency range of 500 to 2500 kc. Specifically, the monitor performs the following functions:

1. Measures percentage modulation on either positive or negative peaks.
2. Provides indication of overmodulation.
3. Enables program level monitoring.
4. Measures carrier amplitude shift when modulation is applied.
5. Measures transmitter audio frequency response.

The new monitor consists of three basic elements: (1) A linear diode rectifier which gives an instantaneous output voltage proportional to the carrier envelope, (2) A peak voltmeter which gives a continuous indication of the peak modulation, and (3) A trigger circuit which flashes a light whenever the modulation momentarily exceeds any previously set value.

The linear rectifier is designed for operation at a low power level, which greatly simplifies the coupling to the transmitter. Two auxiliary audio output circuits operating from a separate diode rectifier are provided. One of these, at 600 ohms, is intended for audible monitoring; the other is a high impedance circuit which gives faithful reproduction of the carrier envelope with less than 0.1% distortion. This output circuit can be connected directly to the RCA WM-71A or 69C Distortion and Noise Meter, enabling overall fidelity and noise measurements to be made on the transmitter.

For additional information on the BW-66E, write Broadcast Equipment Sales Section, RCA, Camden, New Jersey.

WILEY WENGER REPRESENTATIVE IN CLEVELAND

WILEY WENGER

Wiley Wenger has been named Sales Representative for RCA Broadcast and Television Equipment in the Cleveland Region, which includes Ohio, Kentucky and parts of Indiana and Illinois. Mr. Wenger will make his headquarters at 718 Keith Bldg., Cleveland, Ohio. He succeeds R. C. C. Dubois, Jr., who has joined the RCA Communications Equipment Section at the home office in Camden.

Wiley has had extensive experience in the Broadcasting Field. His first commercial assignment dates back to 1925, at Dayton, Ohio, where he built WSMK, now WING. He joined the staff of WBBM in Chicago in 1926 and in the following year, he became chief engineer of KTNT, and subsequently the chief engineer of KFNF and WCAR.

Mr. Wenger first became associated with RCA in 1943, when he was appointed Field Representative for R-F Industrial Heating Equipment. He left RCA in 1947 to work with the Industrial Electronics Control Mfg. Company in Illinois, where he developed several r-f heating equipments. Mr. Wenger has been active in amateur radio and developed an electronic key "bug" which has been very successful.

Wiley has been active in IRE, AIEE, and the National Plastics Society. He has written several articles on the subject of heat sealing by means of radio frequency generators. He has several patents issued on r-f heating and also on edge recording of plastic tape.

NAB MAKES *"MERITORIOUS SERVICE"* AWARDS TO RCA ENGINEERS

H. E. ROYS
Advanced-Development, Audio Engineer

W. E. STEWART
Manager, Broadcast Audio Engineering Sect.

The National Association of Broadcasters recently conferred awards of "Meritorious Service" to W. E. Stewart and H. E. Roys (RCA Broadcast Audio Engineers) for their achievements in the development of NAB RECORDING AND REPRODUCING STANDARDS.

Mr. Neil McNaughten, chairman of the NAB "Standards" committee in presenting the awards, commended Mssrs. Roys and Stewart for the thoroughness of their efforts, and for the high degree of perfection which the standards represent today.

Continuation of a Series of Low- and Medium-Power Station Stories (see BROADCAST NEWS, No. 56)

KPRS . . . 1 KW AM

Olathe, Kansas

By DANIEL M. REED
Chief Engineer

Radio Station KPRS which first went on the air in July 1949, is owned and operated by the Johnson County Broadcasting Company, of which Mr. L. H. (Tex) Witherspoon is President and General Manager. Formerly a Lieut. Commander at the U. S. Naval Air Station, Mr. Witherspoon also had previous experience with CBS and Don Lee on the West Coast.

KPRS, Johnson County's first Radio Station, serves an area with over 1,000,000 population which includes Jackson, Douglas, Johnson, Miami, Leavenworth and Wyandotte Counties. (Commonly referred to as the "Billion Dollar Market.") The station employs AP news services and supplies AP with most all radio news originated in Kansas. Station programming policy is that of a true "family" station which furnishes the latest news and features fine music.

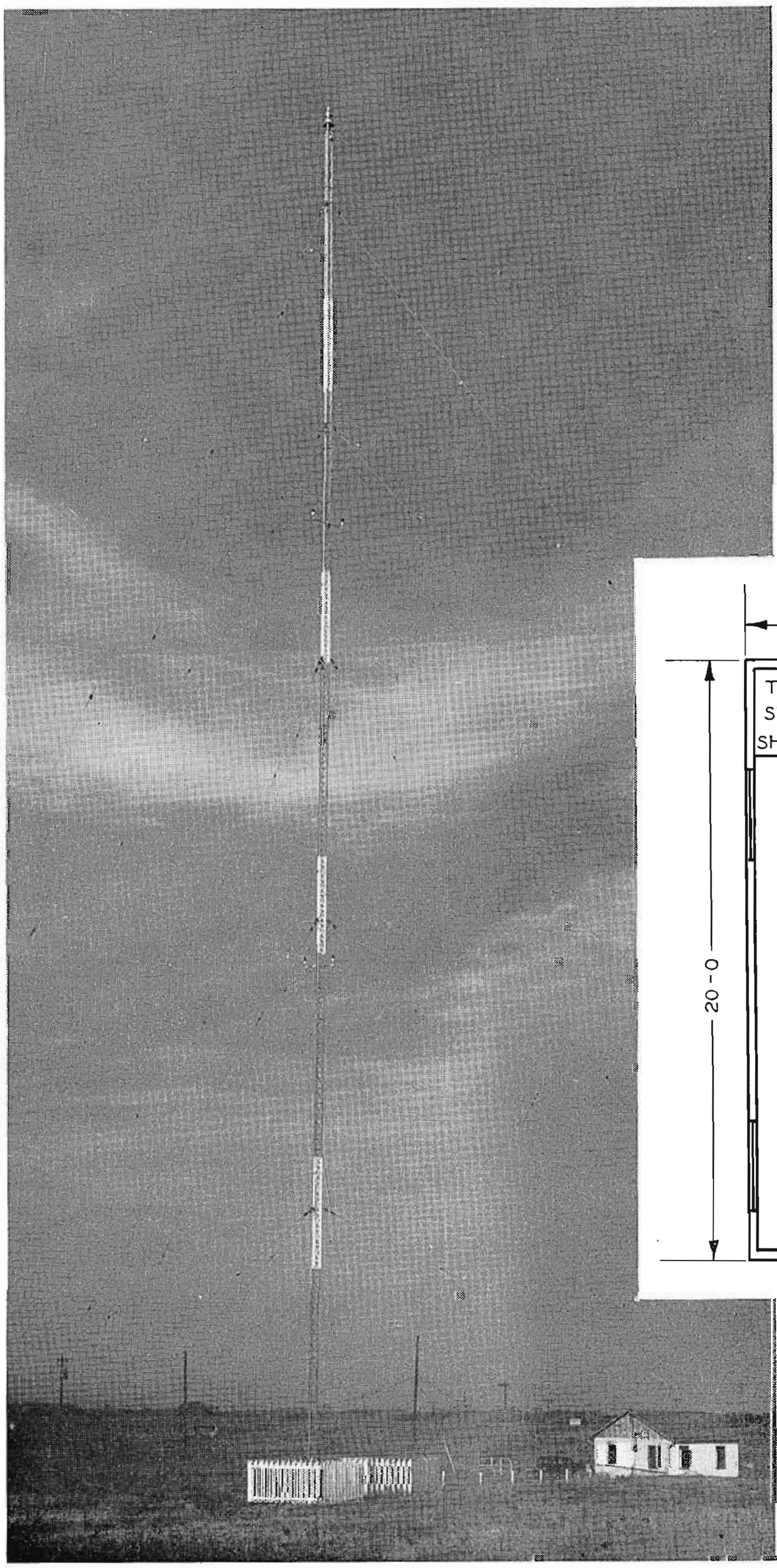


FIG. 1 (at left). The KPRS transmitter building and tower site is located southwest of Olathe.

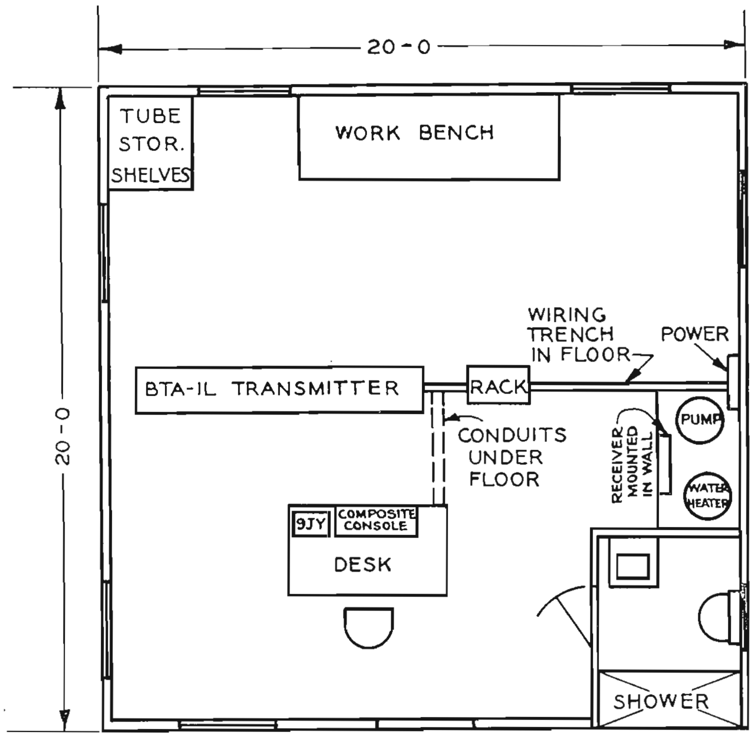


FIG. 2 (above). The transmitter building floor plan layout. A minimum space of approximately 20 feet by 20 feet accommodates the entire transmitter plant facilities.

The station operates from dawn to dusk on 1590 KC at a power of 500 watts. The primary coverage of KPRS includes a radius of about 50 miles from the transmitter.

1 KW AM . . . KPRS

Olathe, Kansas

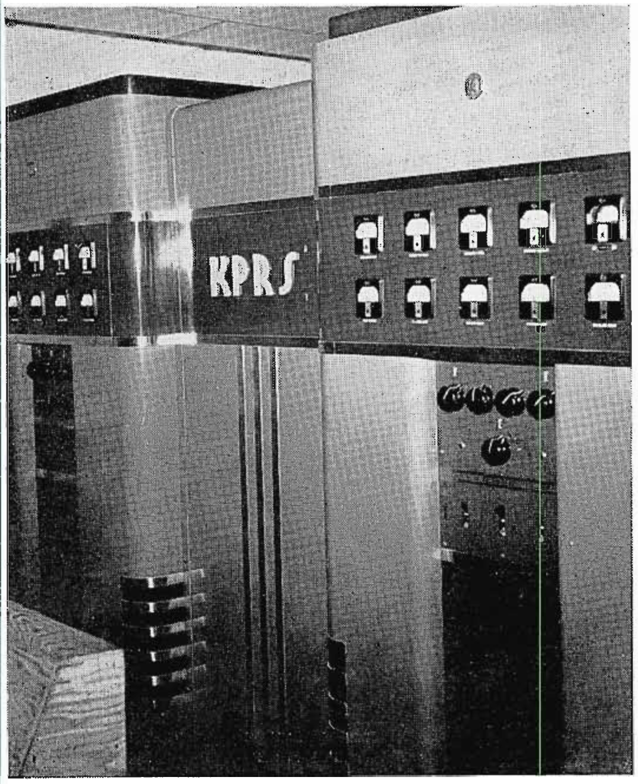


FIG. 3 (at left). The KPRS transmitter is an RCA BTA-1L, 1 KW equipment, presently being operated at half power.

Transmitter and Building

The KPRS transmitter, building and Wincharger tower are located about a mile southwest of Olathe. The transmitter building is constructed of cement block and is laid out to be as compact and economical of space as possible. Additional equipment includes an RCA 9AX cabinet rack in which frequency and modulation monitors, limiting amplifier and jack strips are mounted.

The transmitter employed is an RCA, BTA-1L, 1-KW which is operated at reduced power. Transmitter design includes the RCA 250 Watt transmitter which is used as exciter for the 833-A Power Amplifiers operating in a Class C push-pull circuit. Plate modulation is accomplished by two 833-A tubes operating Class B. The transmitter occupies a floor area of approximately 14.5 square feet. KPRS has logged nearly 5000 hours on the air without any serious trouble or even the replacement of a tube in its RCA transmitter.

Studios

The KPRS studios and associated control room equipment are located in Olathe. Extensive remodeling was carried out to provide modern studios and offices at this location. Studio and control room equipment includes RCA 77-D and 44BX microphones, RCA 70-D turntables and two 45 rpm record players.

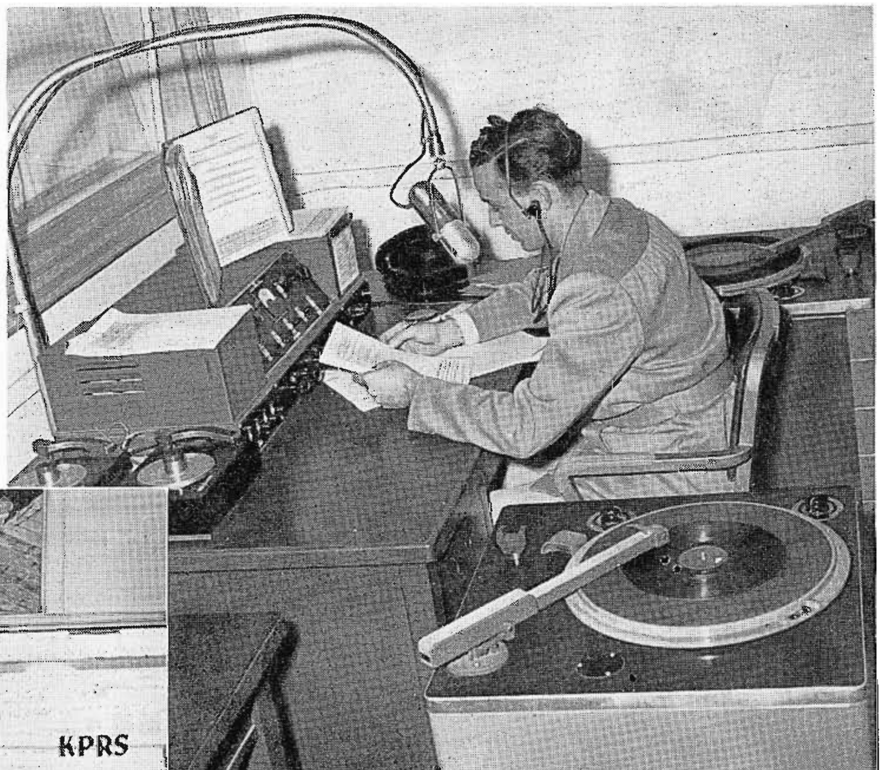


FIG. 4 (above). In the KPRS Studio Control Room are located two RCA 70-D Turntables, console and two 9JY RCA "45" record players.

FIG. 5 (at left). Shown here in the KPRS studio (prior to Hallowe'en celebration) are: left, Mr. Tex Witherspoon, President and General Manager, and at right, Mr. Steve Madden, Station Manager.

KVFD ... 250 W AM-3 KW FM

Fort Dodge, Iowa

By DAVID G. SINCLAIR
Chief Engineer

In the past ten years, KVFD has established itself as one of the outstanding local stations of the country. In October, 1947, it added a sister station, KFMY, the first full time FM station in Iowa, operating on 102.7 megacycles and with radiated power of 10,000 watts.

Most of that time KFVD (The Northwest Broadcasting Co.) has been affiliated with the Mutual Broadcasting System and the Iowa Tall Corn Network. Its manager, Ed Breen, has been a director of the National Association of Broadcasters and president of the Iowa Tall Corn Network. The station has won many awards—two first place in Billboard awards, 1945 and 1947, it has won a $500 War Savings Bond as a first in a Mutual promotion and has placed or been a runner-up in every Mutual station promotion in those ten years.

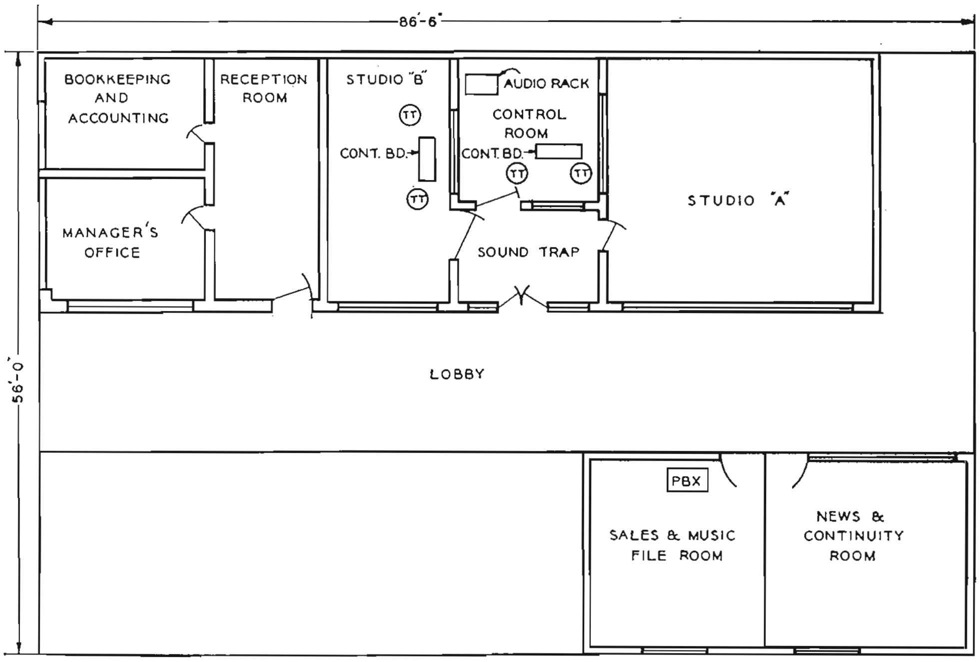


FIG. 1 (above). KVFD/KFMY studio floor plan layout for two studios and control room.

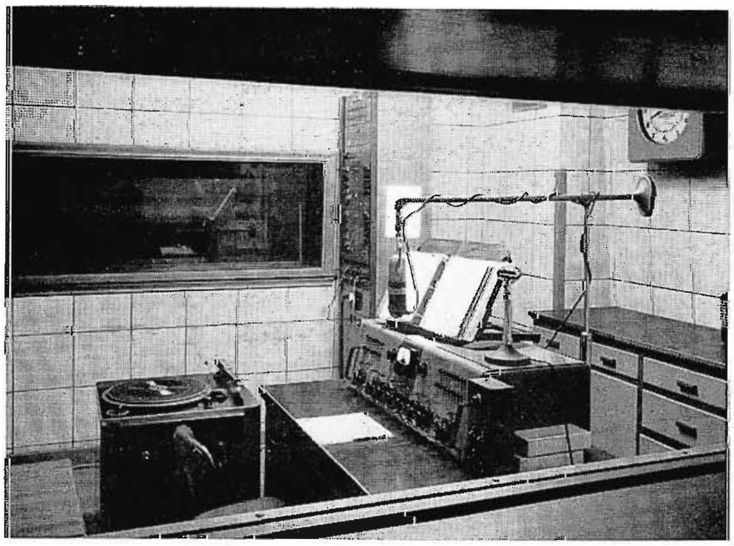
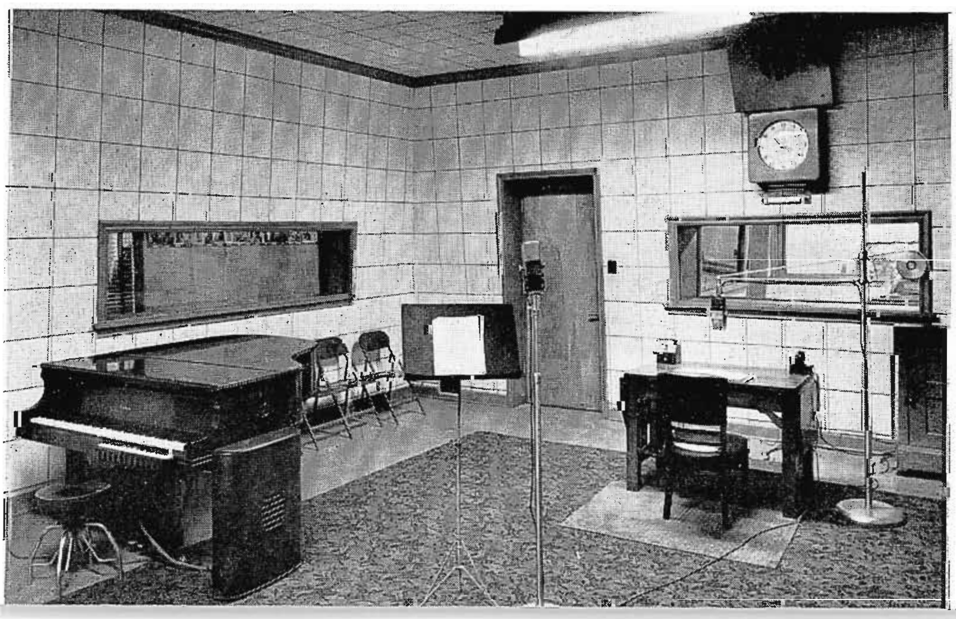


FIG. 2. Control room, looking through window into Studio "A". Equipment includes—RCA consolette, 70-D turntable, 77-D microphone and equipment rack.

FIG. 3. View of Studio "A". Window at right looks into control room and Studio "B". Window at left looks into lobby.



KVFD Studios

The studios are located in down town Fort Dodge in the Warden building, the largest building in town. Back in 1939 the trend was to have studios in town and the transmitter site outside the city limits. However, we eventually plan to have our studios and transmitter all housed in one building just at the edge of the city. Having the whole operation housed in one convenient building close to town in this day when everyone has an automobile will, we believe, work out better.

Our two studios and control room are treated with Johns-Manville acoustical tile backed with rock wool and the walls are slanted. This makes a sound-proof studio with good acoustics. Studio A is equipped with two 44BX RCA microphones. This is where nearly all of our live shows take place. The control room has an RCA Consolette so placed that the operator can see into Studio A or B and control programs from either studio. The audio rack contains amplifiers for feeding network to two other Iowa stations. A recording amplifier, a VU meter, and the necessary patch panel.

250 W AM-3 KW FM . . . KVFD

Fort Dodge, Iowa

Studio B can be used as an extra studio controlled by the consolette in the control room or it can be used to feed our AM station when we are running two different programs, one for AM and one for FM. However, it is used most of the time as a recording studio. The RCA consolette makes it very convenient for controlling and recording various types of programs, whatever their source happens to be. We use only tape recording equipment, no disc or wire.

Transmitter Equipment

The transmitter site is located one and a half miles southwest of Fort Dodge. The transmitter building is too small for our operation and is pretty well filled up with equipment, but we hope to rectify that some day. The little white building beside the transmitter building is a storage spot and comes in very handy. The AM transmitter is a 250K RCA and has been running faithfully for the past ten years. It has given us very little trouble and has been very easy on tubes. The FM transmitter is a 3BTF RCA and is not only a good looking transmitter but has given us good service.

All of the equipment in the transmitter building is RCA with the exception of the Doolittle FM frequency monitor and the Andrews dry air pump. The workshop and test equipment are located in the basement of the transmitter building. A large exhaust fan is located in the ceiling to keep the building cool in the summer.

Six hundred feet of 3⅛ inch coaxial line is used to feed the FM antenna and 300 feet of ⅞ inch coax is used to feed the AM antenna. The antenna system is rather unique. We have a 317 foot Wincharger tower which is used to radiate our AM signal. The 3⅛ inch coaxial cable is suspended on springs and runs up the center of the tower. It is insulated from the tower a quarter wave up. The FM antenna is mounted on the side of the tower at the very top. So far the tower has withstood one cyclone, a ninety mile an hour wind, and severe icing conditions.

Our FM station KFMY was planned and constructed entirely by the engineering staff of KVFD. From the FCC application to the installation of all the equipment, including all tower construction work, our own engineers did the job. It was even necessary to design and make our own transmission line mounting hardware for the tower as none was available at the time.

FIG. 4. The KVFD transmitter equipment. At the left is the RCA 3 KW FM and at the right the RCA, 250 W AM Transmitter.

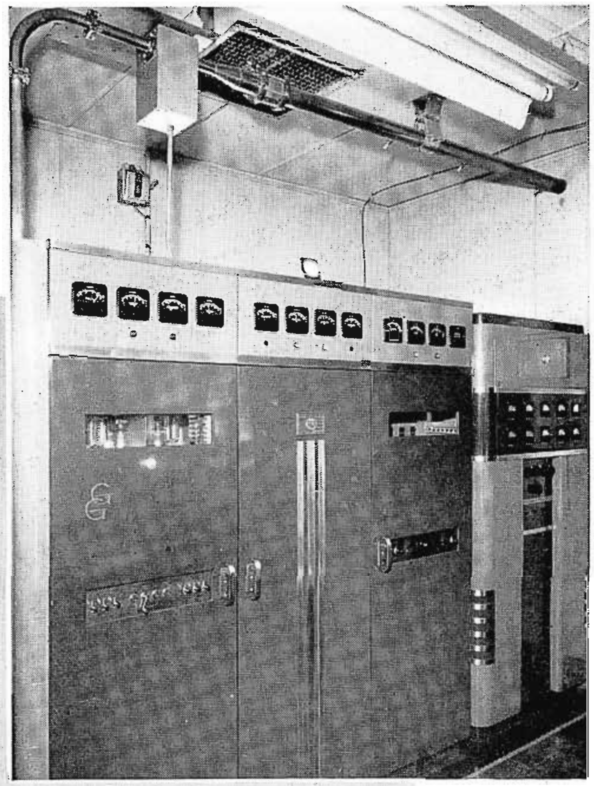


FIG. 5. View of the KVFD-KFMY transmitter site. At left is the transmitter house and at right, the storage shack.

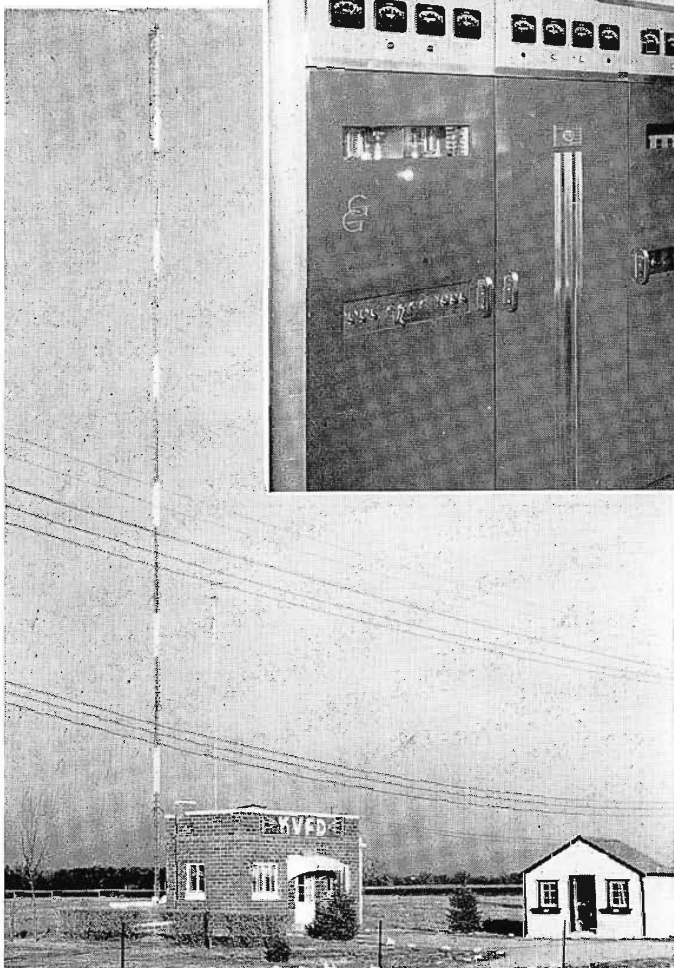
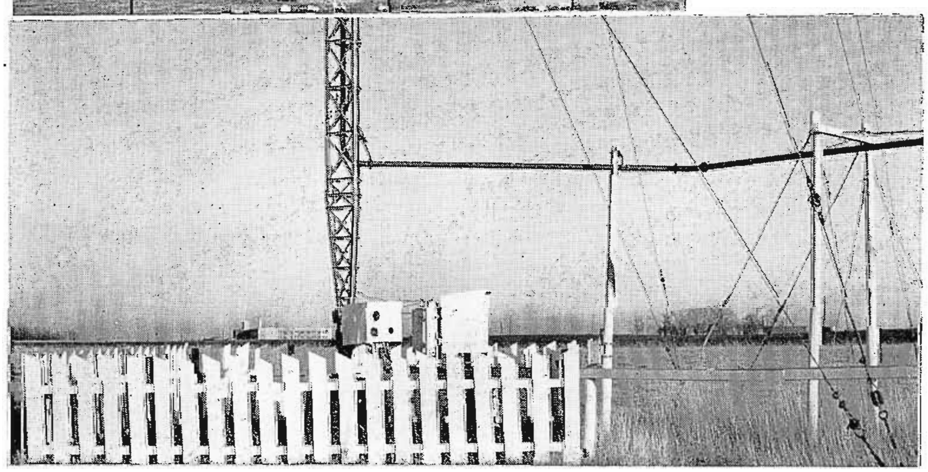


FIG. 6. Photo of coupling unit and lighting chokes for AM. Also visible is 3⅛" coax line running up center of tower.



WDHN . . . 1 KW FM

New Brunswick, New Jersey

By

NEIL ARVESCHOUG
Chief Engineer

JACK CASEY
Program Director

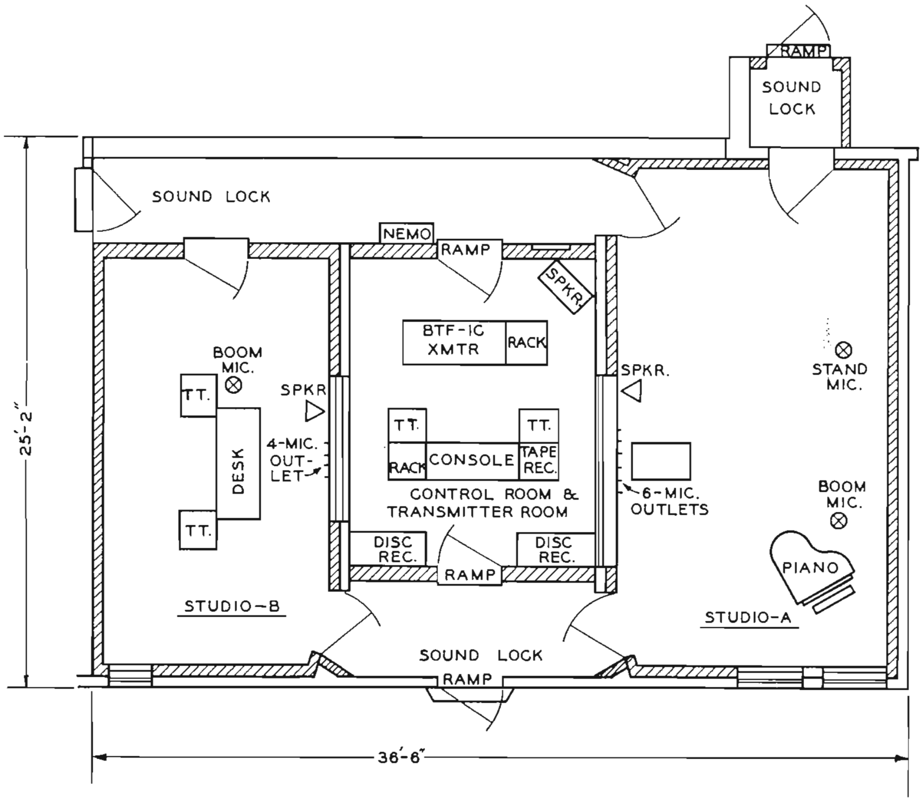


FIG. 1 (above). WDHN floor plan layout which shows how transmitter and studio facilities are combined in a compact area.

On May 7, 1950, WDHN celebrated its second anniversary in the broadcast field. In that relatively short period, the station has built an enviable reputation throughout Central New Jersey for its wide-spread coverage of sports, news and special events. In addition, WDHN has pioneered in the TV field, having conducted tests in the Ultra High Frequency bands at both 500 and 700 megacycles.

The energetic station is owned and operated by the Home News Publishing Company, publishers of The Daily Home News and The Sunday Times. It is situated in downtown New Brunswick in a modern two-story brick building which also houses the editorial, advertising and business personnel of the newspapers.

A compact, functional control room between Studio A and Studio B, provides the control engineer complete vision into both rooms. For efficiency and ease of operation, the transmitter has also been placed in the control room at the engineer's back. Thus, simply turning around from the console gives him all the meter readings and adjustments at a glance.

Also in the control room are two disc recorders, two tape recorders (portable), one turntable, one patching and monitoring rack and a 15 inch monitoring speaker.

Both studios have semi-floating walls and floors, polycylindrical treatment and cork insulation throughout. "A" is 24 feet by 13 feet with six mike outlets, two

FIG. 2 (at left). View into the control room showing the 1 KW FM transmitter. Left to right are: Neil Arveschoug, Chief Engineer; Joe Balogh and Gene Halasz.

spares, one boom mike, one stand mike and two table mikes. This studio is used for everything except platter shows, which are put on from "B". This smaller studio is 20 feet by 11 feet with two mike outlets, two turntable outlets and two portable telephone outlets for request record shows.

The transmitter is an RCA 1 KW FM and located in the control room. (This is the only transmitter in the station, no standby deemed necessary.) General studio and transmitter arrangements are such that any combination of microphones, turntables, disc recorders, tape recorders, etc., can be accomplished through patching. Five mikes can be used at one time in Studio "A", if necessary. Four mikes or two mikes and two turntables can be used simultaneously in "B". Recording can be done in either studio, with either tape or disc, while the other studio is on the air.

On a steel flagpole, some 350 feet away from the transmitter, is the station's Andrew Multi-V type antenna. Messenger cable is used to support the ⅞ inch coaxial cable which runs across the WDHN parking lot and up to the First National Bank where it terminates at a spot on the flagpole approximately 136 feet above the street.

WDHN has concentrated its programming on sports and news coverage along with extensive public service shows and special events, both in studio and outside. The station's record library of more than 6,000 platters is used freely for musical interludes and also for the two-hour nightly request show.

The station is vitally interested in television and has an application for a commercial license on file with the FCC.

Neil Arveschoug, Chief Engineer, heads the technical staff of four. Gene Halasz and Joe Balogh are the two full-time engineers under Arveschoug while a third man fills in on week-ends. Jack Casey is the Program and Sports Director while Lloyd Burns heads the Commercial and Sales departments. General Manager is Hugh Boyd.

FIG. 3 (above). The two RCA, 70-D Turntables above are located in studio "B". Sal Domino, staff disk jockey, is seated before the mike.

FIG. 4. WDHN's record library consisting of more than 6000 transcriptions provides a wide variety of musical entertainment.

KXYZ . . . 5 KW AM

Houston, Texas

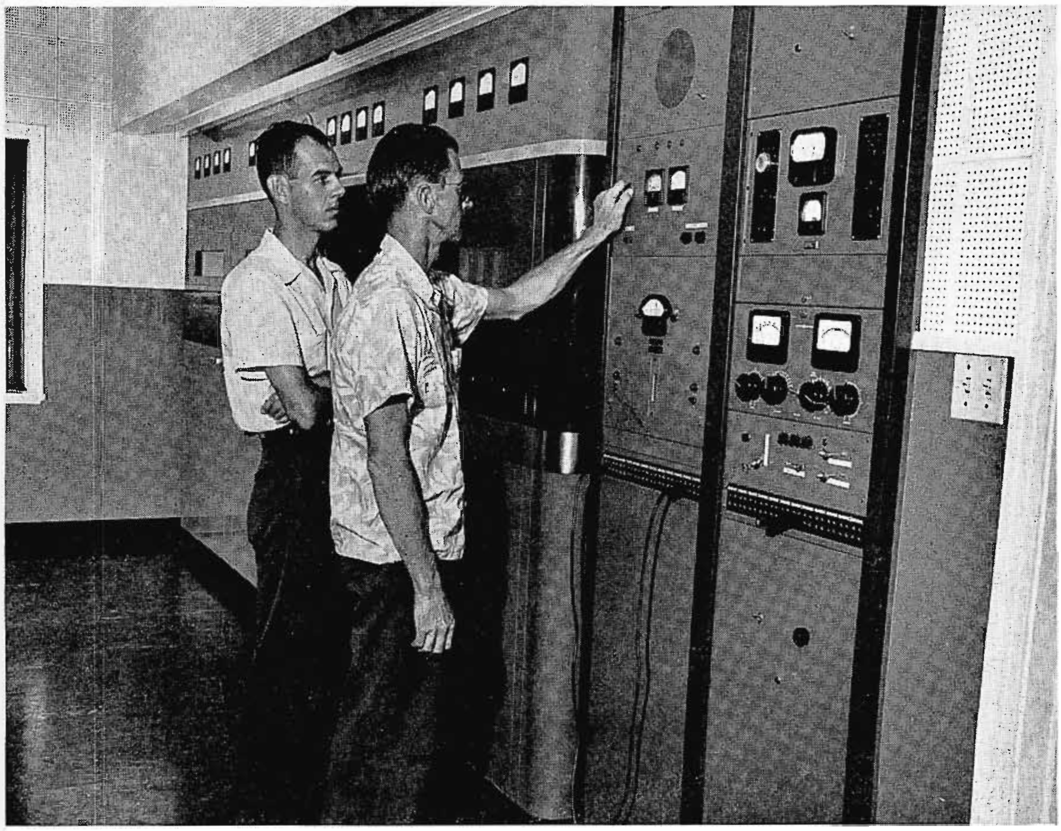


FIG. 1 (above). Front view of the RCA, BTA-5F AM transmitter. Visible in front of equipment racks are: C. V. Clarke, Plant Engineer (left), and J. F. Byrne, Operator (right).

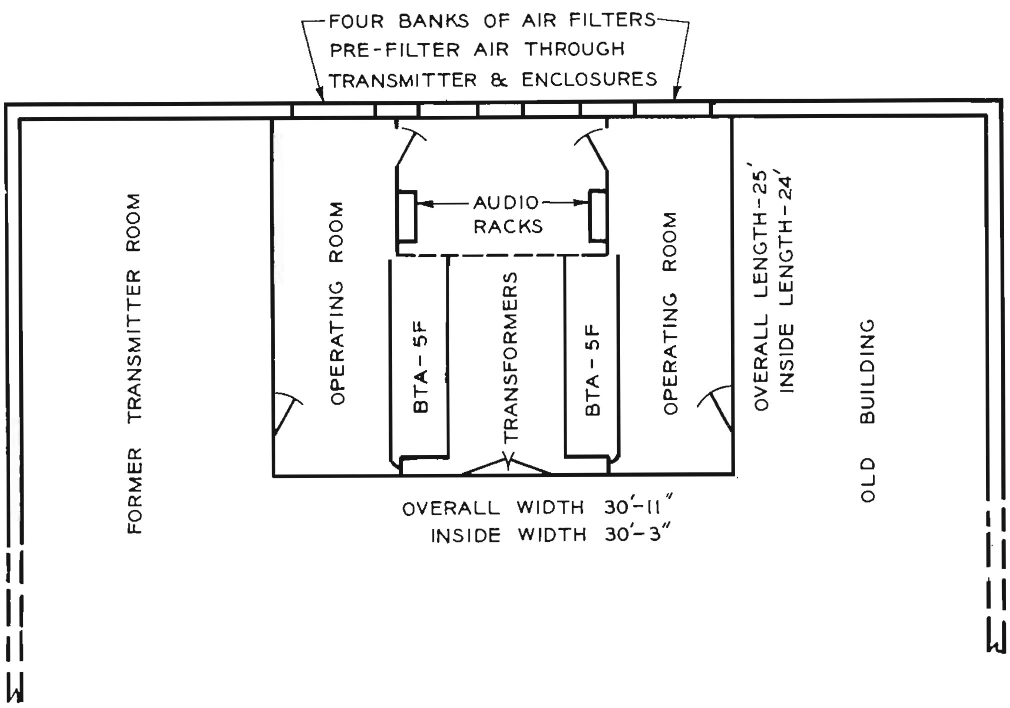


FIG. 2 (above). Floor plan of the KXYZ layout in which the 5 KW transmitters of different stations are located.

By

GERALD R. CHINSKI

Technical Supervisor

On May 1, 1950, KXYZ, owned and operated by the Shamrock Broadcasting Company of Houston, Texas, put into regular operation a new RCA BTA-5F. The new transmitter replaces an old RCA 5-C which had been in continuous operation on 1320 KC in the same plant building for 15 years.

From the time a decision to replace the old transmitter was made, the engineering staff of KXYZ was faced with the familiar problem of executing the job without disturbing the station's regular programming operation. Since no change in frequency or power was involved, this would ordinarily have been fairly simple. However, in our case there were several factors that produced complications. The most important complication was presented by the fact that the plant building also housed the 5 KW—5-C transmitter of another regional station, KPRC. As a matter of fact, the Houston Post Company, operators of KPRC, had, coincident with KXYZ, decided to retire their transmitter of equal vintage and replace it with a new RCA BTA-5F. This means that two 5KW transmitters were to be replaced simultaneously in the same plant building.

A careful survey of plant space revealed that it would not be possible to install both new transmitters in the efficient manner which we desired without some new construction.

Accordingly, it was elected to add to the plant floor space by building in between two wings of the structure as shown in the floor plan sketch. This construction work was started in January of 1950 and delivery schedule of the new transmitter was so adjusted that when they arrived at the Port Houston Docks in March they were trucked at once to the plant and set in permanent position for wiring.

As will be noted from the sketch, the new building construction actually is composed of three enclosures, the middle one being common to the rear of each BTA-5F transmitter. The attic under the roof over the new addition is equipped with suitable exhaust fans and venting louvre to provide for the movement of over 7,000 cubic feet of air per minute. This air is brought into the enclosures through three separate banks of cleanable type filters so that all air passed through and around the transmitters is prefiltered.

A further provision is made to allow for manually adjusting the attic exhaust louvre so that the warm air can be recirculated in the operating enclosures for heating when desired. Manually operated louvres are also provided ahead of the prefilter banks to reduce or shut off the air flow through them in cold weather.

Since so many of these excellent transmitters are in service and their performance is so well known, no attempt will be made here to specifically describe the KXYZ, BTA-5F. Suffice to say that it meets fully, in every way, all specifications and expectations.

When we dedicated the new transmitter on a fifteen minute program at 7:45 P.M. May 1, 1950, we took advantage of a device which we feel may be of some interest. Since, after all, we still had a 5 KW AM transmitter, we had to think up some method of promoting the new facility to the average listener. Promotion-wise we had, for several weeks prior to the dedication, run ads and spot announcements to the effect that KXYZ would shortly have "BTA-5F" which would mean "cleaner, clearer and stronger" reception.

To determine how we could best illustrate the "stronger" reception on the same carrier lever, C. V. Clarke, our plant engineer, and I made some comparison tests between the old and new transmitter under maximum practical volume limiting conditions for each. With our new volume limiting amplifiers which were deliberately made a part of the new installations, we found that we could use a full six decibels greater limiting than on the old transmitter. Further, the distortion throughout the pass band was less.

Having determined a definite advantage, we then set about instituting what we felt would be the best and simplest

method of displaying it. This involved beginning our programming the morning of May 1 on the BTA-5F transmitter with everything normal to permanent operation except that a six decibel pad was inserted in the program line with provision for instantaneous disconnect.

Programming throughout the day then, up to a predetermined cue time in the dedicatory slot at 7:45 P.M., was essentially as it always had been before on the old 5-C.

The dedicatory program itself contained the usual interviews and build-up to the crucial time when, during a specially selected musical number, the executive vice-president of the company, Mr. Fred Nahas, pressed a button which, in effect, placed the BTA-5F in full modulation capacity operation.

The "gimmick" was well received by many interested listeners and evoked considerable favorable comment. A transcription made of the dedicatory program from an "off air" receiver shows rather dramatically how much difference a six decibel change in level can make especially when displayed under controlled conditions.

While one might be inclined to the opinion that there was some element of trickery in this device, it is the honest feeling of the staff of KXYZ that certainly none was intended. Our sole purpose was to use some practical method to display to the lay audience a technological advantage of our new installation which we know to exist.

After all, we are a commercial broadcast station and our stock in trade is our signal—its legibility as well as its composition.

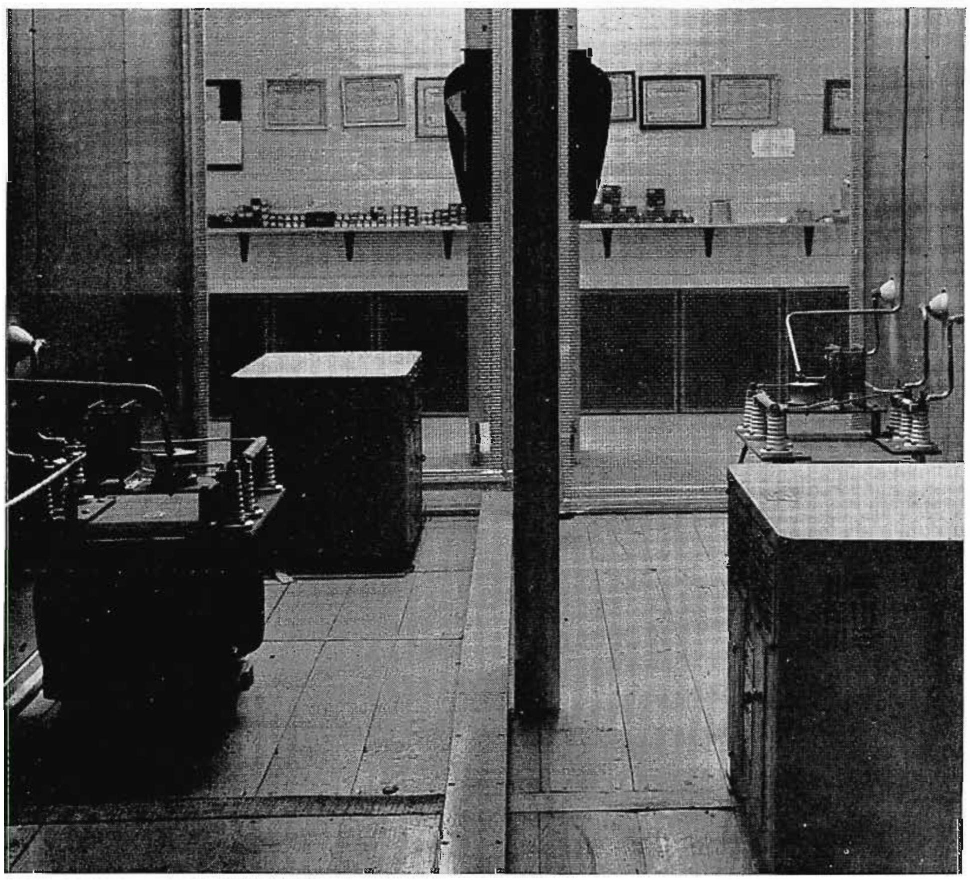


FIG. 3 (above). Central enclosure showing a rear view of the KPRC transmitter at left and rear view of KXYZ transmitter at right.

WSGN ...3 KW FM - 5 KW AM

Birmingham, Alabama

by J. V. SANDERSON

Chief Engineer

High atop Red Mountain, just 10 minutes from the business center of Birmingham, Alabama, Stations WSGN and WSGN-FM occupy one of the best radio sites in the country. From this location, the stations eventually will beam television down into the thickly-populated areas on either side, and throughout the state of Alabama. Owned and operated by The Birmingham News Company, these stations are under the direction of Henry P. Johnston, executive vice president of the company, and managing director of the radio operations.

Tower and Antenna

WSGN and WSGN-FM, in cooperation with a competitive corporation, the Voice of Alabama, of which Thad Holt is president and managing director, have built a joint tower, and are broadcasting simultaneously different and competitive programs. This is the first instance in the United States that two separate and competitive corporations have operated three stations jointly over one tower.

The tower, which rises 541.5 feet, is on the highest point of Red Mountain. On top of this super-structure is the four-bay Pylon antenna, which is the joint antenna for Stations WSGN-FM, the ABC network outlet, and WAFM, the CBS outlet. On top of this antenna is a Television super-turnstile, which is now used by WAFM-TV, and will be used jointly by WSGN-TV, provided the FCC approves the application of The Birmingham News Company, which has been caught in the "freeze". The joint operation is made possible by specially-built RCA filters.

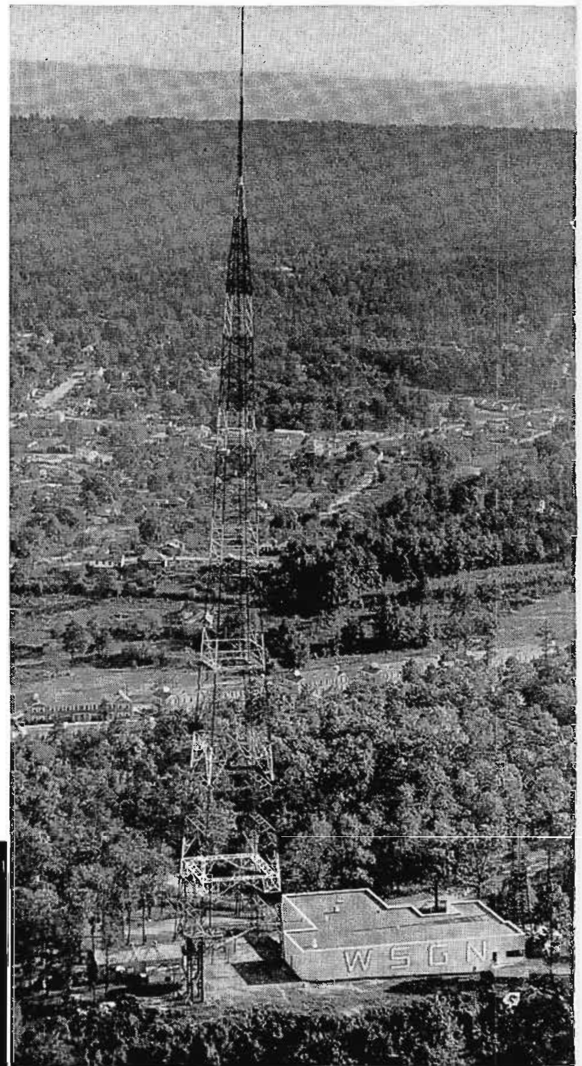


FIG. 2 (right). A simple antenna and tower combination accommodates four transmitters (two FM and two TV).

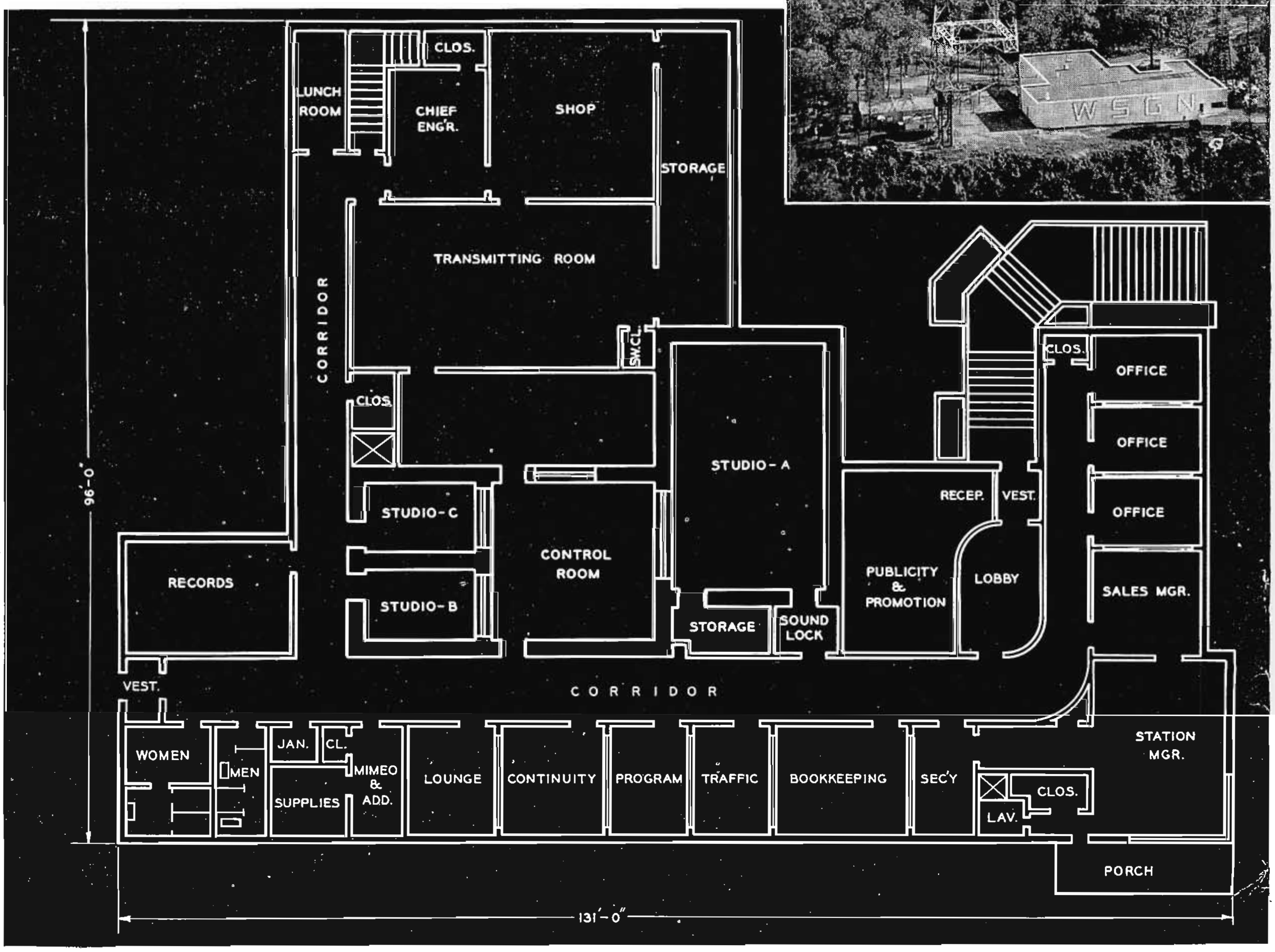


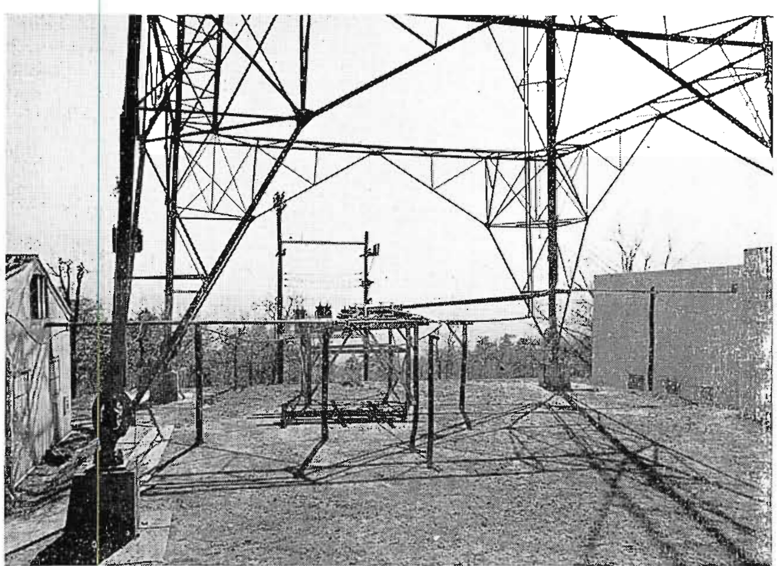
FIG. 1. (below). Plan layout of facilities which are conveniently located all on one floor.

3 KW FM - 5 KW AM... WSGN
Birmingham, Alabama

exception of the AM transmitter, which remains at the Alabama State Fair Grounds. WSGN uses 610 kilocycles, with 5,000 watts daytime power, and 1,000 watts night-time; WSGN-FM operates on 93.7 megacycles. Both stations are on the air from 5 A.M. to midnight, duplicating AM and FM programs. Outlets for the ABC network, WSGN and WSGN-FM feed special sports events and public service programs to the state-wide Alabama Broadcasting System.

The Red Mountain location of The Birmingham News Company's Stations is a 36-acre park, which these stations and the Voice of Alabama stations are developing into a scenic Radio Park. Although the development of Radio Park, as well as the construction and use of the joint tower is being done through the cooperation of WSGN, WSGN-FM and the future WSGN-TV, and WAPI, WAFM and WAFM-TV, the two corporations remain entirely separate and competitive.

FIG. 3 (below). Closeup of tower at base showing feed line networks.



Buildings and Facilities

The handsome new building of Stations WSGN and WSGN-FM, within ten feet of the tower, has been so constructed that, with slight modifications and facilities, WSGN-TV can be installed and go on the air without delay. This building has previously been occupied by the two Birmingham News Company stations.

Station WSGN was formerly located in the Dixie-Carlton Hotel building in downtown Birmingham, broadcasting AM programs over its transmitter at the Alabama State Fair Grounds, and its FM programs from a temporary building and tower in Radio Park on Red Mountain. The hotel was sold to the Y.W.C.A., and the space occupied by WSGN was required for that operation, necessitating the stations moving to other quarters. Mr. Johnston took a long-range view and decided on building for the future. All operations of The Birmingham News Company's stations were centralized on Red Mountain.

The structure covers approximately 10,000 square feet, is fireproof, with brick walls, floors of steel and concrete, with flooring material of rubber and cork tile. All walls are of acoustic plaster. Studios are insulated and have floating floors. The control room has complete copper screens shielding grounded.

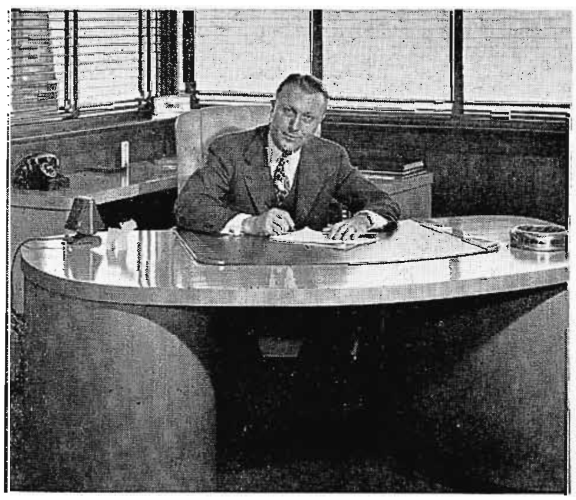
The entire building is air conditioned, and oil-heated. The heat dissipated by the transmitter is also used in heating the building. Floor plan is unusual, and the RCA equipment is so set up that the control room and transmitter room adjoin, being separated by glass panels, and the monitoring of transmitter can be done from the control room. These two rooms are separated from Studio W (West), Studio S (South) and Studio N (North), by glass panels. It is thus possible for one to stand in any of these rooms and, at a glance, see all activity going on in the three studios and control and transmitter rooms.

The West and North wings of the building are given over to modern sales rooms, programming, continuity, promotion, advertising, bookkeeping, traffic and other offices, and the suite of offices of Mr. Johnston.

All operations of The Birmingham News Stations are thus concentrated in one central point (all on one floor), with the

FIG. 4 (below). View into main studio control room from Studio "A". Studios "B" and "C" are visible at rear.

FIG. 5 (below). Henry P. Johnston, executive vice president of Birmingham News Company, is manager of radio operations.



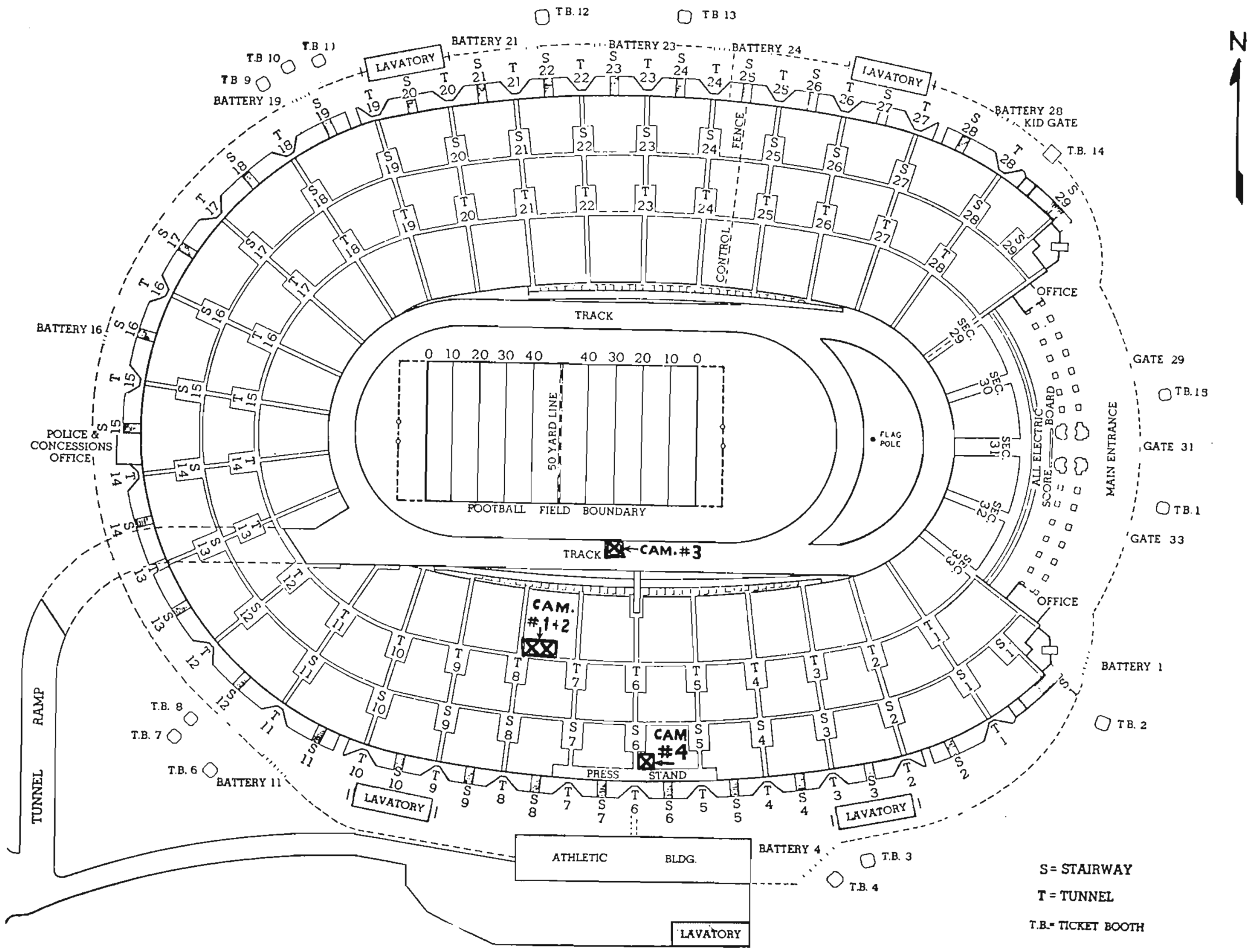


FIG. 1 (above). Diagram of the Los Angeles Coliseum showing the location of KECA-TV cameras.

Televising FOOTBALL FROM LOS ANGELES COLISEUM

By

PHILIP G. CALDWELL

Chief Engineer, Western Division
American Broadcasting Company

Coverage of football games at the Los Angeles Coliseum represents a unique challenge to a television broadcaster. This is the story of how KECA-TV presented the spectacle of college football to the Los Angeles audience during the 1949 season. Included are some of the details and complexities of making such a broadcast from the largest permanent seated football stadium in the nation.

Football pickups have been made for a number of years in various cities of the country, but it has been only recently that the size of the TV viewing audience has really made this job big business. The commercial aspect alone of arranging the rights and selling the time is an interesting and complex story. That, however, is not the subject of this article except insofar as it affects the actual handling of the equipment for commercial announcements and spots.

The Coliseum

In order to appreciate some of the operating problems encountered, it seems appropriate to enumerate a few facts concerning the layout and size of the Coliseum. It is the largest permanent seated stadium in the nation. The new lighting system has 432, 1½ KW lamps and will maintain 100 foot candles on the playing field. Distance between walls at field level—684 feet long, 345 feet wide. The playing field is 32 feet below ground level. The last row of seats is 106 feet from field level. There are 79 rows of seats with a total capacity of 105,000.

Jimmy Vandiveer, Executive Producer of Remotes for KECA-TV, was placed in charge of production and direction of the Coliseum telecasts. Harold Huntsman, Engineering Field Supervisor, headed up the technical phases of the telecasts.

Planning for Camera Locations

First came the important consideration of camera locations in the Coliseum. Many long conferences were held with the authorities of UCLA and USC to determine just where the cameras could be placed. Greatest problem was the obstruction of the view of people sitting in back of the two most important cameras in the stands. It was desirable that two cameras be placed as near the fifty-yard line as possible and here was where the seat holders were most likely to complain. Newspaper men also claimed priority on the tunnel portals which are the only practical locations for cameras whether for television or photographs. After three weeks of conference and testing with live cameras, tunnel portal eight was selected as a suitable location for Cameras #1 and #2. These were planned for televising the wide angle action and most of the closeups.

With the cooperation of the Universities and the Coliseum, Camera #3 was located literally at the edge of the track near the mouth of the tunnel leading from the players' dressing rooms. This was planned to provide a much closer view of the players than any of the other cameras used.

Camera #4 was finally placed in the Press Box which is located on the rim of the Coliseum. Here, it could handle long shots of the game showing almost the entire field.

Fig. 1 is a diagram of the Los Angeles Coliseum which, fortunately for television, has its football field arranged in an east-west direction. It was possible, therefore, to locate the cameras on the south side of the stadium, permitting good shots under all lighting conditions whether by day or night. Clearly marked on this diagram are locations of the four cameras employed for these broadcasts. These specific locations are made more graphic by an examination of Figs. 2, 3, 4, 5 and 6, which are actual photographs of the cameras. Fig. 7 is a view from the Press Box of the Coliseum showing the overall shot that was available to Camera #4. Actually this camera was located directly behind the announcers who are pictured in Fig. 8. One of the features of our broadcast was the excellent verbal commentary of Tom Harmon, former Michigan All-American. A regular service of Mr. Harmon was his diagrammatic analysis of important plays immediately after they happened. These diagrams, which were presented to viewers via Camera #4, were similar to those used by football coaches. In Fig. 9, Mr. Harmon is shown seated at his operating position.

FIG. 2 (below). Operators of Cameras #1 and #2 were stationed near "Portal 8" where wide angle shots or closeups could be handled.

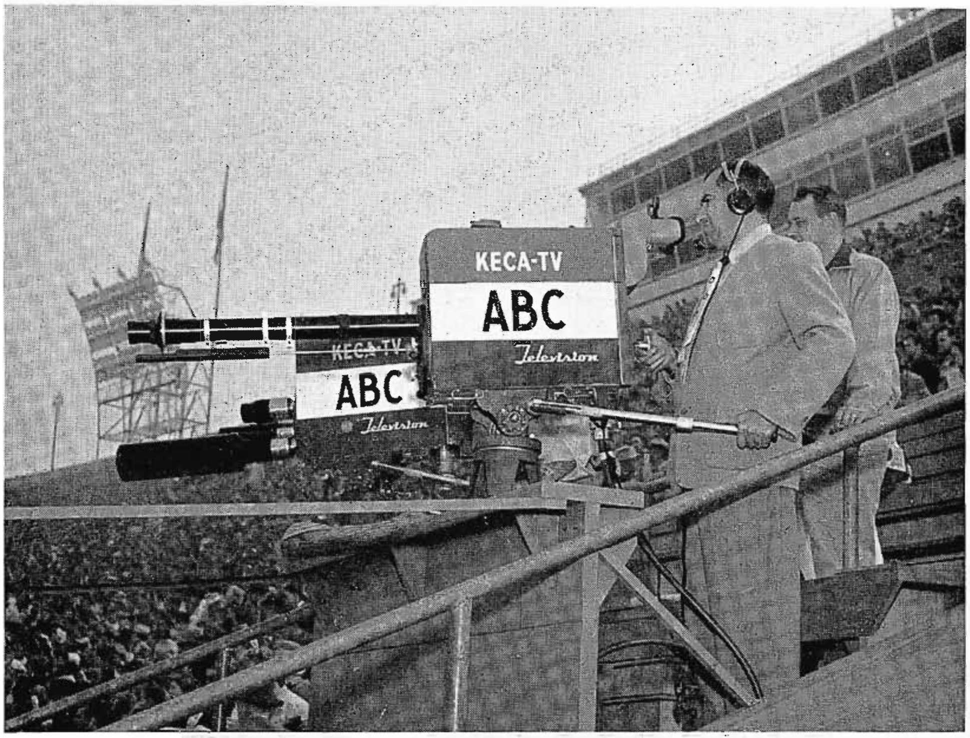


FIG. 3. Working as a team, Camera #1 was equipped with a "Zoomar" Lens and Camera #2 with 25", 17" and 13" lenses.

FIG. 4. Cameras #1 and #2, as viewed from the edge of the field. Press box is located at top right in photo.

Other "Football-TV" Problems and Solutions

A Pacific Coast Conference ruling forbids the showing on television of any motion pictures taken of any Conference player or any game or part of any game. Thus the players could not be introduced by film. To solve this, still pictures were obtained of the first three strings of all the teams, including out-of-town schools, to play in the Coliseum. It was arranged to have these pictures mounted individually on cards with the player's name, position, height, weight, age and year in school lettered around the margin. Before each game the starting lineup of each team would then be shown by means of these player "intro" cards. It was also arranged so that the picture of each player making a touchdown would be flashed on the screen immediately after the play.

One of the great drawbacks for the remote director in the past has been the fact that he must sit in the remote truck with the controls entirely removed from the actual scene of the game he was covering. Thus, he usualy has had no actual first-hand knowledge of the scene, but depended entirely on what was seen on the monitor screens for each camera.

For the KECA-TV setup, however, it was felt that games could be done much better if the controls were in the press box where the director could see the field and

FIG. 5 (above). Closeup view of "color" Camera #3, which was used to present dramatic closeup of football action.

the game his cameras were shooting. There was another important reason for this. With the Mobile Unit outside the Los Angeles rim it was necessary to string many cables over the aisles where spectator traffic was heavy and too, it was necessary to park the truck at the end of the dressing room where it occupied important space. So, as mentioned above, controls were moved to the top of the Coliseum to Press Box J. With controls in Booth J, and with announcers, Tom Harmon, Fort Pearson, and Camera #4 in Booth I alongside, Director Vandiveer had far better control over the production of the games than had been considered possible.

Individual Camera Functions

Perhaps a brief study or resume of the actual functions of each camera employed at the Coliseum will aid in picturing how football action can be closely followed.

Cameras #1 and #2 (located at tunnel 8) were employed to cover the basic action of the football game. Camera #1

FIG. 6 (above). View of stands showing location of Camera #3 at edge of track. Cameras #1 and #2 are in center background of photo.

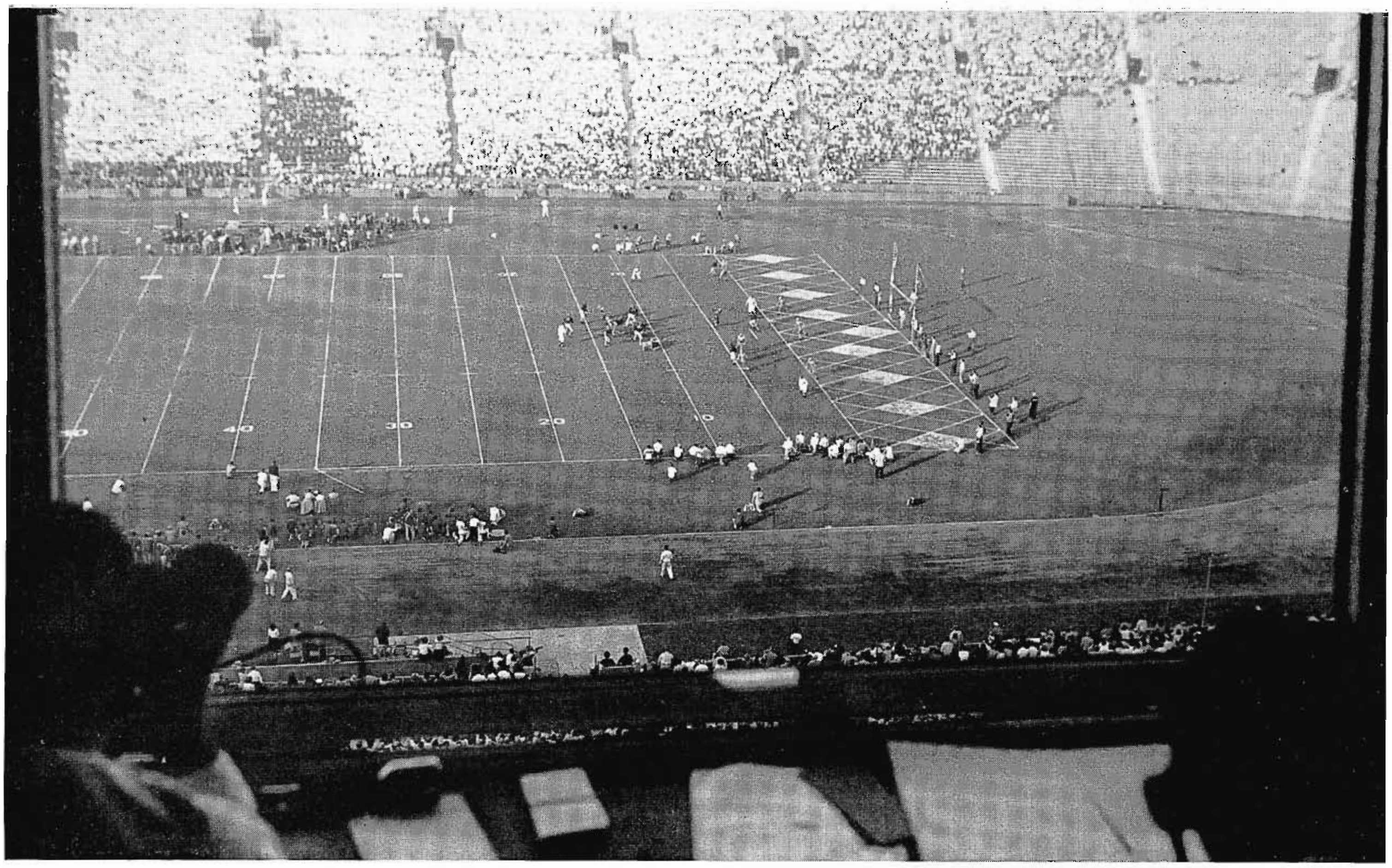


FIG. 7 (above). View of the playing field (as seen by Camera #4) from the press box located at the top of the stands.

was always equipped with a Zoomar lens for day games to make possible "zooms" from long shots into player closeups. The Zoomar lens was used fairly close in for developing plays about the line, with as narrow an angle as possible.

Camera #2 was equipped with 25-inch, 17-inch and 13-inch lenses and worked as a part of a two-camera team with Camera #1. Camera #2 handled the action once it became widespread. It is a credit to the teamwork of these cameramen that they "lost" the ball from the field of view only three times during the entire season.

Camera #3, located directly on the field, provided dramatic closeups of the football action and of players going on and off the field. The director used this close-in camera as often as possible to deliver pictures which were unique to most viewers. Camera #3 was considered the "color" camera since its purpose was to bring the viewer the feeling of being at the game, as well as seeing the actual plays.

Camera #4 (located in the Press Box for long shots) was used primarily for two purposes; first, orientation (position of teams on the field) or general viewing of the entire action; second, for presentation of statistics on the players. Every time a spectacular play was made by an individual player, Camera #4 was focused on a photograph of that player. Camera #4 also handled shots of Tom Harmon and Fort Pearson as they were working and was employed to shoot titles and game cards.

Operators' Positions

The Director sat in Press Box J with four monitors in front of him showing the pictures of all four cameras. Sitting in front of him were the engineers who took care of the electronic quality of the pictures of the four cameras. Alongside was the camera switching operator who cut to the various cameras as directed. Usually standing alongside was the field supervisor, responsible for the entire engineering crew of twelve men.

Back and to the right of Director Vandiveer was an operator who monitored the microphone in the booth next door. At the left of the director, another operator took care of all the scripts, timed the various segments of the show and gave cues for the commercials.

Next to control booth J, was the announce booth I, mentioned earlier. Here Camera #4 and operator were stationed on the elevated back half of the booth. Camera #4 was on a dolly and could move in for closeups of the announcer nearby, or to an angle satisfactory for long shots of either half of the field.

Sitting in the front half of the booth I were the announcers and spotter. Directly in front of Announcer Harmon was a monitor showing at all times what picture was on the air. This monitor was an inclined mirror which projected only a few inches above the table and thus allowed the announcer to "look over" and watch the field, as well as the air picture. A television set under the table projected the picture onto the mirror. On the extreme right was the production assistant wearing headphones. He went through the indexed player introduction cards in a hurry to get the picture of the player making the touchdown. He also handed the announcers all the typewritten commercial cues and copy and relayed directions as given to him by

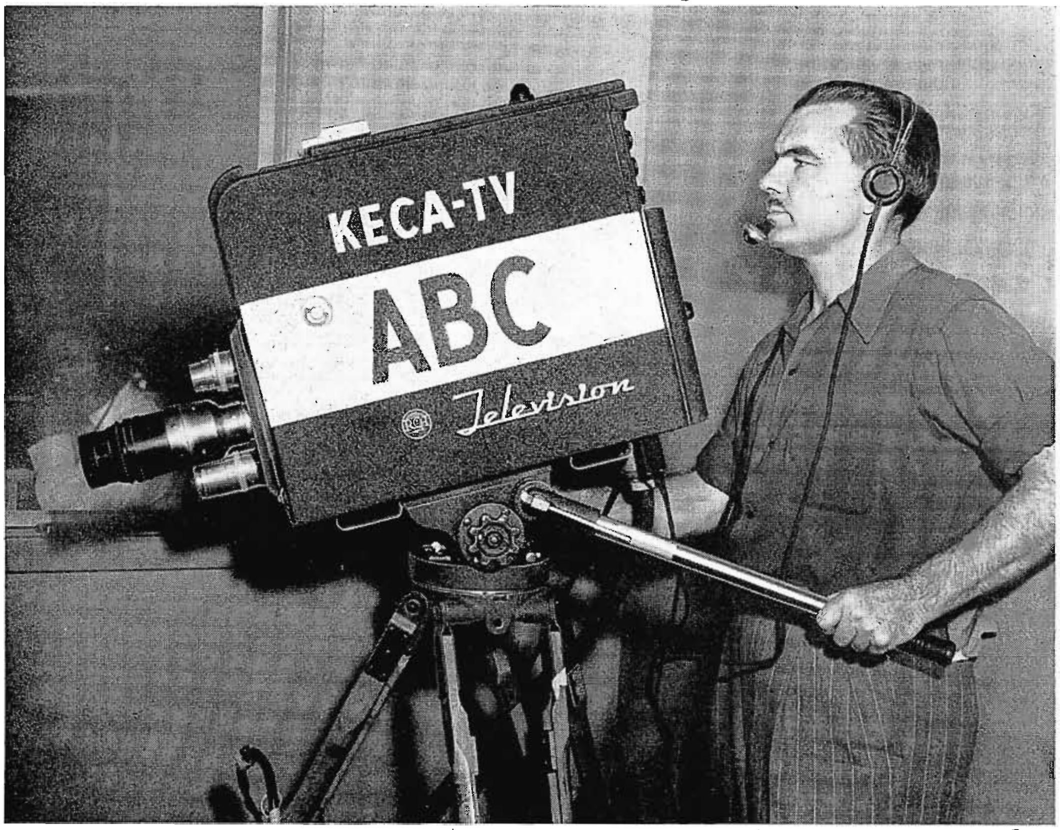
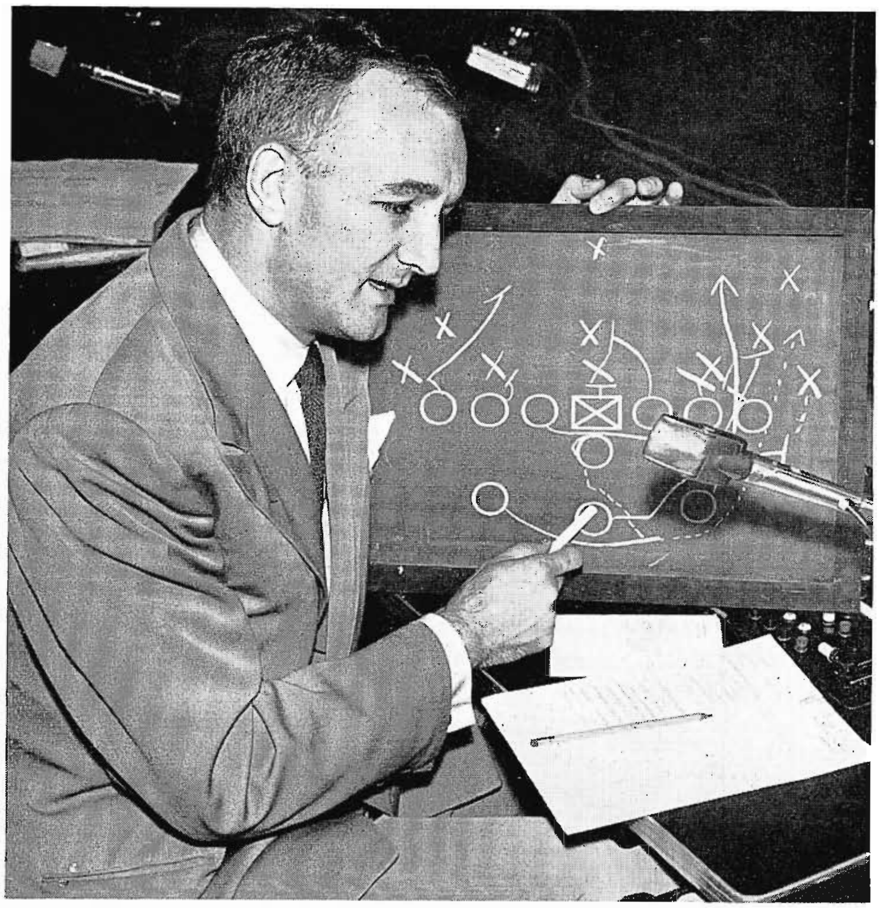


FIG. 8. Camera #4 shown here was located in the press box. This camera was physically adjacent to camera controls, monitors and the announcers.

FIG. 9. "Tom" Harmon provided televiewers with "Blackboard" diagrams of long runs or touchdown plays.



Vandiveer on the intercommunication system. The Director was able to talk to the entire crew through the use of headsets and button microphones. Throughout the games he talked to his four cameramen, or to his two production assistants and they in turn could give him information as necessary.

All systems were carefully worked out in advance and each man knew his job and what he would probably do in the event of a pass, kickoff or run.

"Touchdown" Routine Goes Like This

Cameras #1 and #2 down on Tunnel Portal Eight covered the actual developing touchdown plays. Immediately the Director called for Camera #3 down on the field to cover the rooting section and (as he saw the shot was ready) cut in Camera #3 briefly. By this time the production assistant had found the picture of the player making the touchdown and Camera #4 had it lined up on the easel. As soon as the Director saw it on the monitor, he called for Camera #4.

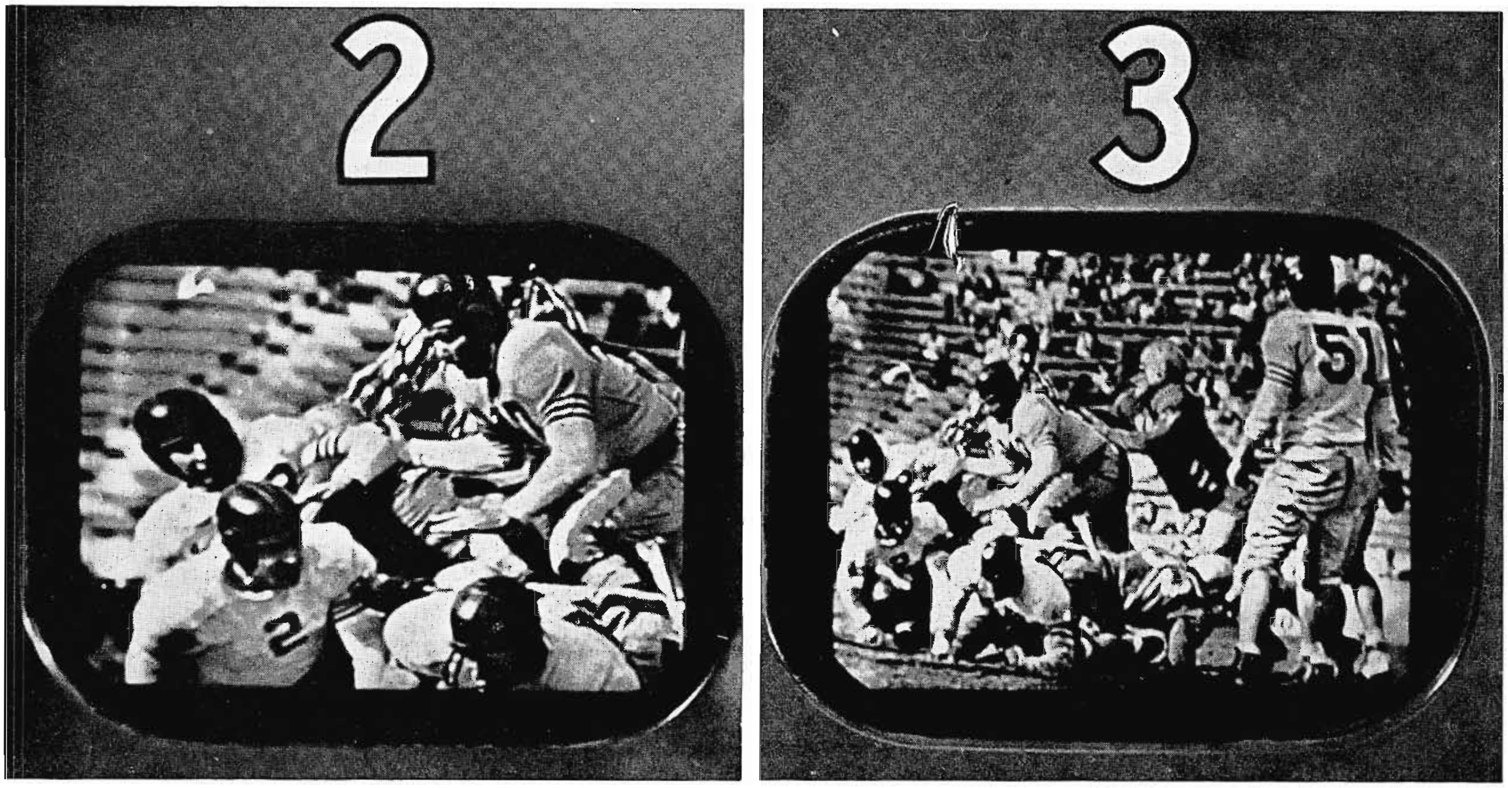


FIG. 10 (above). Photos taken directly from the monitors for Cameras #2 and #3. Camera #2 is covering a "closeup" and #3, action through the line.

Now Camera #2 lined up a wide angle shot of the line up for the conversion. The Director called for Camera #2 and asked Camera #1 to get on a closeup of the player who would kick. As this shot came up it was taken. Then Camera #2 with the wide angle was taken to cover the kick. Meantime Camera #1 was on the referee to cover his decision. The kick was made. The cut was made to Camera #1 as the referee indicated whether it was good or bad.

Now Announcer Harmon was ready with his blackboard to diagram the play. Vandiveer watched monitor four to see when the shot was ready then alerted the production assistant to cue the announcer and took "#4" as it covered Harmon diagramming the play. Meantime Camera #3, on the field, had the new score set up on the scoreboard. As soon as Tom Harmon finished on Camera #4, the Director called for Camera #3 with the score. By this time the teams were lining up for the kick-off and Camera #2 was in on a wide angle shot of the team ready to kick. Camera #1, meanwhile, was set on a closeup of the men who would receive the kickoff and coverage of the game continued.

Equipment Setup

Fig. 11, is a block diagram showing in detail the arrangement of the cameras, various monitors, the relay equipment, the announcer's position and the various engineering and program positions used throughout the broadcast. As indicated, a fairly standard arrangement of RCA equipment was employed. Fig. 12, shows the audio layout. The actual monitors are shown in Fig. 14, a view in which the four camera monitors, the line monitor, the switcher, an off-the-air receiver and a corner of the microwave control unit are visible. Note the use of Coca-Cola cups as light-shades for the CR tubes.

In Fig. 11, the relaying connections for delivering the signal to the transmitter are shown. Actually this circuit was protected three ways in the form of two Telephone Company circuits, one of which was microwave and one coaxial cable. These were routed from the Coliseum to the Hollywood Telephone office, at which point the signal was transmitted 19 miles to Mt. Wilson via another microwave circuit. In addition company-owned 7000 mc microwave units were used to provide a direct circuit to Mt. Wilson as further protection against failure of the telephone equipment. These precautions resulted in solid operation with respect to relaying.

Line and film commercial inserts were regularly added to the broadcast from the main ABC-TV Studio in Hollywood. These were fed via telephone facilities to Mount Wilson.

It is obvious that a production of this magnitude requires a considerable number of both engineers and program personnel. Actually, between audio and video positions, a total of ten engineers were employed. In addition, there were seven program and production people and three announcers. The net result was a production of football which uniformly attracted the biggest audiences of any shows in town and further gained for KECA-TV the award for the outstanding sporting presentation of 1949 as made by the Academy of TV Arts and Sciences.

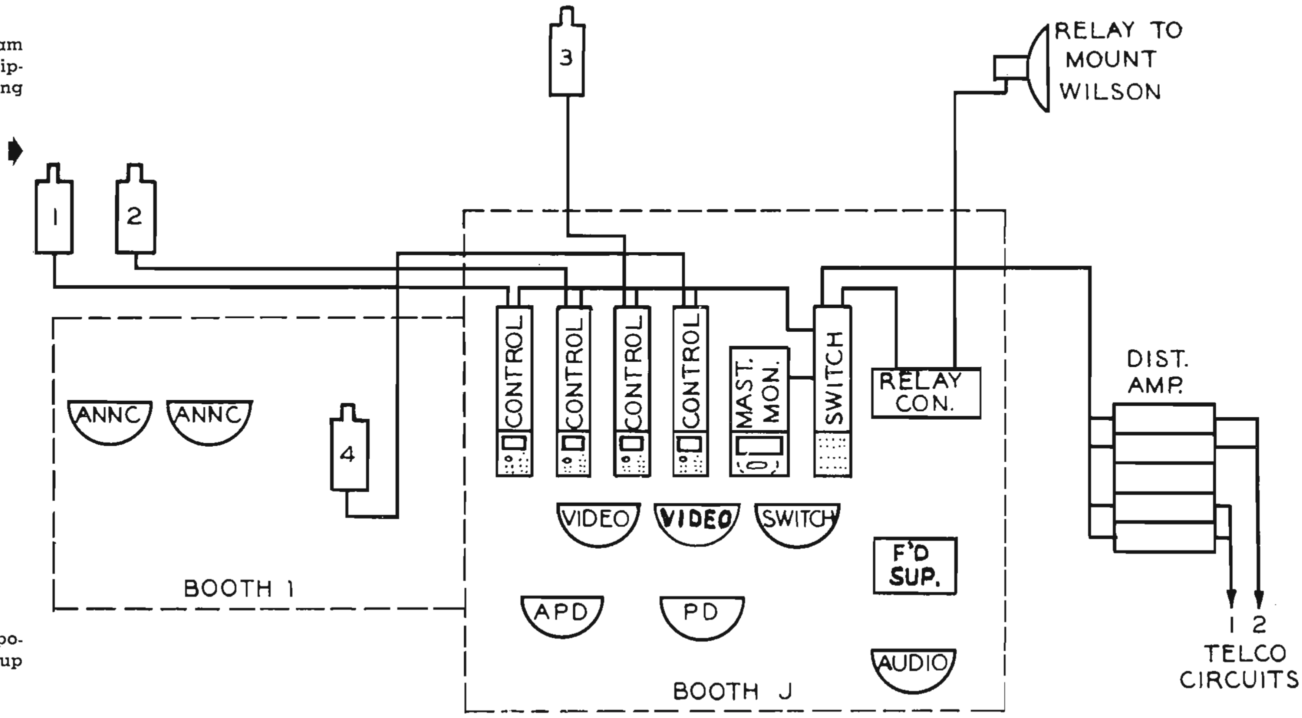


FIG. 11. Block diagram of the KECA-TV equipment setup for handling football telecasts.

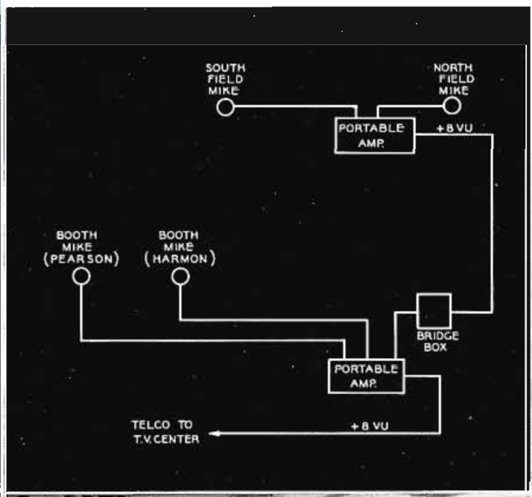


FIG. 12. Microphone positions and audio setup used at KECA-TV.

FIG. 13. Partial view of control room with KECA-TV Engineers grouped around control equipment.

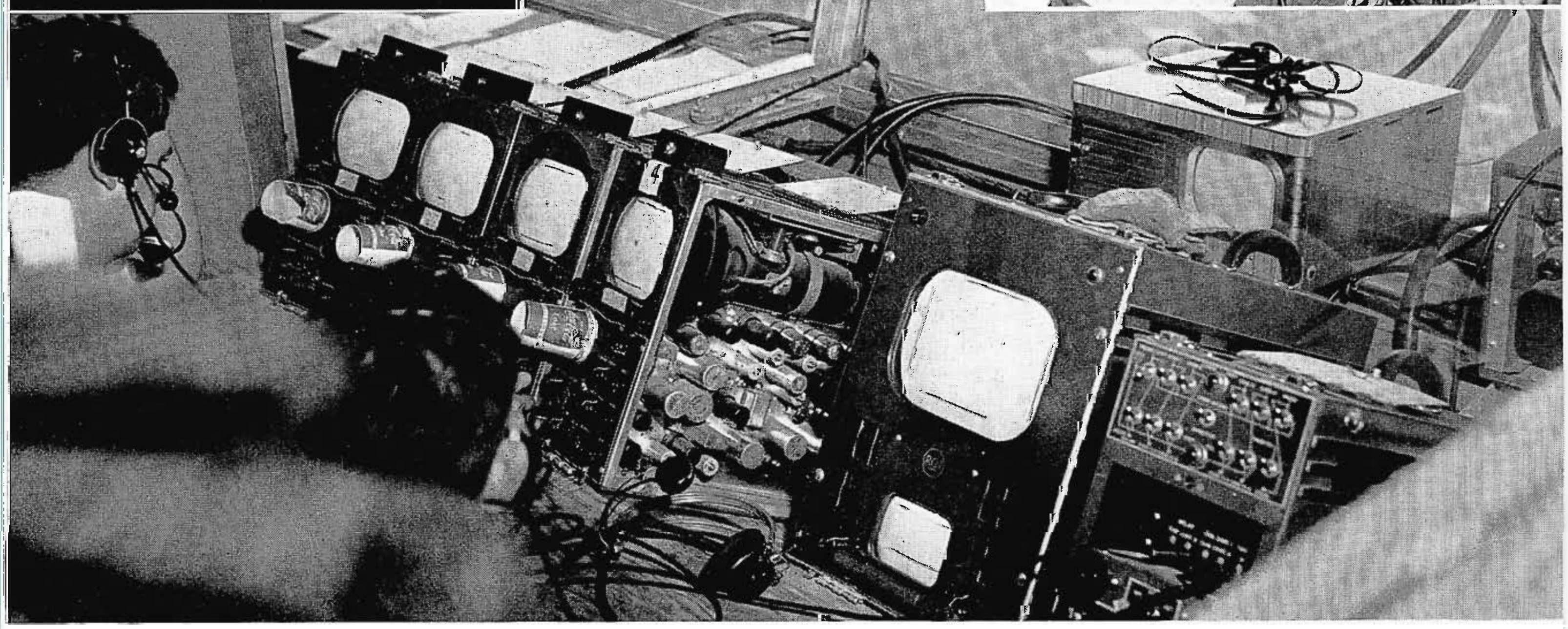


FIG. 14 (above). Closeup of the control room equipment which includes camera monitors, line monitor, field switcher and "Off-air" receiver.

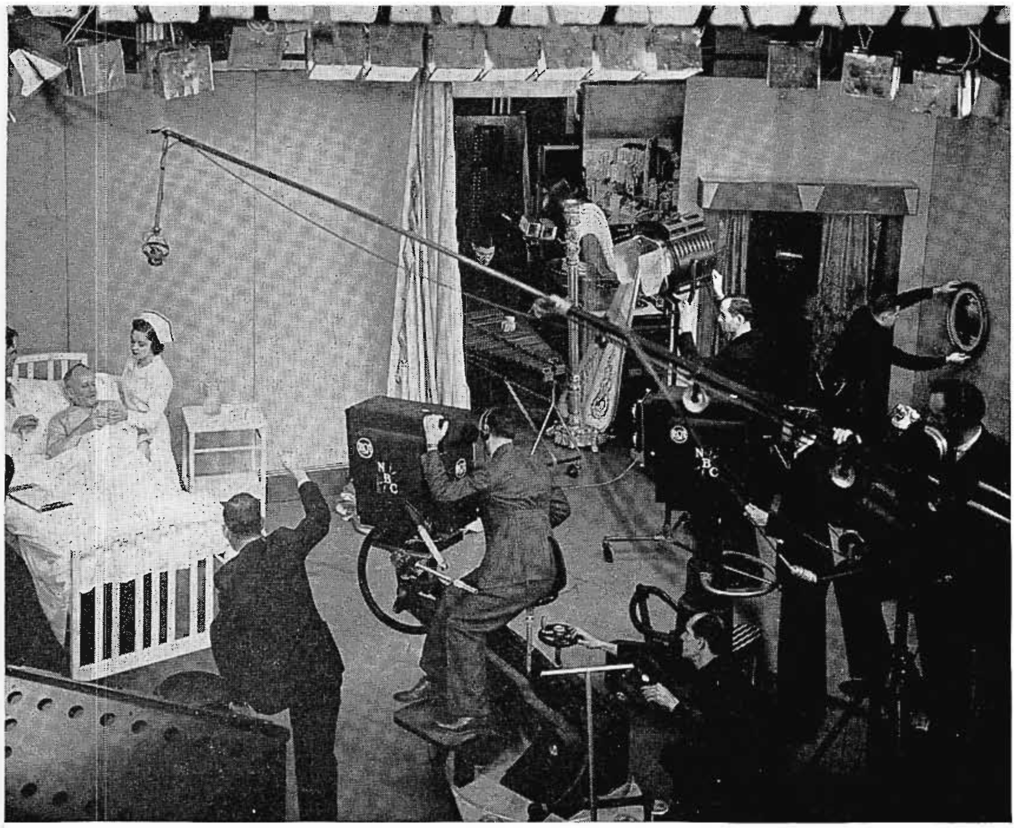


FIG. 1 (at left). In early television, studio lighting techniques and equipment were patterned after motion picture practices.

TV STUDIO ILLUMINATION

By
H. M. GURIN* & R. L. ZAHOUR**

The evolution of television has been so rapid that the present equipment and results can scarcely be identified with the original apparatus. The advances in new studio equipment transmission and reception have created entirely new requirements for present day operation on a sound technical and economic basis. One of the most significant elements which has contributed to this advance has been the development of highly sensitive camera pickup tubes. Since studio illumination plays such an important part in realizing the advantages to be gained from the proper use of these new pickup tubes, it is appropriate that the methods and techniques employed be carefully scrutinized.

In the early days of television experimentation around 1936, lighting equipment was similar to that used in the motion picture industry, Fig. 1. Very shortly thereafter it became apparent that the actual use of some of this equipment had to be radically altered from motion picture practice because of the mobility and the number of cameras required for simultaneous use. In addition, because of the relative insensitivity of (the iconoscope) the camera pickup tube, which was then employed, a tremendous amount of light, in the order of 1000 to 2000 footcandles incident, was required. As a result, large cumbersome units, radiating an uncomfortable amount of heat, were displaced by clusters of reflector lamps mounted in special fixtures as shown in Fig. 2. This system led to a much greater flexibility in manipulating the light sources and clearing the floor for greater camera freedom and provided broad diffuse light but did not solve the problems of heat. A further difficulty existed in obtaining a satisfactory degree of modelling light because of the high foundation light necessary to obtain a satisfactory picture.

The introduction of the present image orthicon was a major step forward in obtaining the excellent results some of the more fortunate people in the larger cities have almost learned to take for granted.

* National Broadcasting Company, New York City.
** Westinghouse Electric Corp., Bloomfield, N. J.

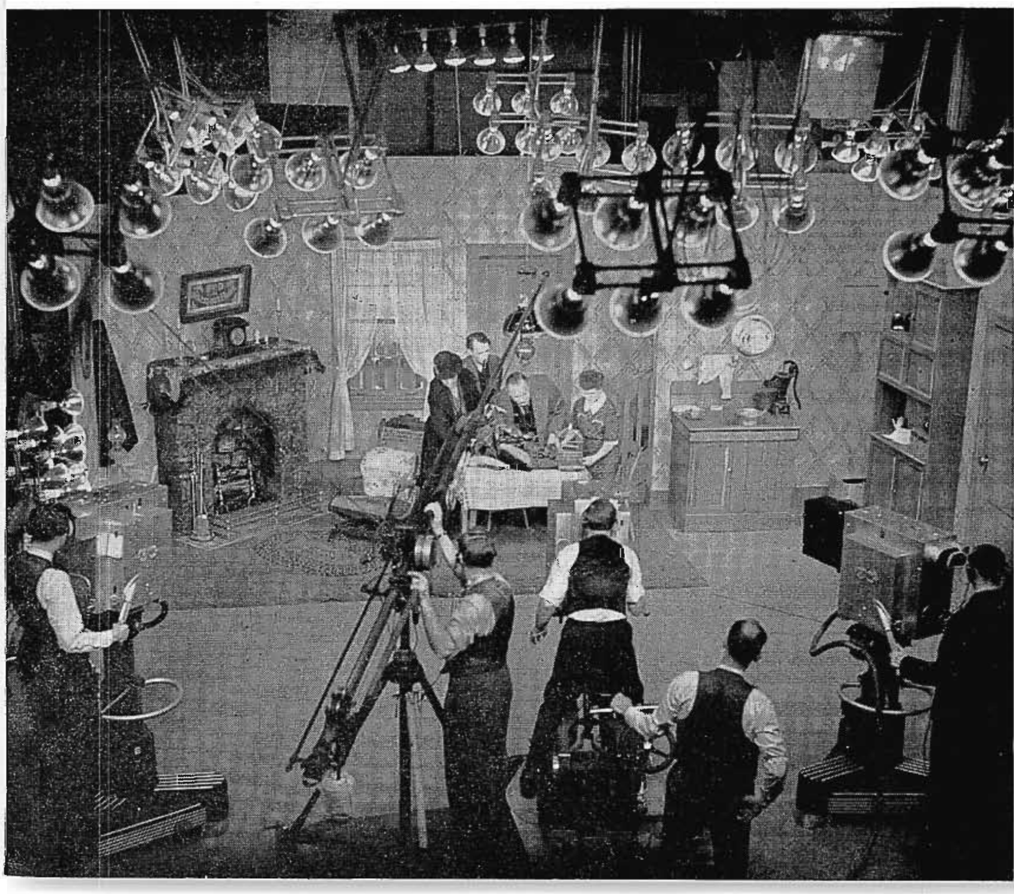
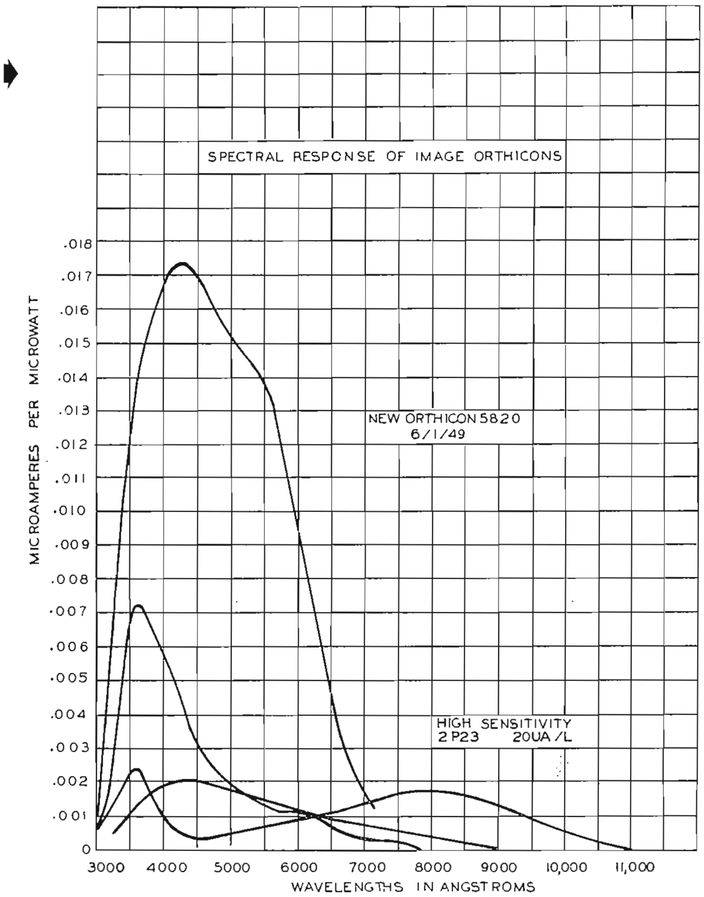


FIG. 2 (at left). A progressive step was the installation of clusters of lights providing greater flexibility.

FIG. 3. Spectral characteristics of various image orthicon tubes. Advent of these tubes was a major step in solution of many lighting problems.



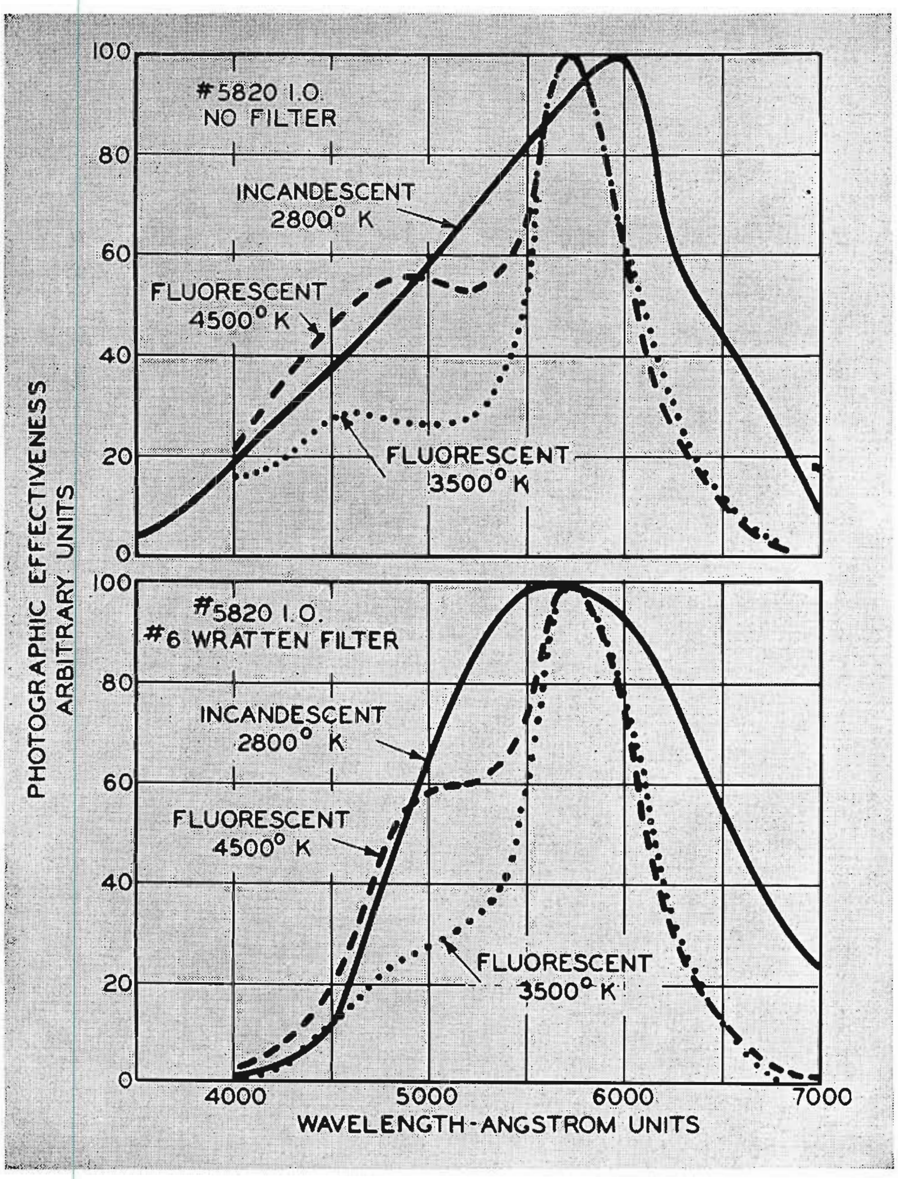


FIG. 4. Curves illustrating the spectral responses or photographic effectiveness of various commercially available incandescent and fluorescent lamps.

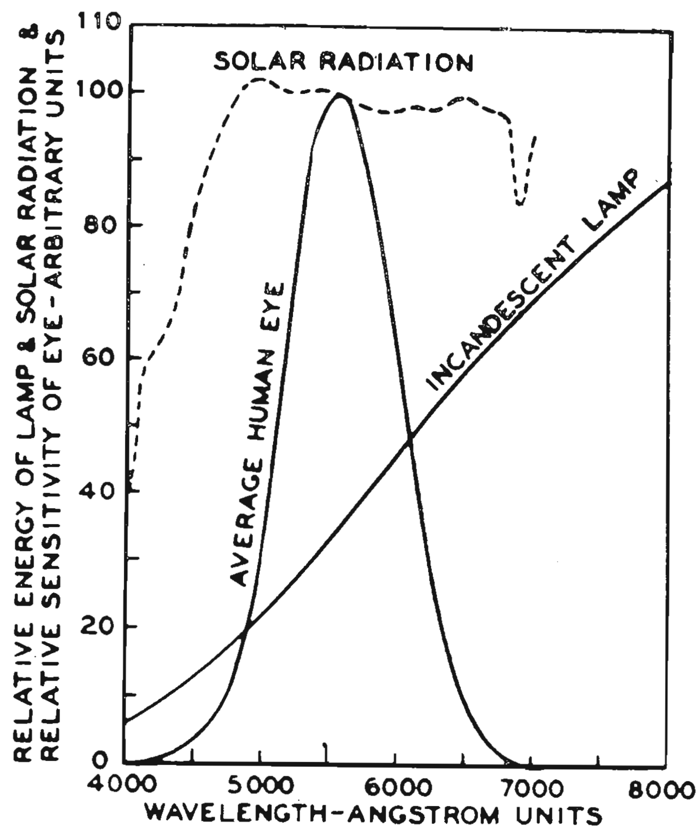


FIG. 5. Curves showing the spectral characteristics of the human eye, sunlight and incandescent light.

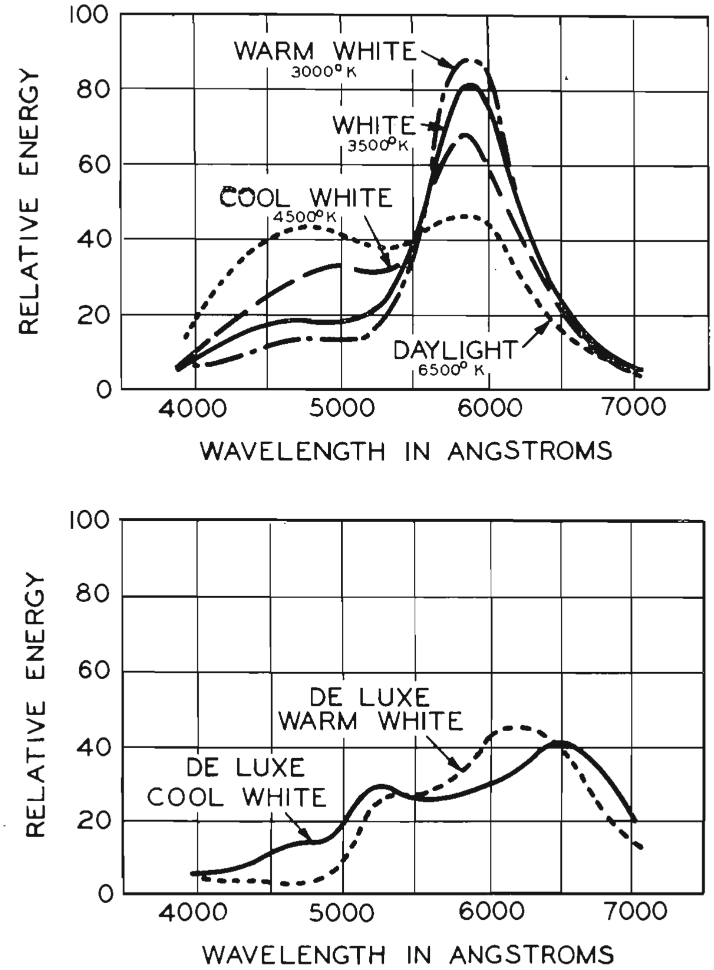


FIG. 6. Overall photographic responses may be obtained when relative sensitivity of the pickup tube and relative energy of the source (as shown by curves at left) are known.

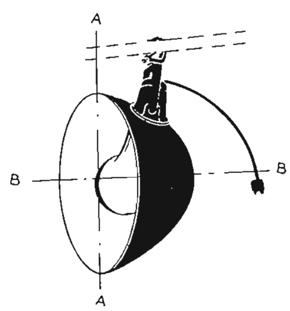
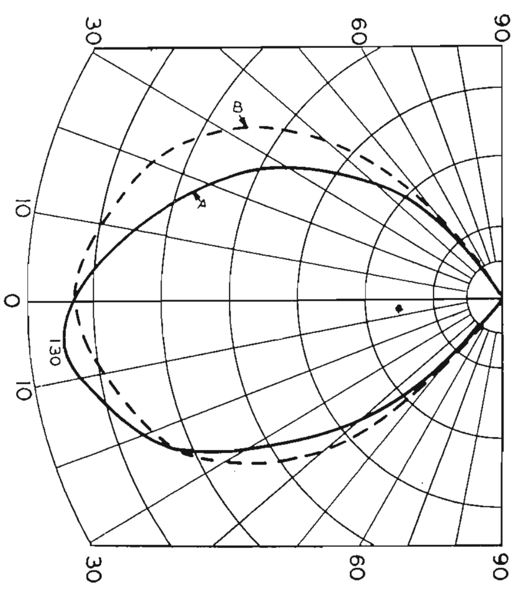


FIG. 7. Shown here is a typical incandescent floodlight used in television studio lighting to produce a wide, uniform distribution curve.

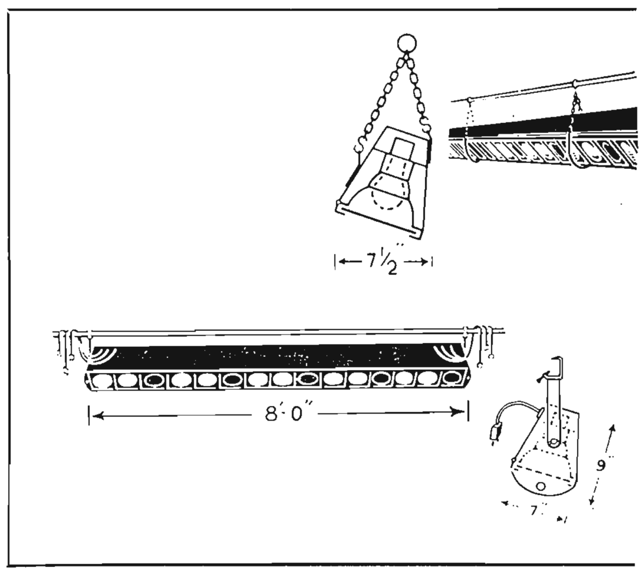


It must be borne in mind that the overall picture is affected not only by the studio lighting but by a great many other factors which are probably not so obvious to the casual viewer. The alignment of the camera pickup tube itself with respect to its tonal gradations of the gray scale (or transfer characteristic), the studio equipment, the operation of the transmitter, external interference from diathermy machines, aircraft, ignition systems, r.f. multiple reflections, antenna orientation, etc. and, last but not least in importance, the actual alignment and adjustment of the receiver, all affect the end result. Unfortunately, criticism of the picture quality too often has been directed to the lighting without due consideration of the factors just mentioned.

Problem

The ability to obtain suitable lighting in a television studio is complicated by the need for uninterrupted action which can be instantaneously transferred from one field of view to another. There is no time to halt action on the set while resetting camera positions, adjusting lenses for different depths of field, readjusting lights, etc., as is possible on a motion picture set where usually only one camera is used. The instantaneous switching from one scene to another without mutual interference of lights adds to the complexity of the operation.

A problem, however, common to both motion pictures and television studio practice, is the need of selecting the proper quality of light for a given camera pickup characteristic to obtain a satisfactory rendition of colors in a suitable gray scale for black and white pictures. The solution of this difficulty will permit the use of color



in scenery and costuming with its associated favorable psychological effect on the performers.

Another problem which faces television has been the limited space, usually converted broadcast studios, in which operations were carried out. As a result, the physical factors of size, weight of equipment, ease in manipulation and general handling are important considerations. In addition, the problem of heat dissipation for the required illumination cannot be ignored.

Methods of Attack

The need for suitable lighting has long been recognized and even with the advent of the image orthicon pickup tube the problems of correct illumination properly applied have not been completely solved but definite strides to an acceptable solution have been made. It has been found that a light source should provide spectral characteristics correctly related to that of the camera pickup tube used and psychologically suited to the participants within the television studio. The spectral characteristics of several different image orthicon tubes are illustrated in Fig. 3. Figs. 4 and 5 show the spectral characteristics of a number of available fluorescent lamps as well as that of sunlight, the average eye response and of the conventional filament or incandescent light.

When the various light sources are combined with a #5820 image orthicon, the pickup tube now being rapidly accepted for studio use, an over-all photographic response can be plotted by multiplying

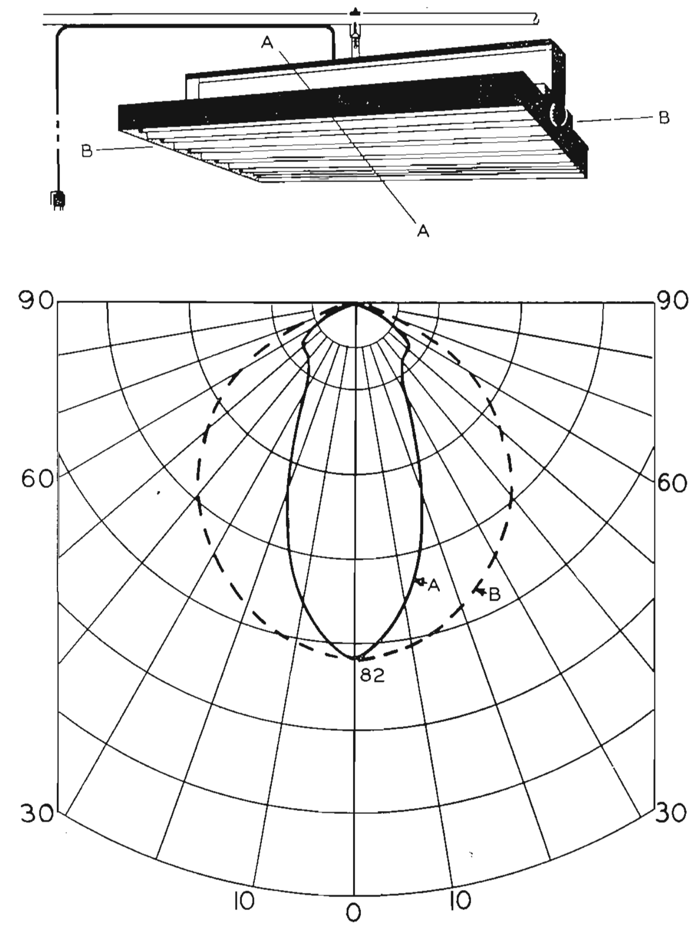


FIG. 8. Typical fluorescent floodlights (equipped with reflectors for four or six lamps) also produce wide, uniform distribution curves.

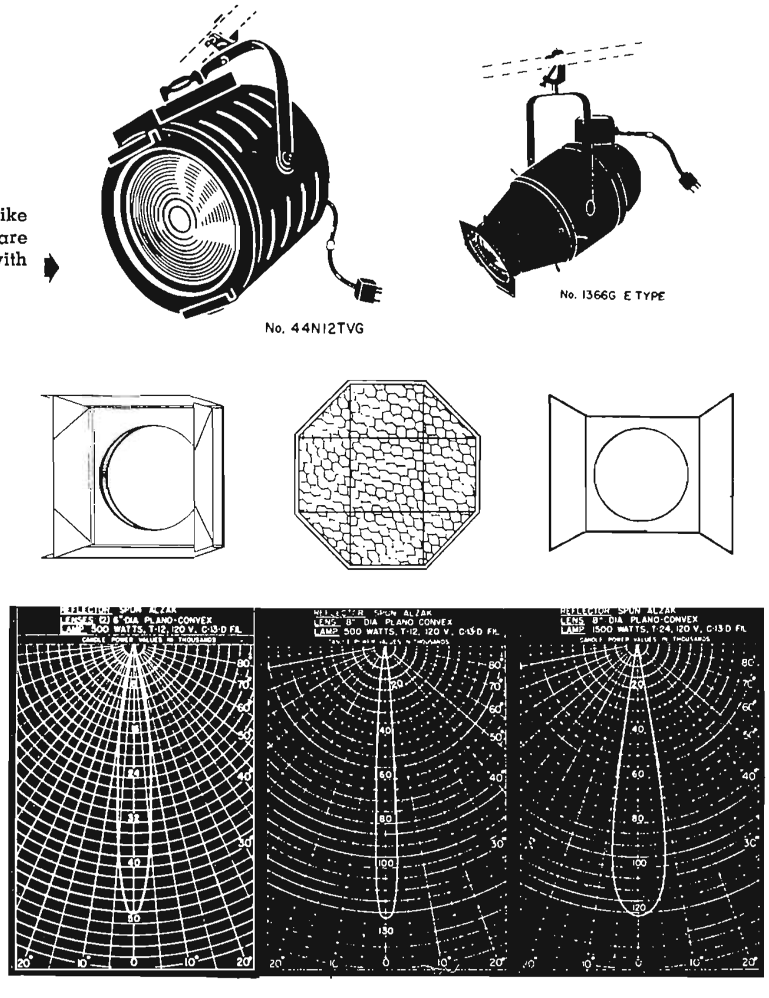
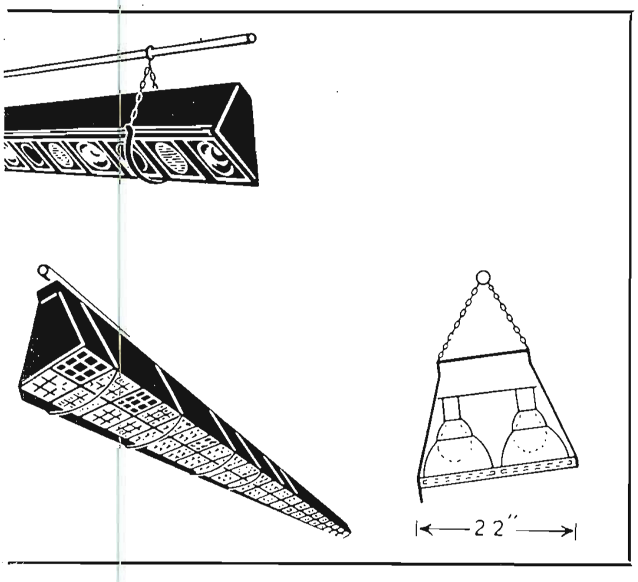


FIG. 9. Spotlights like those shown here are usually furnished with spherical Alzak reflectors.

FIG. 10 (below). Strip lights made up of a series of incandescents are supplied in lengths from three to eight feet.



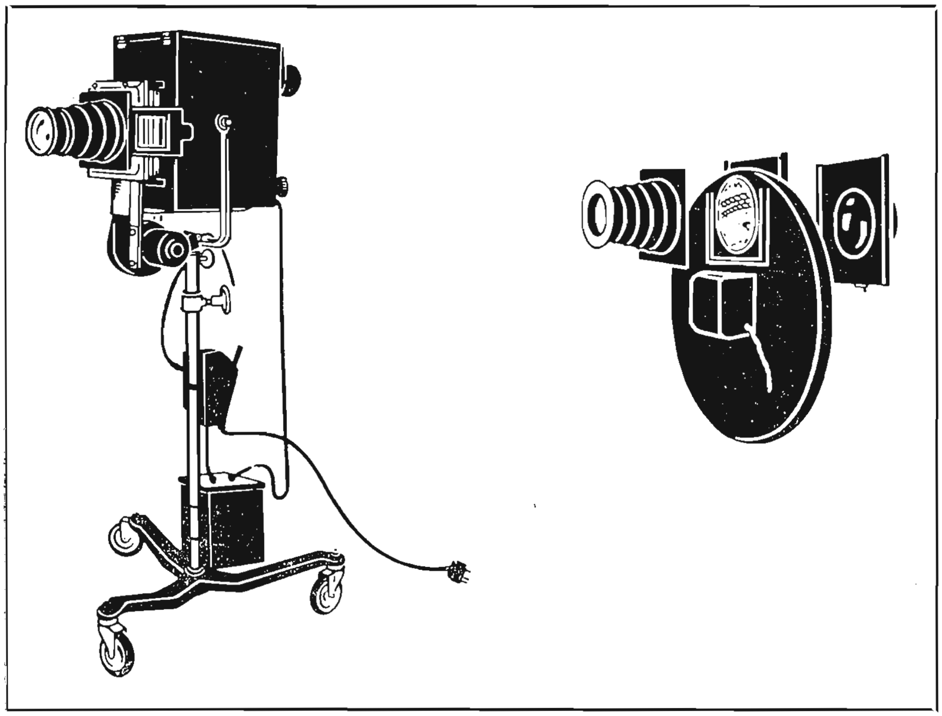
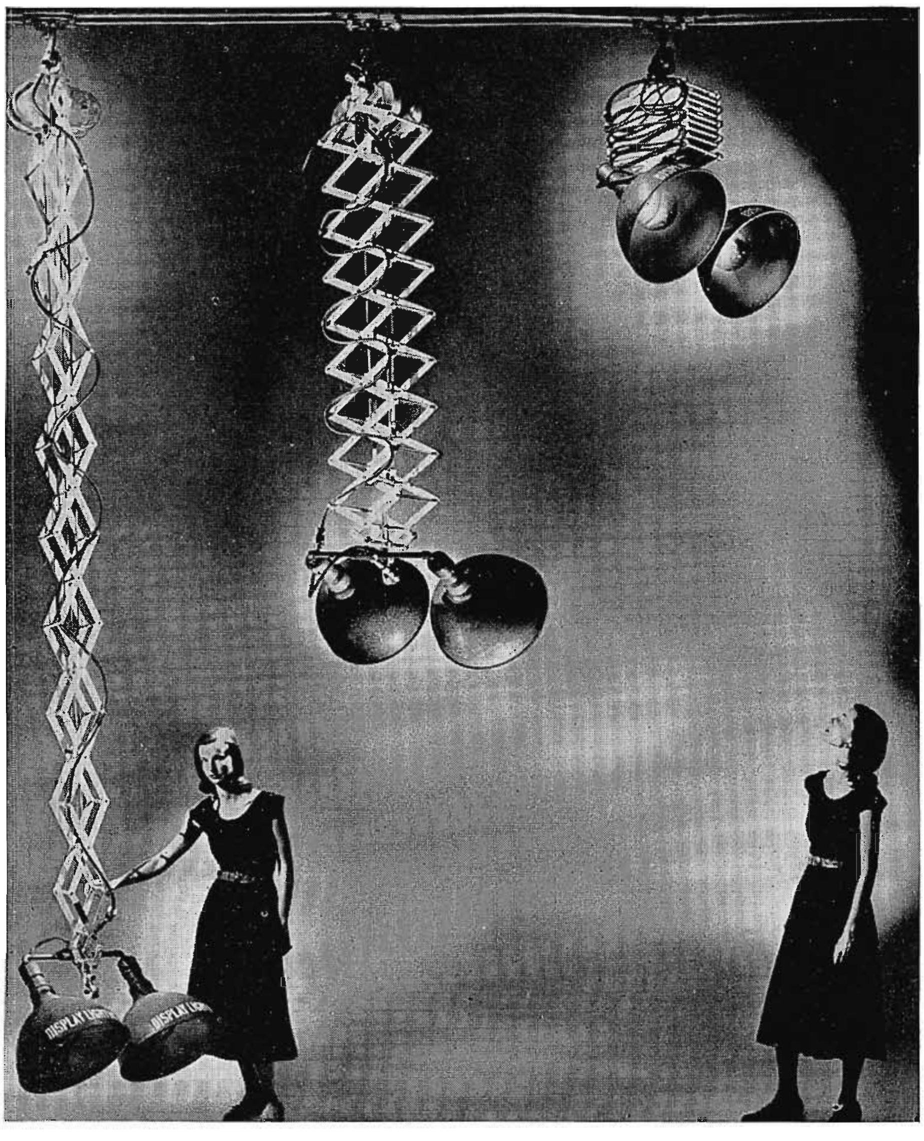


FIG. 11 (above). Effects lighting is sometimes created by use of projectors with motor-driven effects discs.



the relative sensitivity of the pickup tube with the relative energy of the source as shown in Fig. 6.

It will be noted that when an incandescent light source is used, the combination leads to a curve which approaches the contour of the average eye response. This is significant since it leads to a tonal rendition in the gray scale which can be readily reconciled to the actual colors used in the scene. This objective can also be obtained with fluorescent light if a Wratten #6 filter is used at the camera. Because of these fortunate circumstances, fluorescent lights can be mixed with incandescent to excellent advantage.

No light source, however well matched to the pickup device, is efficiently utilized without a satisfactory reflector and housing.

In television studio lighting such equipment may be classified into four types:

1. Floodlights
2. Spotlights
3. Strip Lights
4. Effects Lights

} with accessories

1. In general, floodlights are of the incandescent or fluorescent type.

Incandescent floods are scientifically designed hyperbolic aluminum reflectors of matte Alzak finish weighing about 5 to 7 pounds. Fig. 7 illustrates a typical incandescent floodlight and its wide, uniform distribution curve. Floods are made in sizes from 10 to 18 inches in diameter for use with lamps from 250 to 2000 watts. They are useful in providing a wide angle distribution of uniform illumination of moderate intensity.

Fluorescent floodlights consist of a rectangular aluminum housing 44 to 65 inches long, 3½ to 5 inches deep, and 16 to 44 inches wide, equipped with 60 degree specular parabolic reflectors for either four or six lamps. Fig. 8 illustrates a typical fluorescent floodlight unit with its wide, uniform distribution curve. The lamp circuits of a 6-lamp fixture, for example, may be wired to permit 1/3, 2/3 and full operation. Fluorescent fixtures weigh from 39 pounds with 6—64 inch Slimline lamps to 64 pounds with 6—40-watt preheat fluorescent lamps. Ballasts are usually housed separately from the fixture and located as remotely as possible to reduce transmission of audible hum.

FIG. 12 (at left). TV studio lights are often suspended on pantograph devices as shown here.

2. Spotlights usually assume the form of a cylindrical ventilated metal housing built in sizes for plano-convex or Fresnel lenses of 3 to 16 inches diameter, with projection lamps from 75 to 5000 watts respectively. These spots are generally provided with spherical Alzak specular reflectors and lampholders with an external adjustment handle which permits beam spread variations of 5 to 50 degrees, Fig. 9. A frame on the front accommodates such accessories as barn doors or diffusers to mask the beam pattern or soften the light. Some spotlights have an inbuilt iris which permits a variation of sharply defined beam spreads of high intensity for creating artistic effects.

3. A strip light, as the name implies, is a metal trough-like fixture which houses a series of similar incandescent sources such as the PAR-38 or R-40 lamps, either spot or flood, or aluminum reflectors with 200- to 500-watt lamps, Fig. 10. They are made in lengths from 3 to 8 feet with 6 to 15 outlets respectively usually wired to 3 circuits. Strip lights produce general shadowless illumination of low intensities, and serve in providing a uniform light on backgrounds, walls and such, from overhead or side borders. Spread lens roundels and diffusers are available for modifying light beams of the individual lamps.

4. Effects lighting creations are often produced by a projector equipped with a motor-driven "effects disc" painted to create scenes such as moving clouds, moonlight water ripple, rising fire or smoke, falling leaves, ocean waves, and many other effects. Fig. 11 shows a schematic view of an effects device.

Equipment Facilities

Good television studio practice favors the installation of a permanent grid which resembles an architectural system of rigid 1½ inch iron pipe cross members four to six feet apart, and hung as close to the ceiling as possible, with sufficient clearance for electrical raceways, sheaves, conduits or ventilation ducts above. The grid may also be temporary. When temporary, the grid structure is supported by heavy vertical pipes which are rigidly anchored to the floor or walls, but can be readily removed.

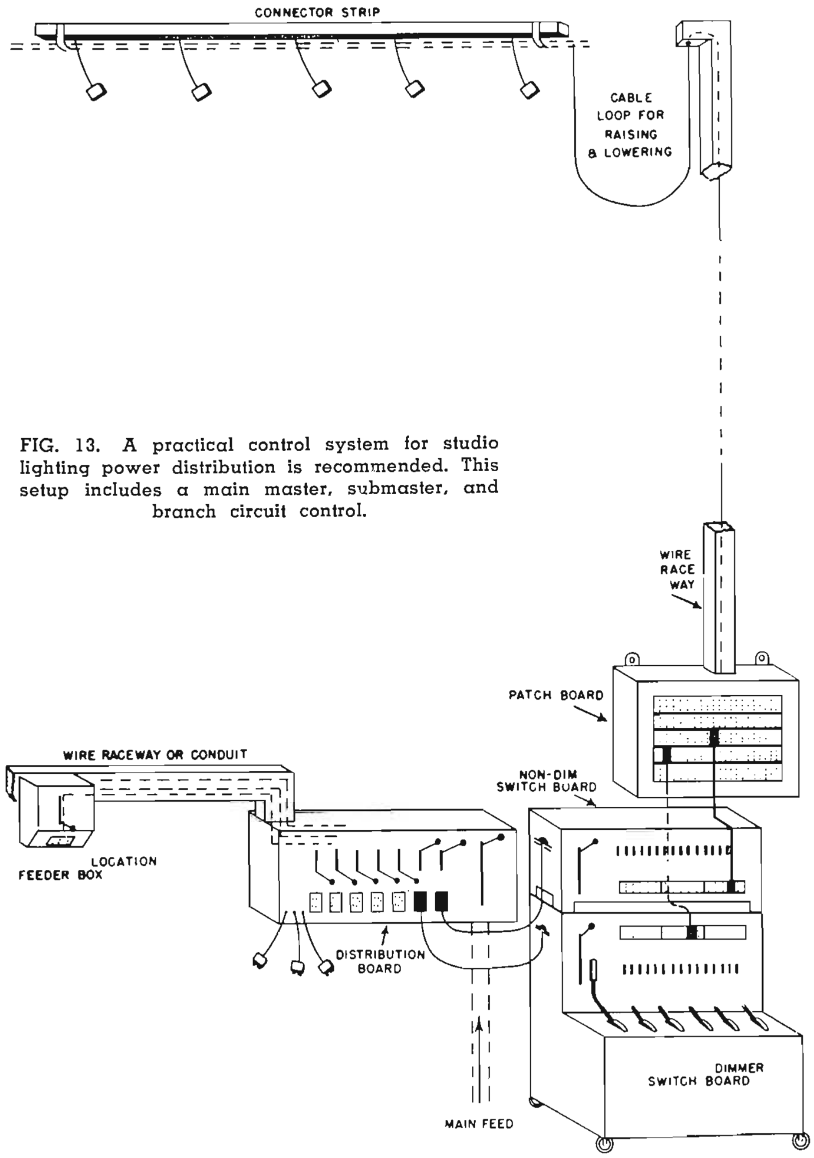


FIG. 13. A practical control system for studio lighting power distribution is recommended. This setup includes a main master, submaster, and branch circuit control.

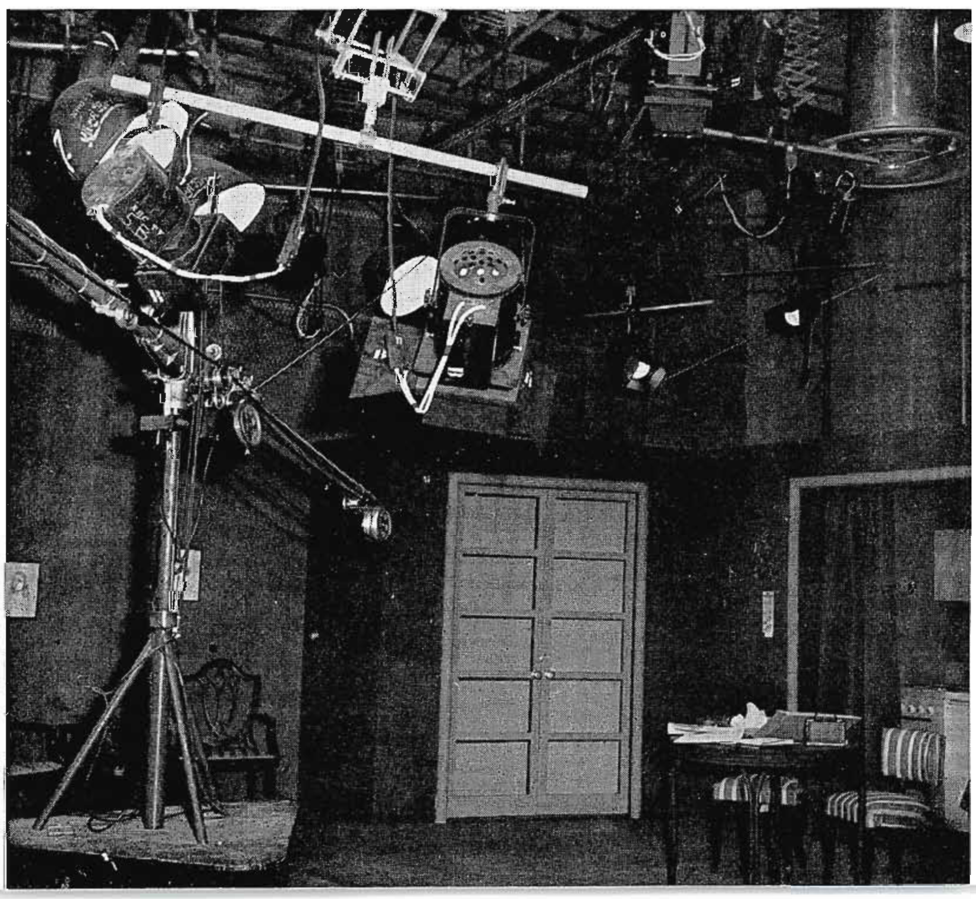


FIG. 14 (at right). View of TV studio lighting arrangement where flexibility is essential to accommodate a variety of programs.

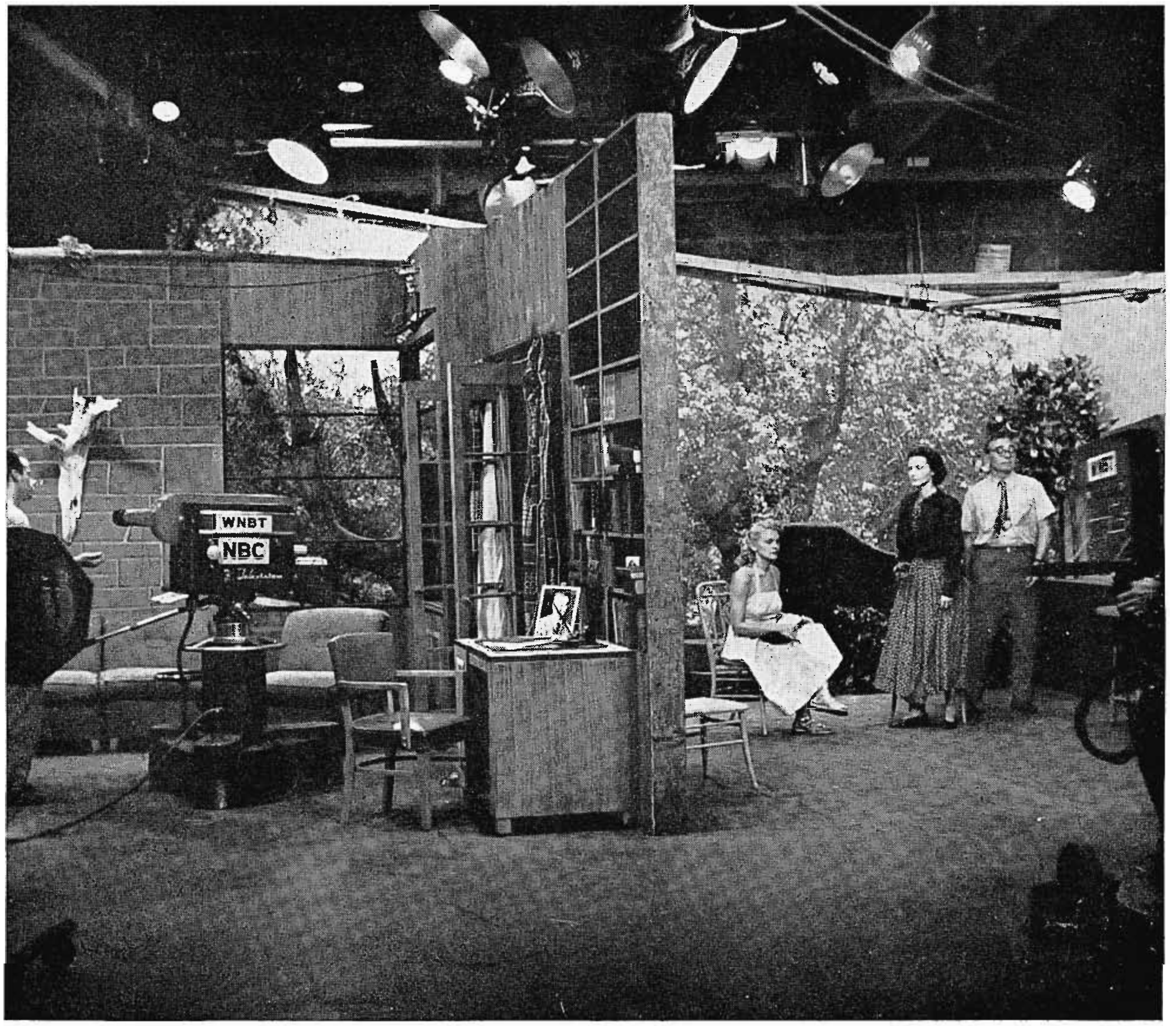


FIG. 15. A lighting arrangement in which frequent scenery changes and camera movements may require rapid manipulation of lights.

FIG. 16 (below). In this studio scene overhead spots and floods are manipulated to produce the desired lighting effect.

In some television studio installations, catwalks above or around the grid are used for making adjustments, hanging scenery, etc. However, the sacrifice in the effective studio height due to catwalks may in some cases present a serious disadvantage.

It has been found good practice to suspend lighting equipment on pantograph devices spaced on 4- to 6-foot centers and fastened rigidly to the grid structure, Fig. 12. The pantograph is constructed to prevent any side-sway, yet it permits raising or lowering of a lighting unit with its cable feeder from 18 feet to 4 feet above the floor, while a universal clamp allows 360-degree horizontal rotation and 90-degree tilting of the fixture.

Electrical Control

An adequate electrical control system for television studio lighting consists of:

1. A system of power input.
2. A system of controls.
3. A circuit terminating patch or connecting panel for conveniently energizing branch circuits.
4. A system of branch circuits permanently and conveniently distributed over the studio area.

1. *Power Input.*

Experience and present practices indicate that 20 to 40 watts per square foot of studio area is adequate for power requirements. Meters are usually provided on input lines so that the loads may be balanced and phased properly on a 3-phase system.

2. *System of Controls.*

A practical system of control in which power input is distributed, consists of a main master, submaster, and branch circuits which are easily manipulated through controls and switches that operate quietly. Since blackouts should be possible, a master switch is provided for all studio lights except "work lights", while a submaster switch controls all studio lights over a given work area, Fig. 13. Fused branch circuits terminate at a switching panel which are connected by a patching or connecting system to outlets distributed throughout the studio. All panels and switchboards should be located at a convenient position within the studio so that the lighting man can view the scene. In the over-all scheme, power is patched to the dimmers and the dimmed output is then connected through switch controls to the individual branch circuits appearing on wall patch panel. Dimmers are used only for effects such as fades, but not for control of the amount of light.

Branch circuits are usually heavy enough to carry up to 2000 watts capacity. For special lighting effects, some grid circuits are wired to carry 5 KW. A majority of the branch circuits terminate at the grid, while the others feed wall outlets. It is considered good practice to provide one branch circuit for 20 to 30 feet of floor area.

Applications

The application of these basic principles for power distribution and lighting controls can be adapted to various sizes of studios which can be classified into three categories.

The first, which requires the greatest degree of flexibility, may be called the general purpose or workshop studio. Herein originate a wide variety of dramatic performances, commercial sequences, and almost any type of small musical or speech groupings. In a studio of this type the maximum mobility in scenery changes and camera movements are essential. As a result, the lighting system must also be capable of matching these requirements both in physical manipulation and in beam pattern and intensity control. Figs. 14,

FIG. 17. In theatre type studios where audiences are present, modelling light equipment may be located in the wings.

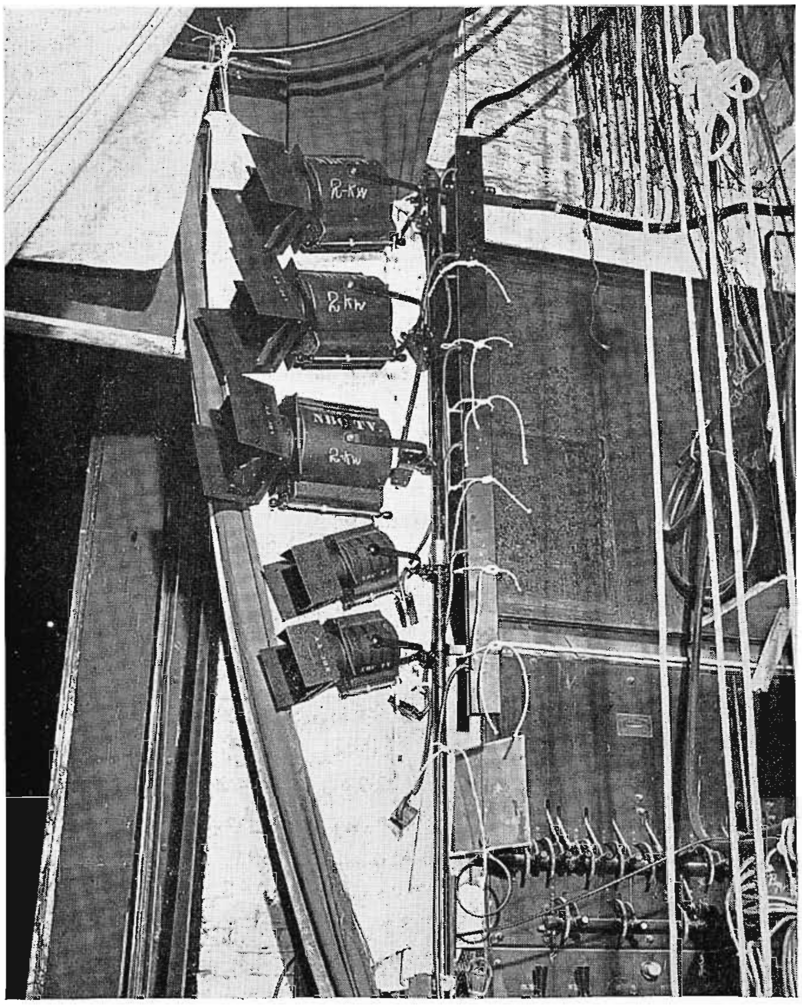
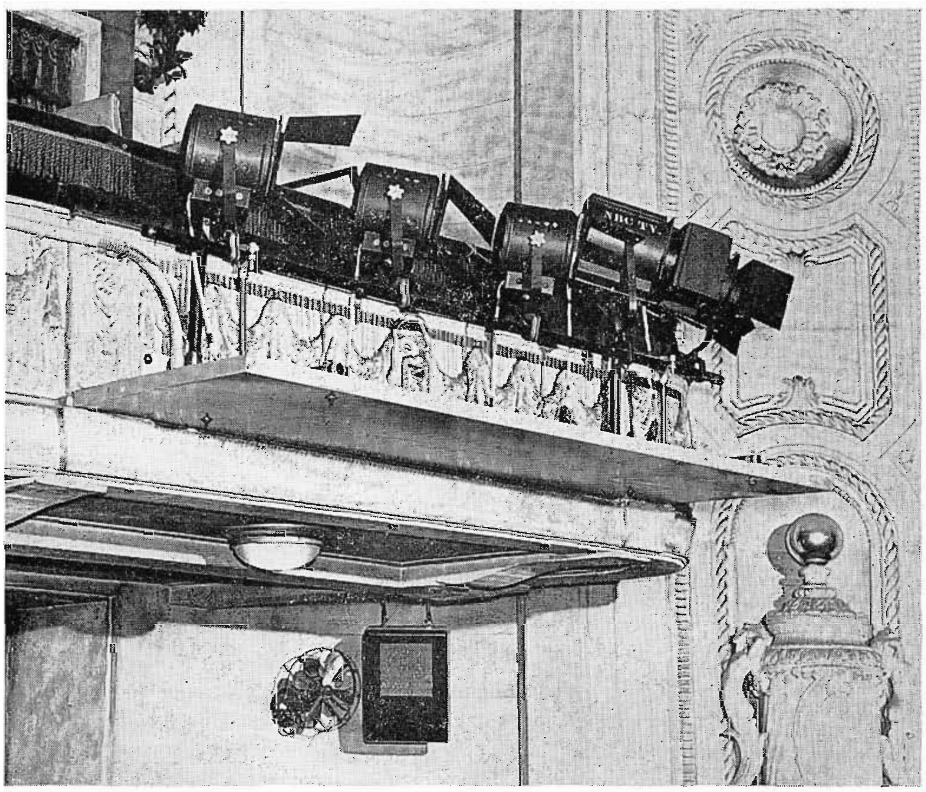


FIG. 18 (below). Another possible position for theatre studio lighting equipment is on a platform adjacent to a loge.



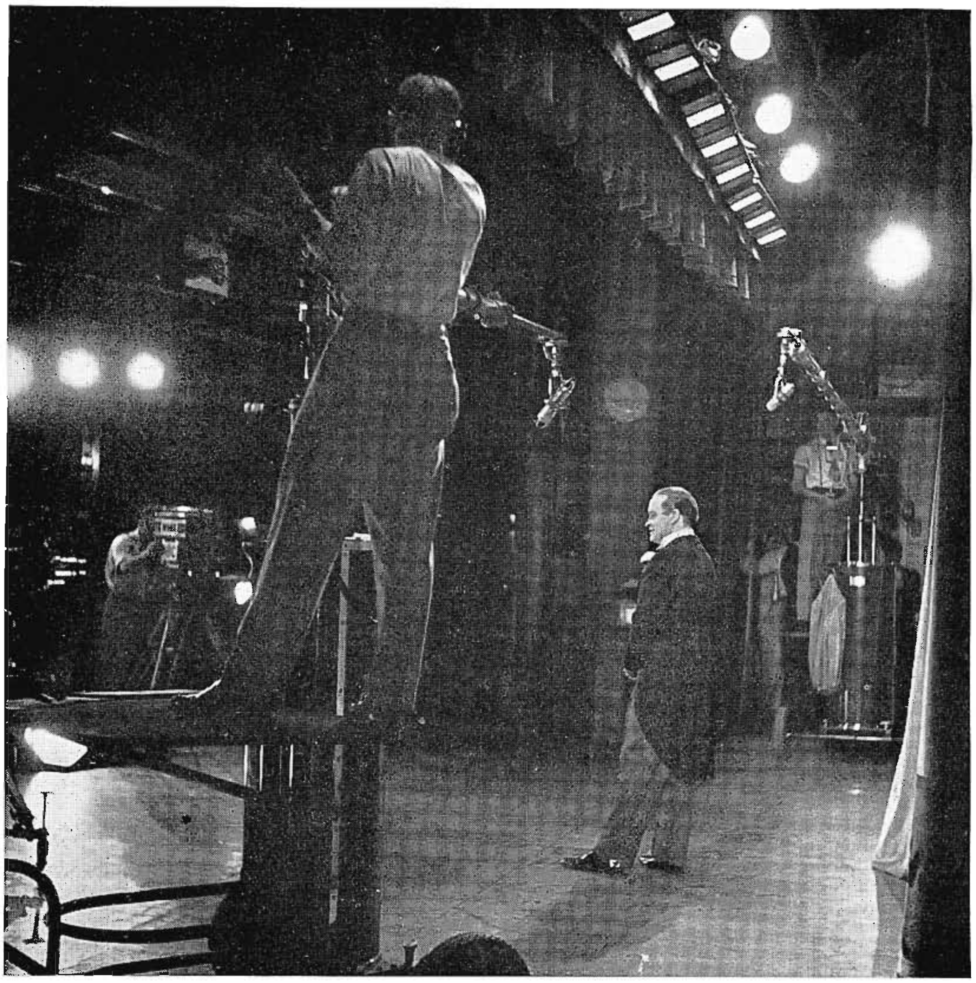


FIG. 19 (above). View of an NBC theatre studio illustrating the lighting arrangement utilized.

15 and 16 illustrate studios wherein the most recent developments have been incorporated.

The second type of studio frequently used for television programming is the one in which an audience is present and which is used chiefly for theatrical presentations as in a variety show of the Texaco "Star Theatre" type. Here the television point of view is that of an observer in the theatre and varies primarily not so much from different angles as from the area of view between a close-up and a long-shot. The lighting problems are consequently not as complicated as in the workshop studio but results suffer sometimes from inadequate front fill light. Footlights are used only to a limited extent because of the unnatural effects produced. Follow spots have been found to be satisfactory for long-shots but usually fail to improve the appearance of the principal characters on close-ups because the sharp beam creates harsh shadows, and lines around the eyes, nose and mouth. Color gelatines (frequently used in theatres to create pleasing color tones to the theatre audience) are almost completely lost to the television audience and introduce an undesirable change in the gray scale.

Much lighting equipment is supported on battens and hoisted above the stage together with other scenic material. Lower angle light for modelling is obtained by the use of standards located in the wings or on the sides of the theatre, Figs. 17 and 18. Fig. 19 illustrates how the lighting effects are produced in the NBC Studio at The International Theatre in New York City.

The third type of studio to which the facilities previously described can be applied on a small scale, is the one in which the set is essentially fixed in position and the program material is repetitive. The lighting can be fixed if desired once the original plan has been established. Under such conditions there is little reason for not achieving desirable artistic effects obtained with spotlights for backlighting, accents, together with floods for fill and base lighting since they add a great deal to the pictorial quality. Such a studio can be used, for example, for newscasting, interviews, quiz programs, kitchen demonstrations, etc.

Having described the equipment and space in which the programs are to originate, the development of applications and techniques can be more readily studied.

Quantity of Light

For general illumination over a working area, intensities ranging from 2 to 150 footcandles may be used, depending upon the nature of the scene. This general illumination or incident light is measured with the color-corrected light sensitive surface of the meter facing the camera lens and perpendicular to the lens axis.

As a guide, the average footcandles of incident light required for the Type 5820 orthicon, range between 32 and 64, with a lens opening of f:8. Lens stops normally used to give sufficient depth of field lie between f:5.6 and f:8. The Table, Fig. 21, lists footcandles of incident light for various lens openings. The inherent characteristics of the pickup tube limit the highlight to shadow or contrast ratio for an average scene to approximately 30 to 1.

Studio Lighting Technique

Studio Lighting technique may be described in accordance with the following types:

1. Base or General Lighting.
2. Key Lighting.
3. Accent Lighting.
4. Fill Lighting.
5. Effects Lighting.

1. *Base Lighting* is a uniform, wide distribution of low intensity illumination which covers the set, and may be provided with either incandescent floodlights or fluorescent lamps.

Where fluorescent equipment is used for base illumination, and provides a considerable percentage of the total illumination on the set, a #6 Wratten filter should be used on the camera lens to correct for color rendition.

2. *Key Lighting* is principal illumination which falls on a subject from light coming through a window, an open door, or fireplace, or at any point where action takes place. Spotlights with accessories and effects lighting devices are engaged to produce this key light.

Modelling lights are used to enhance the appearance of a subject, and for creating artistic effects. For this purpose, Fresnel lens spotlights, equipped with adjustable blinds and diffusers, find application.

Back Light is used to create the illusion of separation between the subject and the background, and to produce the artistic effects such as glistening highlights from the hair. Fresnel lens spotlights, with "barn doors" to control the spill light or shape the beam patterns, are used for this application.

3. *Accent Lighting* includes key lighting, modeling lights, and back lighting.

4. *Fill Light* is employed to add more light to portions of the subject or set to bring out more detail in the shadows, by adding some diffused light on the face of a subject opposite to a key light source. Narrow beam floodlights equipped with diffusers, or Fresnel lens spotlights with diffusers, are engaged for this purpose.

5. *Effects Lighting*—An important part of the interest in a television performance is maintained by the special lighting effects which are introduced to simulate realistic scenes. This is particularly true in the case of firelight, cloud effects, and window light created by equipment previously described. More recently, a technique was borrowed from the motion picture studios in simulating backgrounds and moving scenery as from a train window, the back of a car, etc., by using rear screen projection. Fig. 20 indicates how this is done. Care must be exercised in relation to perspective; distance between the live subject and the screen to avoid unwanted shadows; and the amount of front light to avoid washing out the projected picture. If motion pictures are used, the problem of synchronizing the frame frequency of the projector to the television camera must also be overcome. Fortunately, new equipment has been built which has satisfactorily solved this difficulty. It is obvious that outdoor settings can be quickly and economically reproduced. When stills can be used, the cost of backgrounds has also been sharply reduced and the variety of settings increased in proportion to the number of slides available.

Conclusion

With an accumulation of experience and knowledge of the requirements, television studio lighting techniques have reached a point where definitely planned schemes and practices can be recommended to produce artistic effects and good pictures. The best results, however, can be obtained only through imagination and originality in applying the fundamental principles.

It may be well to point out that the final criterion in appraising studio lighting cannot be judged by results obtained on the home television receiver alone. The studio-to-home span includes not only a properly lighted studio scene, but also properly-functioning transmission facilities, and a good quality, correctly adjusted home receiver and antenna. Good pictures are the result of efforts on the part of all of those who form the chain of facilities which link the studio scene to the television receiver.

Our appreciation and thanks are expressed for the helpful aid received from the engineering staffs of NBC, RCA, and Westinghouse Lamp Division, in the completion of the material and charts contained herein.

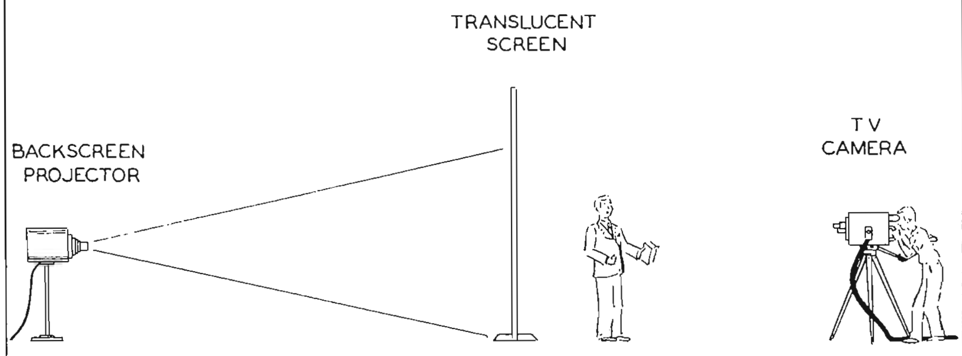


FIG. 20 (above). Moving scenery may be simulated by means of back-screen projection.

INCIDENT LIGHT REQUIRED FOR RCA IMAGE ORTHICON 5820

LENS STOP	INCIDENT LIGHT
f:1.9	2-4 Footcandles
2.8	4-8
3.5	6-12
* 5.6	16-32
* 8	32-64
11	60-120
16	120-240

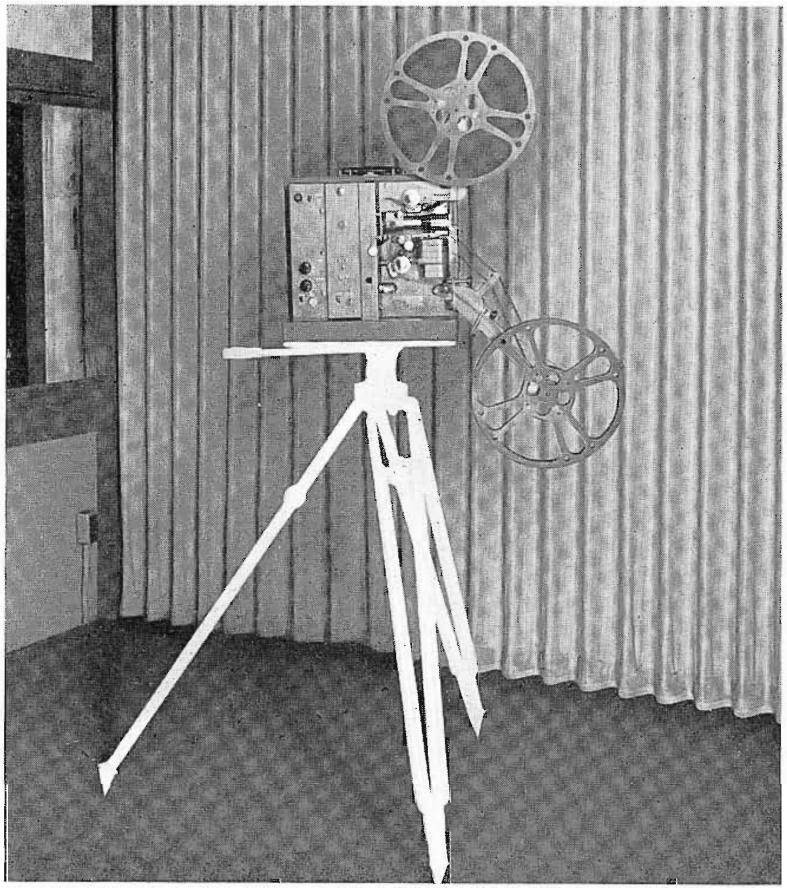
* Normally used.

FIG. 21. Table.

NEW PORTABLE TV FILM PROJECTOR, TP-10A

By G. W. TUNNELL
Television Equipment Sales

The new TP-10A Portable Projector (MI-26963) is intended for use in the production of remote television programs, or as an auxiliary to the film studio facilities. In either case, film commercials or other films of reasonably short duration can be inserted in the program with a minimum of time and facilities. The image orthicon studio or field type camera with a few simple modifications is ideal for use as a film camera when operated with the TP-10A Portable Projector.



The TP-10A when used with Field Camera enables commercials direct from remote pick-up points. Tripod and friction head shown in "phantom" are available as separate items.

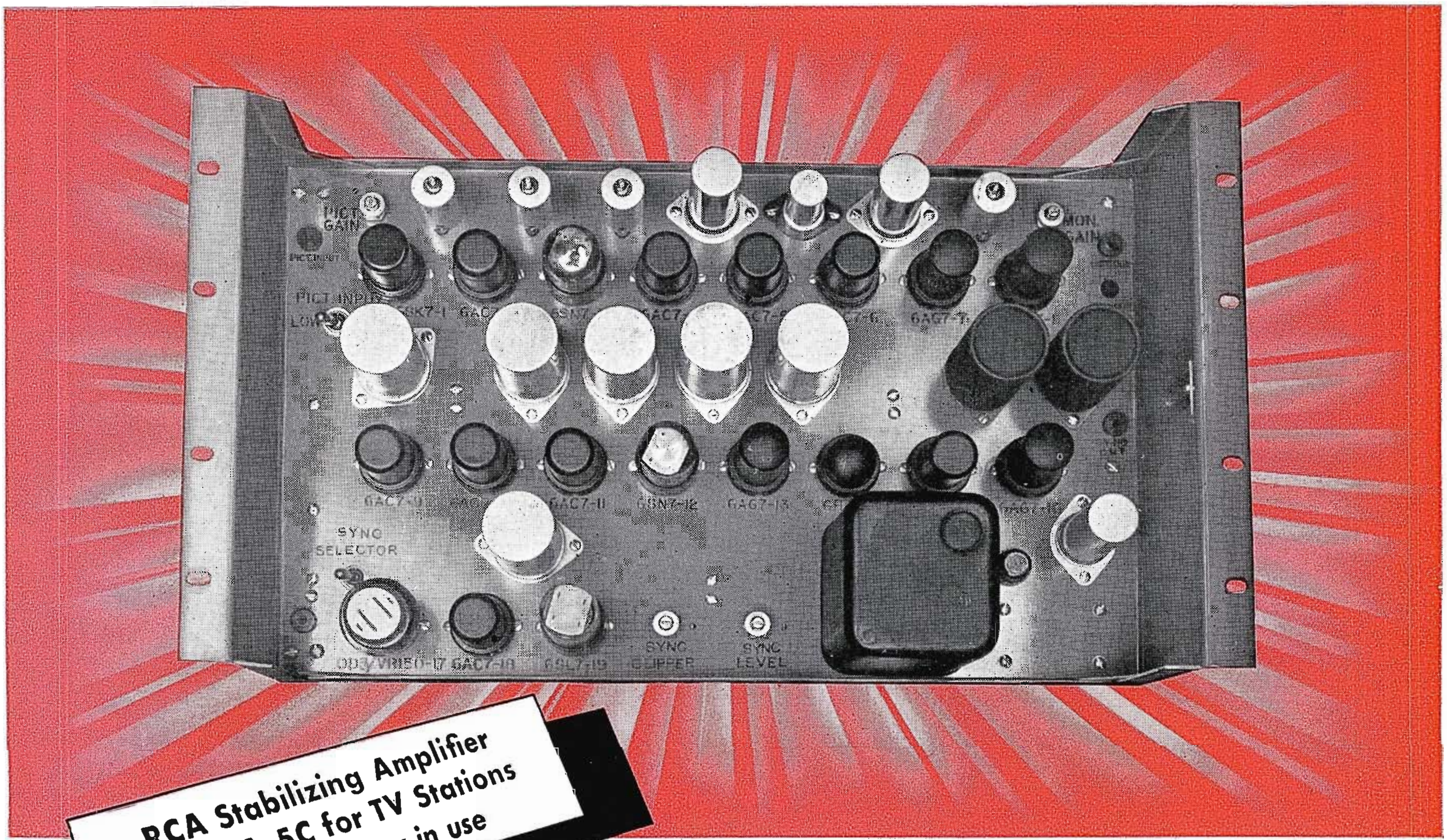
General Description

The Portable Projector is designed to accommodate 16mm sound film, and employs the same fundamental principles used in other projectors, with one major exception: the flashing light source in the portable projector permits elimination of the shutter. The light output is low, which permits the use of the Image Orthicon camera as a film pickup device. The flashing light source allows operation of this system while the film is stationary in the projector aperture. This is particularly helpful, inasmuch as it will assist the operator with the alignment of the film system at the remote location.

Numerous other attractive features are provided. For example, phasing of the projector motor through 360 electrical degrees can be controlled from a knob which exists on the outside of the projector case. An external knob is also provided for turning the projector mechanism manually, thus facilitating the projection of a single frame for set-up purposes. A film rewind mechanism is also provided. The projection lamp is expected to have a much longer life than that of the incandescent type. The projection lens provided has a four-inch focal length and a speed of f/3. The photocell is an RCA type 921 which feeds a preamplifier located in the projector case (output of the preamplifier is approximately —30 vu).

The base plate of the projector is designed to permit mounting on a standard friction head (friction heads and tripods are not supplied). The base of the projector is also designed so that the projector can be seated on a table or similar mounting.

All of these features are included in the TP-10A Projector which fits in a case 12 inches wide, 16 inches long and 15½ inches high. Reels with 400-foot film capacity are supplied. The projector, power supply, preamplifier, reel arms, reels and power cables are all included in one carrying case (total weight of equipment and case is approximately 55 pounds).



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The TA-5C stabilizing amplifier handles sync inputs up to 8 volts—and delivers signal voltage output at standard RMA values through just one simple adjustment of the sync control. Total tube complement—only 19!

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Send me price and complete information on the RCA Type TA-5C Stabilizing Amplifier.

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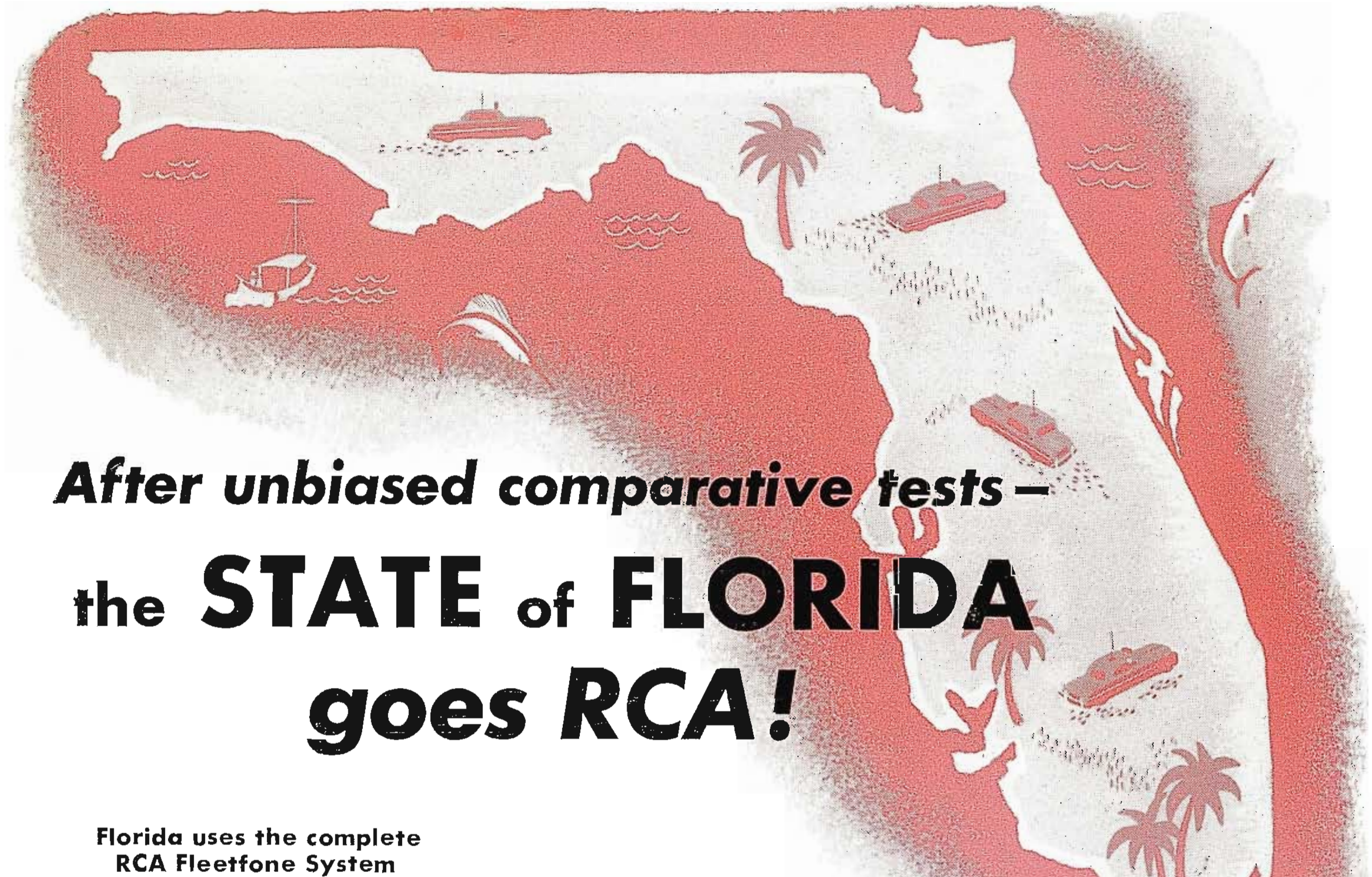
Station____________________



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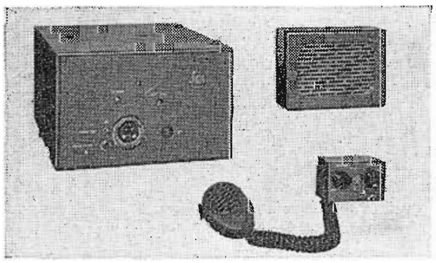
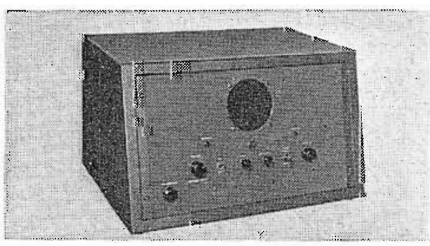
the STATE of FLORIDA goes RCA!

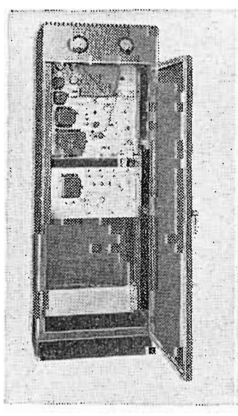
Florida uses the complete RCA Fleetfone System



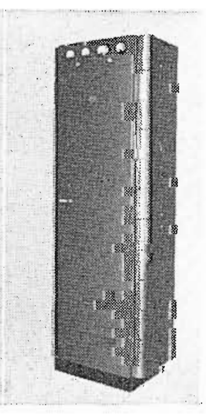
• Mobile Fleetfone 30 watts



• Station Control



• Station Fleetfone 70 watts



• Station Fleetfone 250 watts

RCA 2-way Fleetfone radio chosen after tests by the University of Florida Laboratories

When the Florida State Highway Patrol prepared to expand its 2-way radio system to cover the entire state, competitive bids were invited and manufacturers were asked to submit equipment for tests.

The University of Florida Laboratories submitted these equipments to a series of gruelling tests to determine reliable car-to-car communication distance, adjacent-channel interference, and maximum headquarters-to-mobile range.

Result: Florida has ordered RCA Fleetfone 100%!

• • •

Plan your communications system around *laboratory-approved* equipment. Go RCA. The RCA Fleetfone (for 30 to 50 mc operation) and its companion, the RCA Carfone (for 152 to 174 mc operation) offer the finest in mobile communications.

For information and help on any type of two-way radio system, call or write Dept. 141H, RCA Engineering Products, Camden, N. J.

MOBILE COMMUNICATIONS SECTION

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

THIS NEW TABLE MODEL ELECTRON MICROSCOPE is a very compact, extremely stable unit which employs permanent-magnet type lenses in the optical system. It is expected that the low cost and ease of operation of this new instrument will bring the benefits of electron microscopy within the reach of schools, hospitals and smaller industrial laboratories. The electron microscope — which makes it possible to "see" particles a millionth of an inch in diameter — is one of a number of electronic and nucleonic instruments which RCA has developed for scientific, industrial, educational, and government services.

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