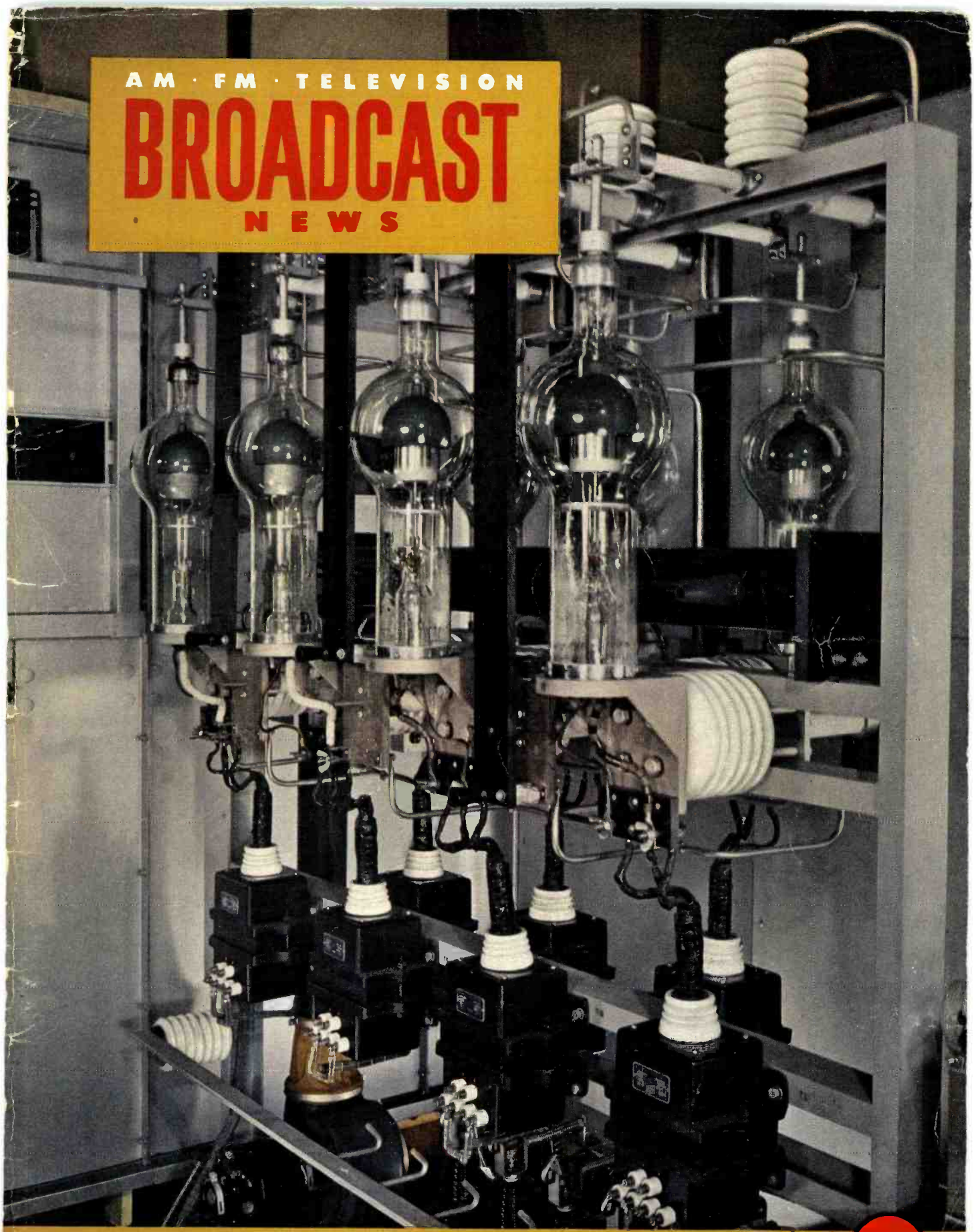
AM · FM · TELEVISION

BROADCAST NEWS



THE FINEST TRANSMITTER EVER BUILT . . See Pg. 8

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The one company that has everything for every broadcaster

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BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

Broadcast News

AM • FM • TELEVISION

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Published by the

RADIO CORPORATION OF AMERICA

ENGINEERING PRODUCTS DEPARTMENT . . . CAMDEN, NEW JERSEY

NUMBER 45 JUNE, 1947

Subscription Rate $1.50 per year. Single copy 50c.

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

Contents

OUR COVER for this issue, as you hardly need be told, is a Kodachrome of the high-voltage rectifier of our new 50 KW AM Transmitter, the Type BTA 50-F, described in the article starting on Page 6. It is one of a series of color photographs of this transmitter made by Rod Allen of our own photographic staff.

OUR FINEST is the way we describe the BTA 50-F Transmitter—and we mean just that. True, we're building some swell FM and Television gear—but FM and TV are relatively new, and not so much is known about actual operating requirements. FM and TV equipment design, you might say, are based on expectation (of how it will be used)—but AM design is based on experience—and brother, we've got it!

The parade of RCA "Fifties" began with the 50-A's we installed at WJZ and WENR in 1927. In 1929 came the 50-B's installed at KOA, WEAF, WTIC, WFAA, WBT, WOC, and others to a total of eighteen (eleven of them are still operating); in 1934 the 50-C's; in 1937 the 50-D's; in 1941 the 50-E's. And now, the BTA 50-F. Already we've built sixteen 50-E's—all scheduled for early installation—and we're building another fifteen. That makes a total of forty-five 50 KW broadcast transmitters —more than half of all those ever built for use in this country. And—RCA's percentage of this blue-chip business is increasing—eight of the fifteen stations with new 50 KW AM grants are installing RCA "Fifties." All of these fifties, past and present, were planned by RCA engineers (and all but the first two models built 100% by us). The same group of "high-power" engineers also designed and built one 500 KW broadcast transmitter (installed in England during the war)—one 100 KW broadcast frequency and thirty-five 50 KW short-wave broadcast transmitters. Moreover, every man who has worked on these jobs is still with RCA, and most of them with the same group. That *is* experience —and the BTA 50-F reflects it. But don't take our word for it—read about it, see it, compare it—and look at the company it keeps—the best stations in the business.

T-DAY IN ST. LOUIS gets a lot of attention in this issue of BROADCAST NEWS. There are several reasons for this—all of them (we think) good. To begin with, KSD-TV is the first truly postwar station to go on the air—and as such, is the first to be fitted with all new postwar equipment. This is a real milestone for us—something we've been looking forward to for a long time. And the first reports indicate that our expectations have not been too high. Although shortages and delays made it necessary to go ahead with numerous substitute items, the results to date have been exceedingly good. Several seasoned observers have said that the pictures are the best they have ever seen. Considering the limited amount of studio equipment used, and the inexperienced personnel, this is certainly a high compliment.

A second reason why we are so interested in KSD-TV is that this is the first real "independent" station—i.e., the first not tied, one way or another, to a manufacturer's or network's apron strings. As such it is the first good example of what most television stations, five years hence, will be like and is a better demonstration of the problems and solutions they will have to meet than are the older existing stations. Because of this we think that its progress and operation will be of transcendent interest to stations just starting on their television plans.

T-DAY EVERYWHERE (well, almost everywhere) is closer than you think. As you read this, the first of our new TT-5A Transmitters is being installed at WNBW, Washington (NBC). The second goes shortly to KSD-TV to replace their temporary job. Thereafter, TT-5A's will roll out of the Camden plant at the rate of two or three a month for the rest of the year. By December some twenty-five will be in the hands of customers. Not all, of course, will be on the air, but judging by the number of stations that are sitting on their hands waiting for them, most of these transmitters will be on the air by this time next year. Praise be, the joint is jumping!

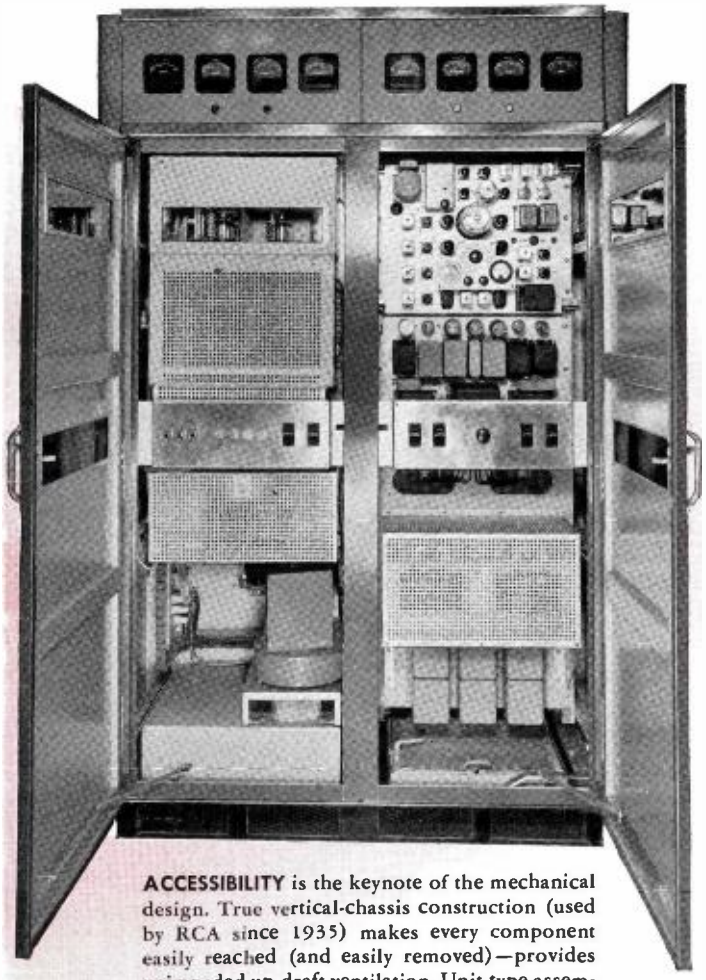
RCA 1 KW FM
Broadcast Transmitter
BTF-1C

RCA KILOWATT FM

This is a Transmitter Man's TRANSMITTER

You know what is meant by a ballplayer's ballplayer. He looks good to the public. Sure . . . but more than that, he looks good to other ballplayers. He makes every play in just the right way—and he makes them look easy, not hard.

The RCA 1KW FM Transmitter (Type BTF-1-C) has a similar standing among transmitter men. It looks good (RCA has always been the leader in styling)—and it sounds good, too (performance specifications are unexcelled). But more than that, it has the engineering features which your engineer appreciates and wants. Some of these features, such as the mechanical design and the control circuits, are common to all RCA transmitters and are already well-known to him. Other features, listed below, are particular to this new FM transmitter.



ACCESSIBILITY is the keynote of the mechanical design. True vertical-chassis construction (used by RCA since 1935) makes every component easily reached (and easily removed)—provides unimpeded up-draft ventilation. Unit-type assembly makes for easy installation, flexibility and simple modification for higher power.

DIRECT FM-type exciter. No fussy, complicated circuits. No trick tubes. (There are only four r-f tubes—an oscillator, two triplers and a buffer amplifier). Frequency control circuits provide crystal-equivalent stability, but are completely independent so that a failure in these circuits does not affect modulation or take the transmitter off the air. Because it uses fewer tubes, does not involve phase multiplication, this exciter is inherently capable of lower noise and distortion than any type yet developed.

ONLY 8 R-F TUBES in the whole transmitter (one oscillator, two triplers, one doubler, four amplifiers). There are two audio tubes, and seven tubes in the power supplies (not including voltage regulators). Thus there are only 17 tubes whose failure can take the transmitter off the air (thirteen additional tubes in regulator and control circuits do not contribute to outages). The total 30 tubes is, we believe, the lowest number of any similar transmitter of this power.

GROUNDED GRID CIRCUIT used in final amplifier, requires no neutralization, provides greater stability than can be obtained with older, more conventional amplifier circuits. This is the easiest transmitter to adjust that you've ever worked on. Can be tuned in a few minutes' time by inexperienced personnel.

DISC-SEAL TUBE, the RCA 7C24, especially designed for grounded-grid operation, is used in the final amplifier (and also in the final amplifier stages of the RCA 3KW and 10KW FM transmitters). Quantity produced, field-tested, rugged, and inexpensive—it is the best-suited tube yet designed for this use.

SHIELDED TANK CIRCUIT used in the final amplifier (and also in RCA 3's and 10's) is a concentric-line design in which the outer tube is at ground potential. Tube and inner line are completely enclosed providing near-perfect shielding. Only in this way can the flow of r-f currents in the cabinet be prevented. R-f radiation from the transmitter housing (and r-f pick-up in nearby audio circuits is less than with other tank circuit design).

SINGLE-ENDED OUTPUT is an important feature. Single-ended circuits are more stable and easier to adjust (no balancing) than push-pull circuits—particularly at FM frequencies. Moreover, single-ended circuits are more easily matched to the grounded transmission lines universally used in FM service.

BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

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In Canada: RCA VICTOR Company Limited, Montreal

Accessibility is the keynote of this mechanical and electrical design. True vertical-chassis construction . . . used by RCA since 1935 . . . provides unimpeded up-draft ventilation, makes every component easy to reach and easy to remove. Unit-type assembly makes for flexibility, easy installation, and simple modification for higher power. Due to small unit sizes, it is particularly adaptable for high-building installations where equipment must be moved in by elevators.

3 dependable kilowatts of FM

. . . with the RCA type BTF-3B

You are looking at a 3-kw FM broadcast transmitter built strictly for professional transmitter engineers who know transmitters—yet is so simple that inexperienced personnel can tune it in minutes. It has every proved feature required for proper operation and it's free from tricks and gadgets.

You'll be interested in these facts

Fact No. 1—This transmitter uses RCA's simple, straightforward, Direct FM-type exciter . . . inherently capable of holding distortion and noise level below that of any other exciter yet developed. Frequency control circuits give stability equal to crystal operation, do not affect modulation, and cannot take your carrier off the air. With only 4 r-f stages . . . 1 oscillator, 2 triplers, 1 buffer . . . it uses fewer tubes and no trick types.

Fact No. 2—The entire transmitter uses only 9 r-f tubes . . . 1 oscillator, 2 triplers, 1 doubler, 5 amplifiers. There are 2 modulator tubes and 10 rectifier tubes . . . excluding voltage regulators. Result: only 21 tubes can seriously affect your carrier. (15 regulators and control tubes do not contribute to transmitter outages.) *This total of 36 tubes is lower, we believe, than any similar transmitter of this power.*

Fact No. 3—The BTF-3B uses the RCA-perfected Grounded-Grid circuit in both the driver and final amplifiers. It's simple to tune. It requires no neutralization. It's more stable than older, more conventional amplifier circuits.

Fact No. 4—The final amplifier uses RCA's vhf Disc-Seal tube, type 7C24 . . . especially designed for grounded-grid operation in our 1-, 3-, 10-, and 50-kw FM transmitters. Quantity-produced, fully field-tested, rugged, and inexpensive, the RCA-7C24 is the best-suited tube yet designed for this service.

Fact No. 5—Shielded tank circuit design of the final amplifier eliminates r-f current flow in transmitter housing. Result: greatly reduced housing radiation compared with conventional tank circuits . . . and greatly reduced r-f pick-up in nearby audio circuits. Reason: outer tubing of concentric tank operates at ground potential . . . provides a near-perfect shielding for its inner conductor.

Fact No. 6—Single-ended output circuits provide greater stability and are easier to adjust (no balancing required) than push-pull circuits—particularly at FM frequencies. Single-ended circuits provide easier matching to the grounded transmission lines universally used in FM service.

Full information is yours for the asking. Write RCA, Dept. 19-E, Broadcast Equipment Section, Camden, N. J.

RCA

BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

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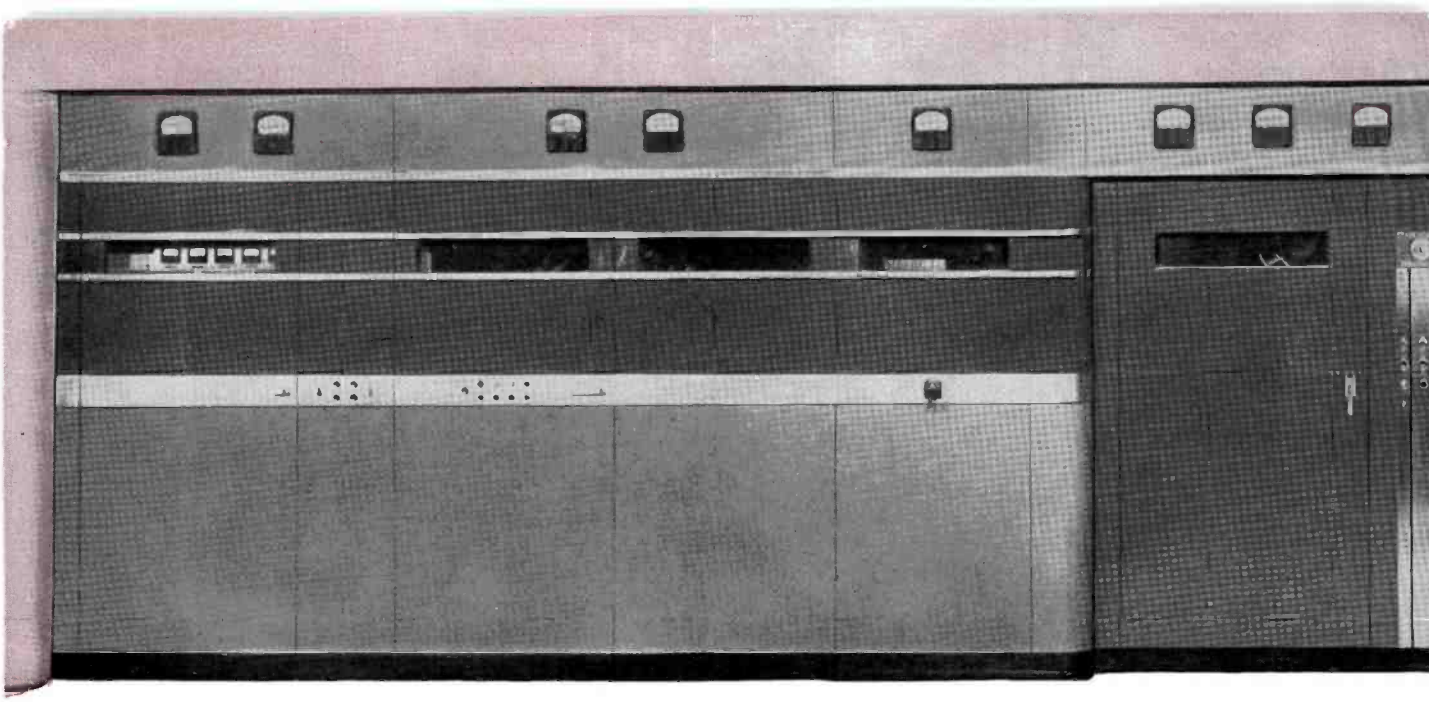
RCA 3-KW
FM Broadcast Transmitter
Type BTF-3B



The finest transmitter RCA has ever built... now available from stock

CONTROL CONSOLE contains controls for both the transmitter and audio channels. Every major function of the transmitter is at the engineer's finger tips or within easy viewing distance.

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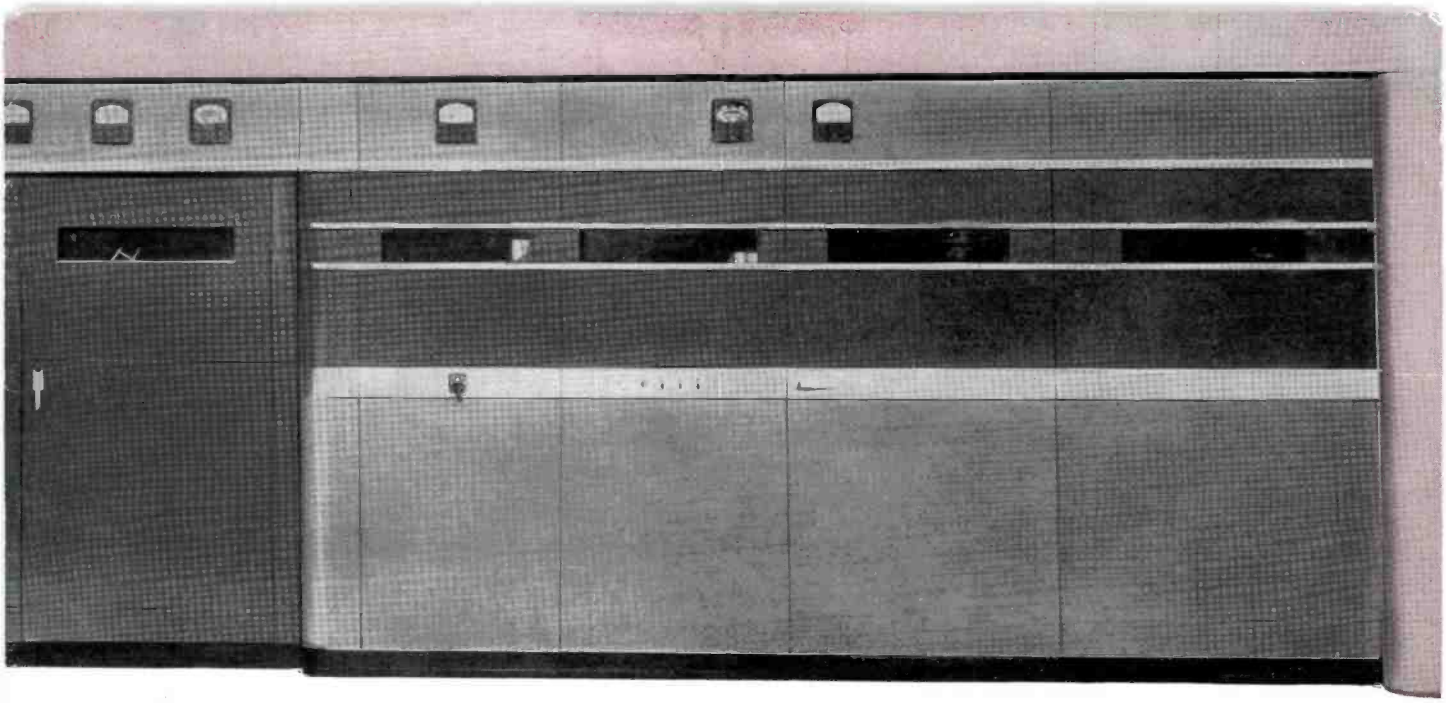
KANSAS CITY, MISSOURI

KMPC
LOS ANGELES, CALIFORNIA



the new 50-kw AM, type BTA-50F

- **Postwar member of a famous line**
- **RCA 50's are now in use or on order at 22 of the nation's 50-kw AM stations**
- **Today, six of the country's top broadcasters are installing this new 50-kw transmitter**

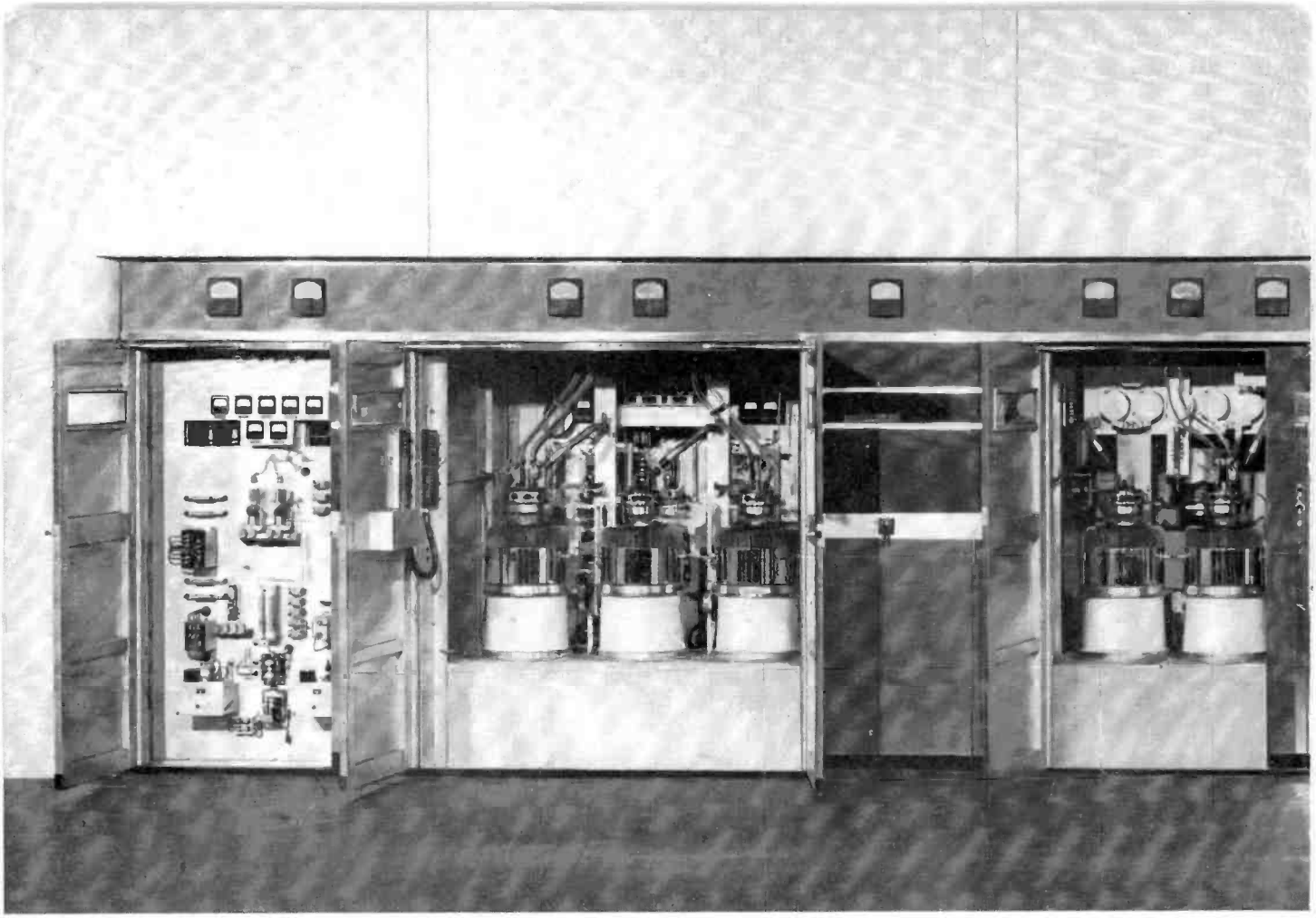
KOMO SEATTLE, WASHINGTON

WCFL CHICAGO, ILLINOIS

WFAA DALLAS, TEXAS

WJJD CHICAGO, ILLINOIS

STAGE by STAGE, IT HAS EVERYTHING YOU MIGHT WANT



a new 50 KW AM TRANSMITTER

by W. L. LYNDON
Transmitter Engineering Section
Engineering Products Department

The first high-powered broadcast transmitter to come over the postwar horizon and be delivered to the field was the RCA Type BTA-50F. The manufacturing of this type of transmitter was started shortly after V-J Day and a number of installations are now well on their way towards completion.

The BTA-50F is an all air-cooled, high-level amplitude-modulated transmitter capable of providing a carrier of 53 kilowatts of radio-frequency power at the transmitter output terminals over the range of 540 to 1600 kilocycles.

The entire transmitter has been designed to insure minimum installation cost, ease of service and maintenance, and ample factor of safety on individual components.

The BTA-50F contains six units; namely, the exciter, modulator, filament power unit, power amplifier, main rectifier, and control-and-distribution unit that are mounted immediately behind a common front panel enclosure. Interlocked doors in this enclosure permit access to the front of the exciter, modulator, and power-amplifier units. The RCA Type 9C22 modulator and power-amplifier tubes are accessible through these front doors and can readily be changed by means of a tube hoist supplied as part of the transmitting equipment. This front panel is thirty-three feet long and eighty-four inches high. It is finished in a pleasing two-tone umber gray and trimmed with satin-chrome styling strips. It is broken down into a number of sections to permit ease of handling and installation. The problem of interwiring has been greatly simplified by the use of a wire duct that runs along the top front of the above units directly behind the enclosure. The top of this duct is removable for the convenience of laying in the interconnection wires. The terminal blocks are located near the top of the individual units, thus eliminating the necessity for long cable lacing runs. A non-interlocked door is located near the right end of the enclosure, which will permit access to the control-and-distribution unit and the front of the switchgear unit. Near this door is located a partition that ex-

FIG. 1. (Above) *The streamlined, unified front of the 50-F contains wide, full-length doors which provide direct, non-hampered access to the low-power r-f modulator and power amplifier compartments. The door at the right is the entrance to the non-interlocked area which contains the control and distribution unit and the main switchboard unit (see diagram on following page).*

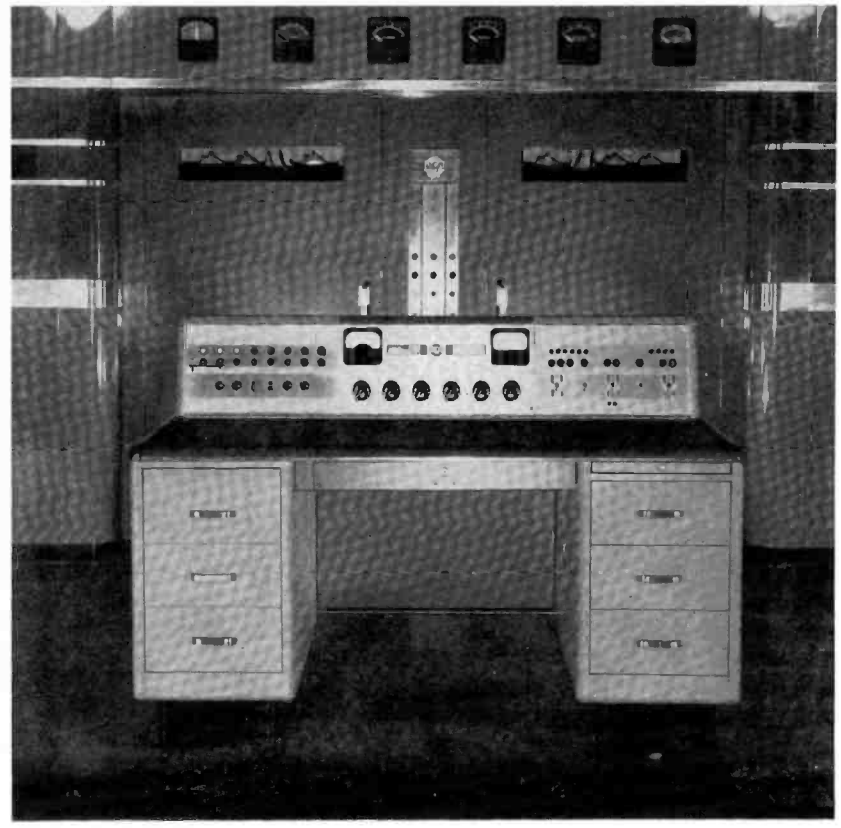
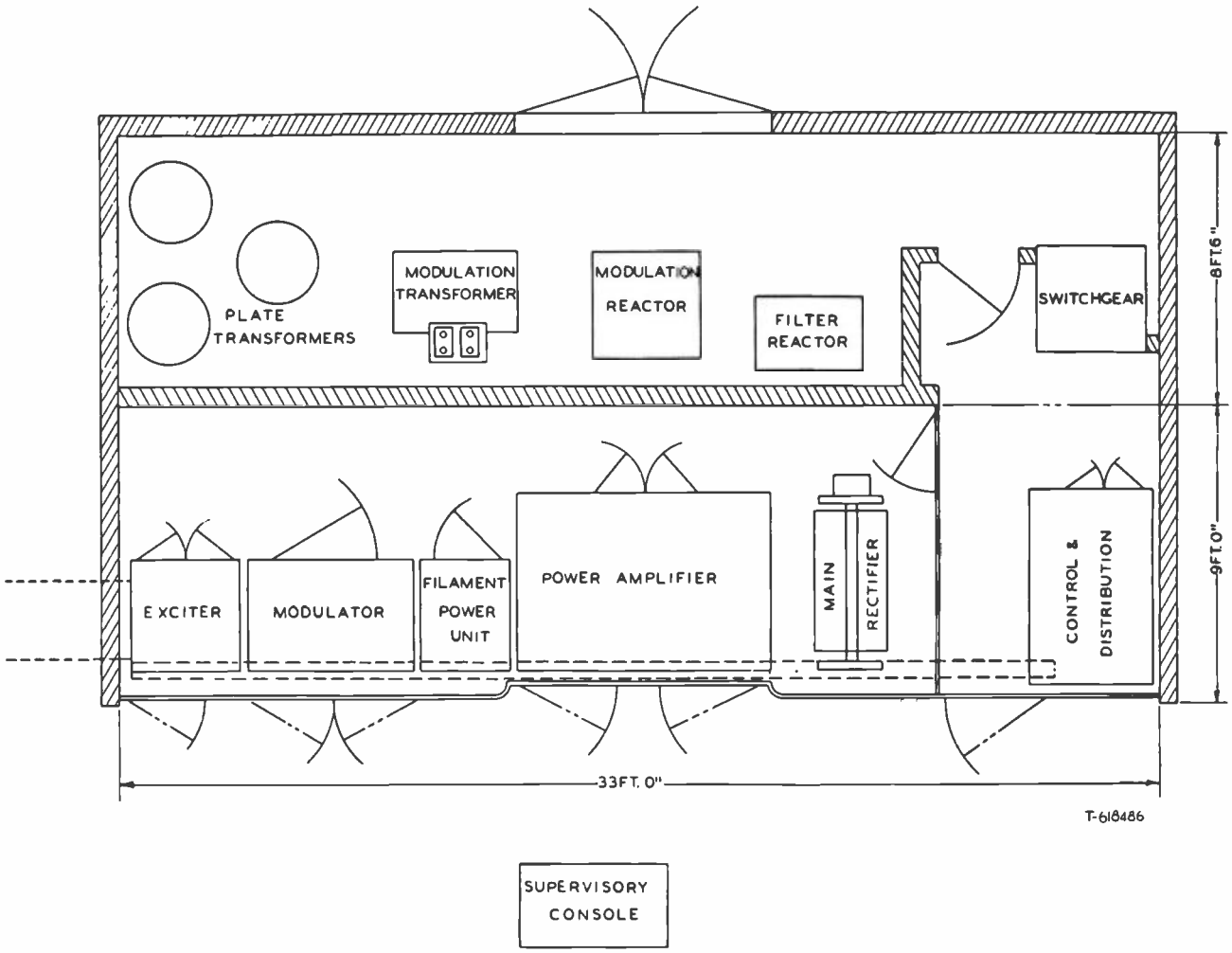


FIG. 2. (Right) *The supervisory control console furnished with the 50-F contains extension controls for the transmitter, together with all audio switching controls required for regular operation. These controls are located on three hinged panels. The right panel contains pilot lamps, overload relay indicator lights, overload reset buttons, and high- and low-power switches. Center panel contains VU meter, outage clock and audio mixers and gain control. The left hand panel contains audio switching controls and indicating lights.*



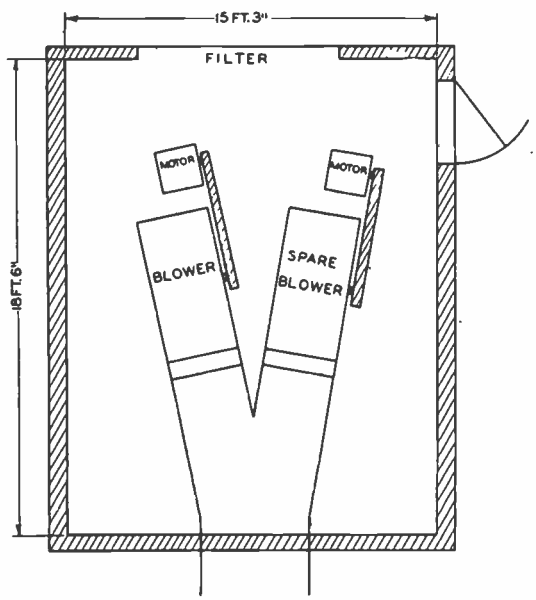


FIG. 3. *A typical floor layout plan for the 50-F transmitter. Area containing switchgear and distribution units is non-interlocked. Transformers and reactors located in rear area may be placed in basement if desired. Blowers, shown in diagram at left, may be on same floor as transmitter, in basement, or wherever convenient. Air duct from blower is shown by dotted lines at left of exciter in above plan.*

tends to the rear of the enclosure for a distance of nine feet. This section contains an interlocked door which provides access to the rear of the transmitter units.

The Class B modulation transformer, modulation reactor, and the high-voltage plate transformers are oil-filled. These units contain no parts that require regular maintenance or servicing other than the occasional inspection of the oil level and periodic checking of moisture content of the oil. The main filter reactor is air cooled and may be located in the transformer vault or adjacent to the transmitting equipment proper.

The exciter section contains two crystal oscillators, Type UL-4392, which are standard for all RCA standard-band broadcast transmitters. A Type RCA-807 transmitter beam power tube acts as an oscillator tube. This oscillator is tuned by means of a tapped inductance which is selected at the time of installation. In order that zero beat may be obtained against a standard reference, a small vernier-type capacitor is included on the oscillator, which will permit a small frequency change. The crys-

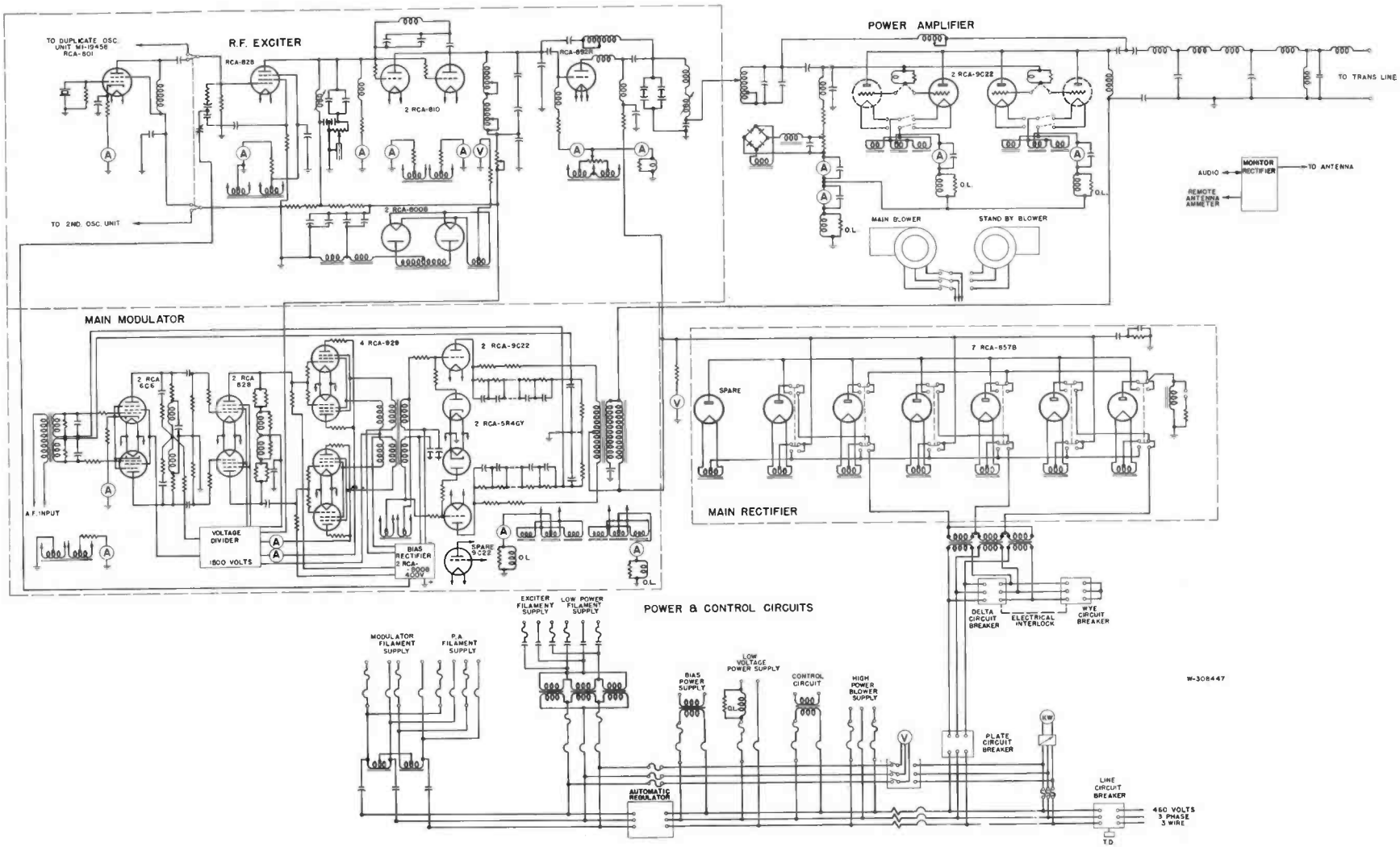


FIG. 4. *Simplified schematic of the 50-F transmitter. Note the relative simplicity, particularly of the r-f circuits, as compared to 50 kw transmitters of earlier design. There are only five r-f stages. All use single-ended easily tuned, class C stages with inductive neutralization. High-level class B modulation with fixed feedback (audio stages only) eliminates all feedback adjustments. The same type tubes are used in the modulator and power amplifier, simplifying stock problem. Spare tube positions are provided in modulator, power amplifier, and high-power rectifier, thereby reducing tube replacement time.*

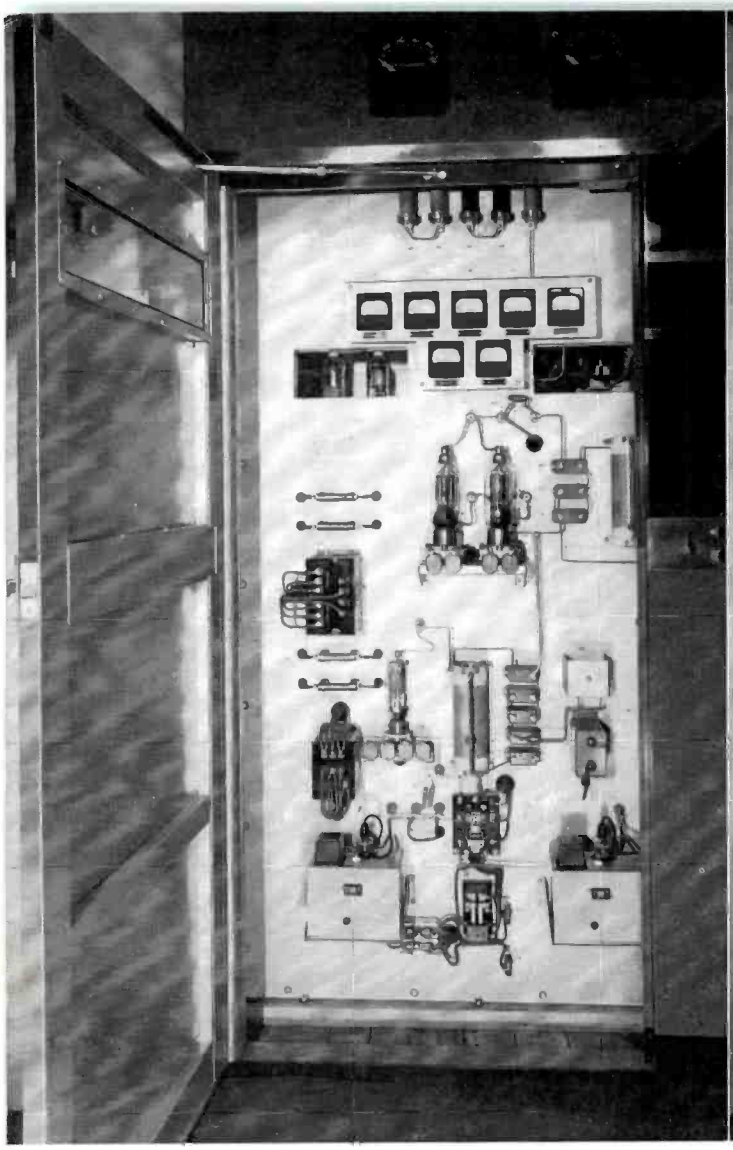


FIG. 5. *Low-power r-f stages are located on a vertical panel in the front of the exciter cubicle. Duplicate oscillators are provided, with manual or automatic changeover being available.*

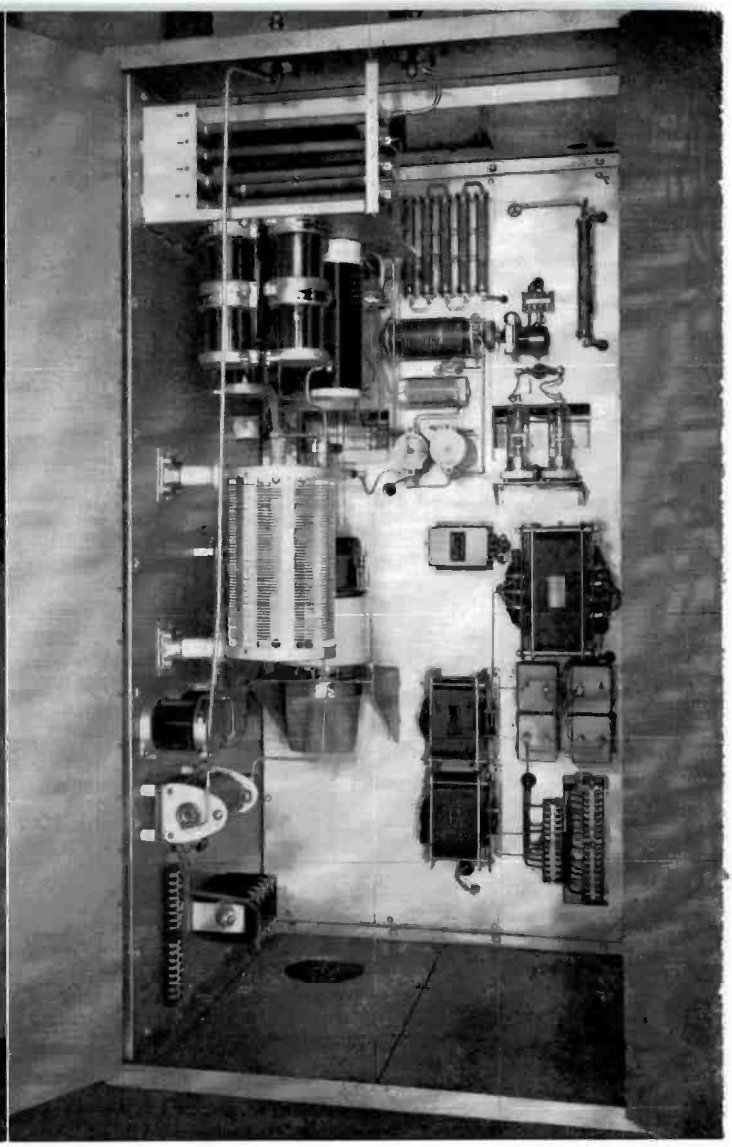


FIG. 6. *The intermediate power amplifier circuits are located in the rear of the exciter cubicle. Note the accessibility of all components and wiring connections.*

tal oscillator feeds into an RCA Type 828 beam power amplifier. Neutralizing is not necessary for this type of tube and the plate-tank circuit is permanently tuned by means of an adjustable inductance. Power output of this 828 stage provides excitation for two RCA 810 triodes, operating in parallel. The plate tank circuit is made up of fixed capacitors and two coils, one a continuously variable motor-driven coil, which is controlled from the front of the enclosure. Neutralizing is permanently adjusted by means of a tapped inductance.

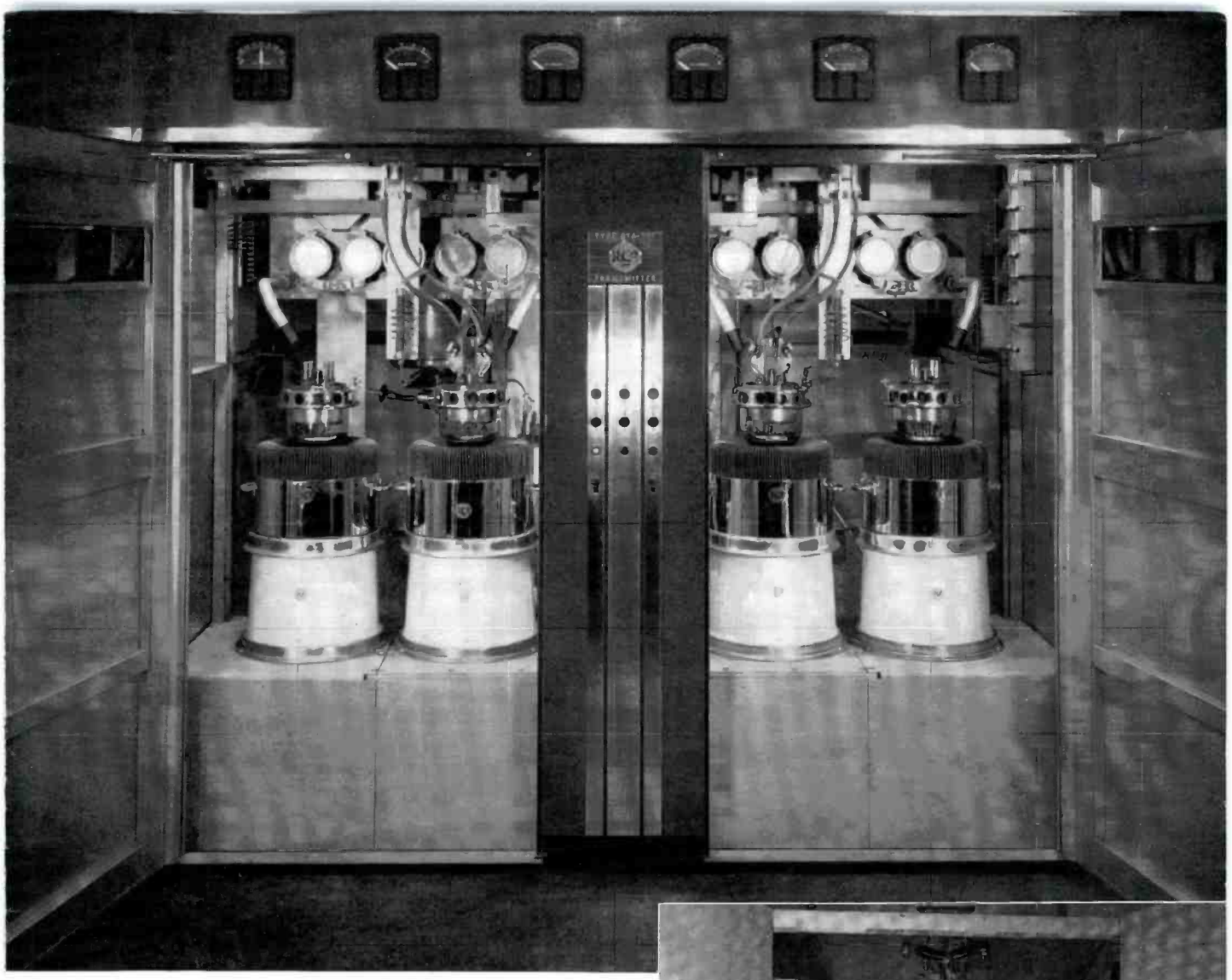
The 810 stage provides excitation for an 892R used in the intermediate power amplifier. Its cooling air is obtained from the main air system. The tank circuit for this stage consists of four mica-dielectric condensers and two low-loss space-wound tank coils, one being motor-driven and containing only a few turns. The controls appear on the front of the enclosure in two locations; in front of the exciter, and near the power-amplifier tuning controls. This latter position centralizes all tuning controls which will greatly facilitate tuning the power amplifier for maximum output efficiency. Inductive neutralizing is also provided for this stage and a low-loss tapped coil is furnished for this purpose.

There is located in this exciter compartment a single-phase, full-wave, 1500-volt d-c rectifier, which provides plate supply for the low-level stages in the radio-frequency chain and all tubes in the speech-amplifier section of the modulator.

The radio-frequency output of this exciter stage is carried through a low-impedance concentric transmission line to the grid-tank circuit of the power amplifier. At normal loading the power required to drive the power amplifier is approximately 5 kilowatts.

The power amplifier consists of two RCA Type 9C22 forced-air-cooled tubes, operating in parallel in a Class "C" circuit. Two additional positions are provided as spares which will permit a new tube to be cut into the circuit merely by changing the filament and the grid connectors. The filament chucks are designed so that a wrench is not necessary to loosen or tighten them in place on the tube pins.

The grid-tank circuit consists of a micalex-spaced coil and mica-dielectric capacitors. The actual loading is taken care of by changing taps on this coil. Self-biasing resistors are employed



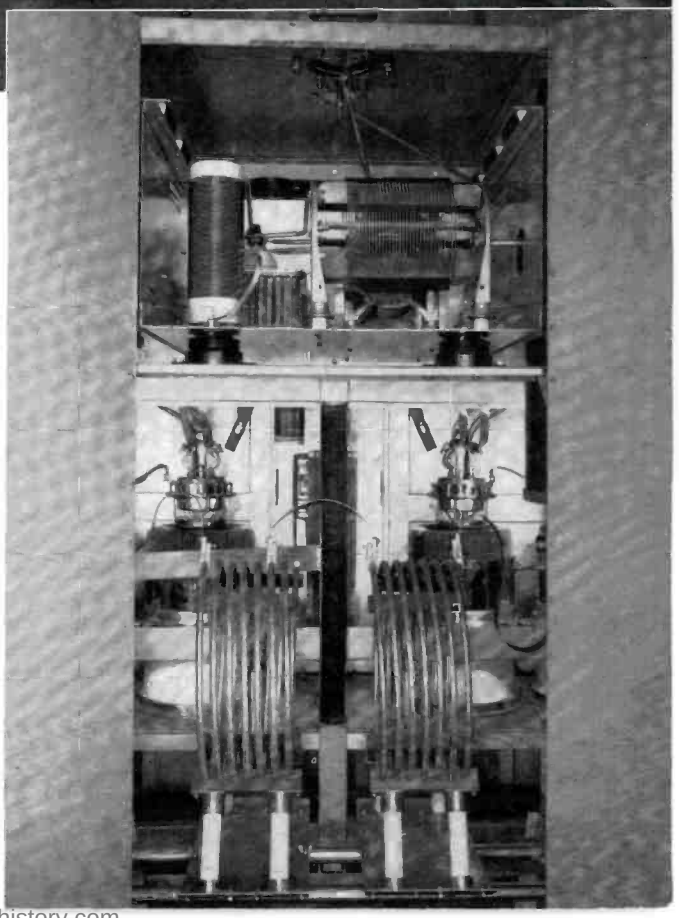


FIG. 7. (Above) *Two large doors provide access to the front of the power amplifier compartment. Four tube positions are provided, two of which are for spare tubes. Placing a spare tube in the circuits is easily accomplished by moving flexible filament and grid leads.*

FIG. 8. (Right) *Rear view of the power amplifier compartment. The shielded compartment above the tank inductances contains the harmonic filter circuit.*

for the Type 9C22 tubes and are located in the air stream. A dry type of rectifier is connected across a section of this resistor, which will supply voltage only during periods when excitation has been removed from the power amplifier. This feature is a precaution to insure that the tube plate dissipation will not be exceeded during such periods.

The power-amplifier tank consists of a Pi network, and tuning is accomplished by motor-driven, gas-filled capacitors. One capacitor is used for tuning purposes and the other as a means of coupling the output to a harmonic-filter circuit. A shunt system of neutralizing is employed for this stage. The tube capacitance is shunted, grid-to-plate, by a single-layer, space-wound inductance of equivalent reactance at the operating frequency. The neutralizing is sufficiently broad to permit new tubes to be installed without resorting to the procedure of reneutralizing.

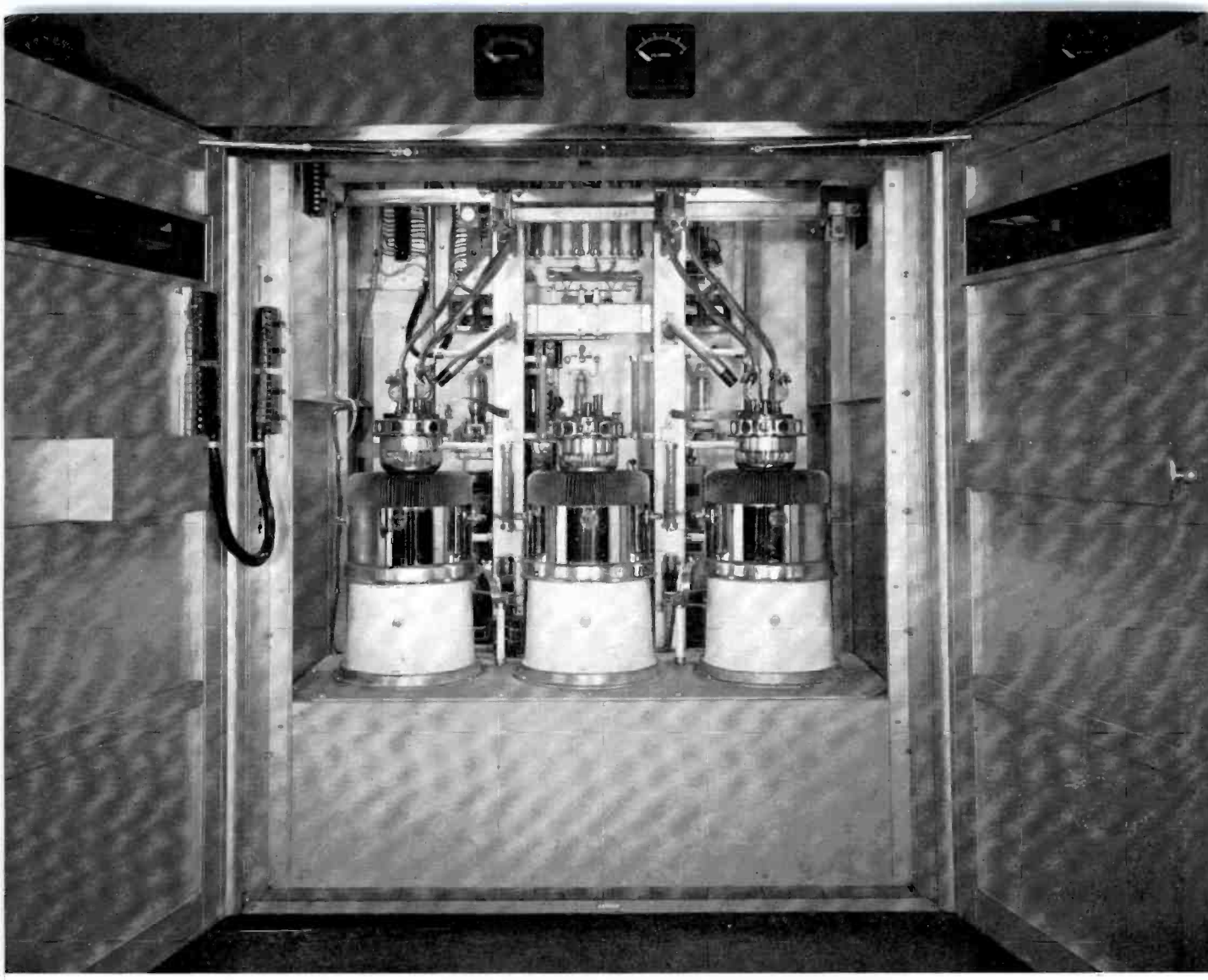


FIG. 9. *Front view of the audio and modulator compartment. Three tube positions are provided, the center being for a spare tube which can be inserted in place of either modulator simply by moving the flexible grid and filament connectors. This arrangemment greatly reduces the time lost in case of a tube failure.*

The harmonic filter normally consists of a "T" type network and is mounted in a compartment which is adequately shielded from the power-amplifier output circuit. This filter is highly effective in preventing the radiation of tank-generated harmonics. The output of the filter is normally designed to feed into a transmission line whose impedance is 230 +j0 or 50-70 +j0 ohms. The output of this harmonic filter is also selected as the point at which radio-frequency voltages are picked up and fed back to the modulation monitor, distortion meter, and hum-frequency feedback unit.

The modulator and speech amplifier is a self-contained unit located adjacent to the exciter compartment. It has sufficient gain to modulate the output carrier 100 per cent with a signal input of +10 dbm. Overall stabilized audio feedback from the plates of the 9C22 to the grids of the first speech amplifier is provided. This single feedback loop contributes materially to the reduction of hum and distortion. The tube lineup consists of two RCA 6C6's driving two RCA 828's, which in turn drive four RCA 828's operating in a cathode-follower circuit. This system of driving the modulator tubes has a number of highly desirable advantages, such as (1) permitting the use of one overall feedback loop, (2) using small, inexpensive tubes to provide adequate drive for the modulator tubes, (3) not requiring a driver transformer.

The speech-amplifier section is mounted on a rear panel assembly which can be readily swung open for servicing or changing tubes. The modulator consists of two 9C22 tubes operating in a Class B circuit. It plate-modulates the two 9C22's located in the power amplifier. An additional socket is provided in the modulator compartment to accommodate a spare 9C22. The length of filament, grid, and plate leads have been made sufficiently long to permit this tube to be readily connected into either side of the Class B circuit. A double door, located on the front of the enclosure, permits the tube hoist to be wheeled into position to replace or remove the 9C22 type of tube.

Twelve filament power transformers and reactors are mounted in a cubicle which is located between the modulator and power amplifier units. Three transformers and three reactors are required for each RCA 9C22. The secondary of each group of three filament transformers are paralleled and the low voltage is car-

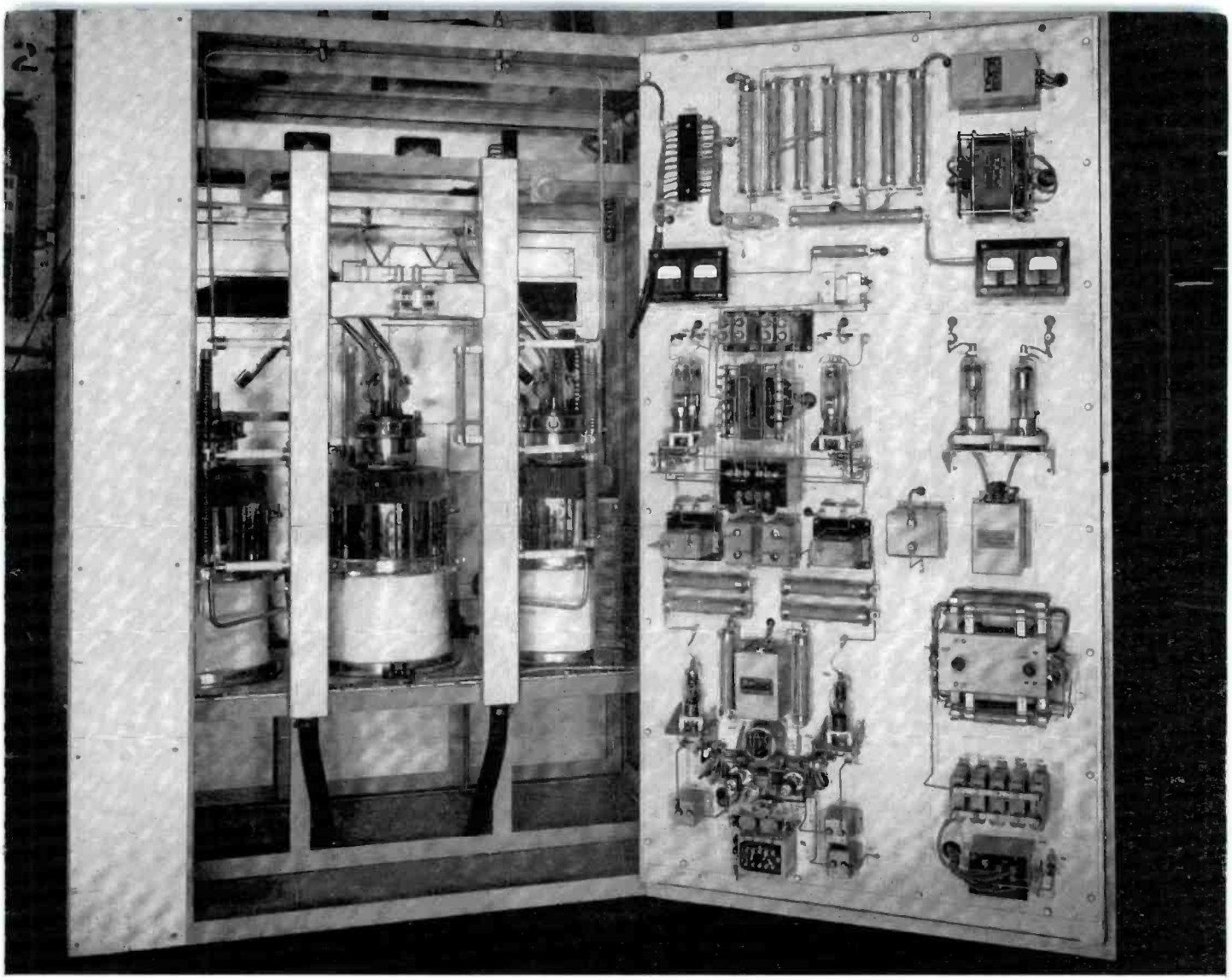


FIG. 10. *Rear view of the audio and modulator compartment. All of the low-power audio components are mounted on the inside of the rear door—making them easily accessible for inspection and maintenance. Use of cathode-follower circuits in the driver stage provides a number of advantages over older type drive circuits.*

ried into the two sections by means of ¼" x 1½" copper bus. This reactor-transformer arrangement provides a high reactance feature for starting filaments, thus dispensing with the need for step starters. The 9C22 filament power is obtained from a two-phase supply. The three-phase circuit is changed to two-phase by means of a phase-changing transformer, and one power amplifier and one modulator tube are connected to each phase. This arrangement is one of the factors contributing toward reducing carrier hum level.

The high-voltage plate rectifier consists of seven Type RCA 857B tubes operating in a three-phase, full-wave circuit. The seventh tube is provided as a spare and is wired so that its output appears at each of the six tube positions. In the event of a tube becoming defective, the spare tube may be switched into service with minimum delay. Spare switches are provided at each active tube position with the upper set of contacts being connected to the spare bus. By simply moving the sparing switch from the upper to the lower position, the defective tube is disconnected and the spare connected in its place. The main filter capacitors are filled with non-inflamable liquid and are mounted directly under the rectifier frame assembly. Each capacitor is provided with an automatic cutout which will remove it from the circuit in the event of its failure. The use of step-starting for the plate supply is also avoided by having a resistor in series with the filter capacitor when the power is first applied and automatically shorting it out after a fraction of a second.

The control circuit provides the optimum of protection and control with the minimum of relay equipment. The circuit provides that the transmitter may be placed on the air in step-by-step operation or, if all filament and plate supply switches are closed, it can be placed on the air by merely closing the "Start" switch. A total of eight overload relays furnish protection for all the 892R, 9C22 tubes and the three tube type rectifiers. The operation of any of these overload relays is indicated by an associated pilot light located on the control console. The equipment is adequately protected against sustained "shorts", arc overloads, or grounds. Should any of these occur and not clear up within a short time, a motor-driven, sequence-type of relay is automatically placed into operation. This will trip the carrier and immediately replace it. Should the trouble persist, this relay

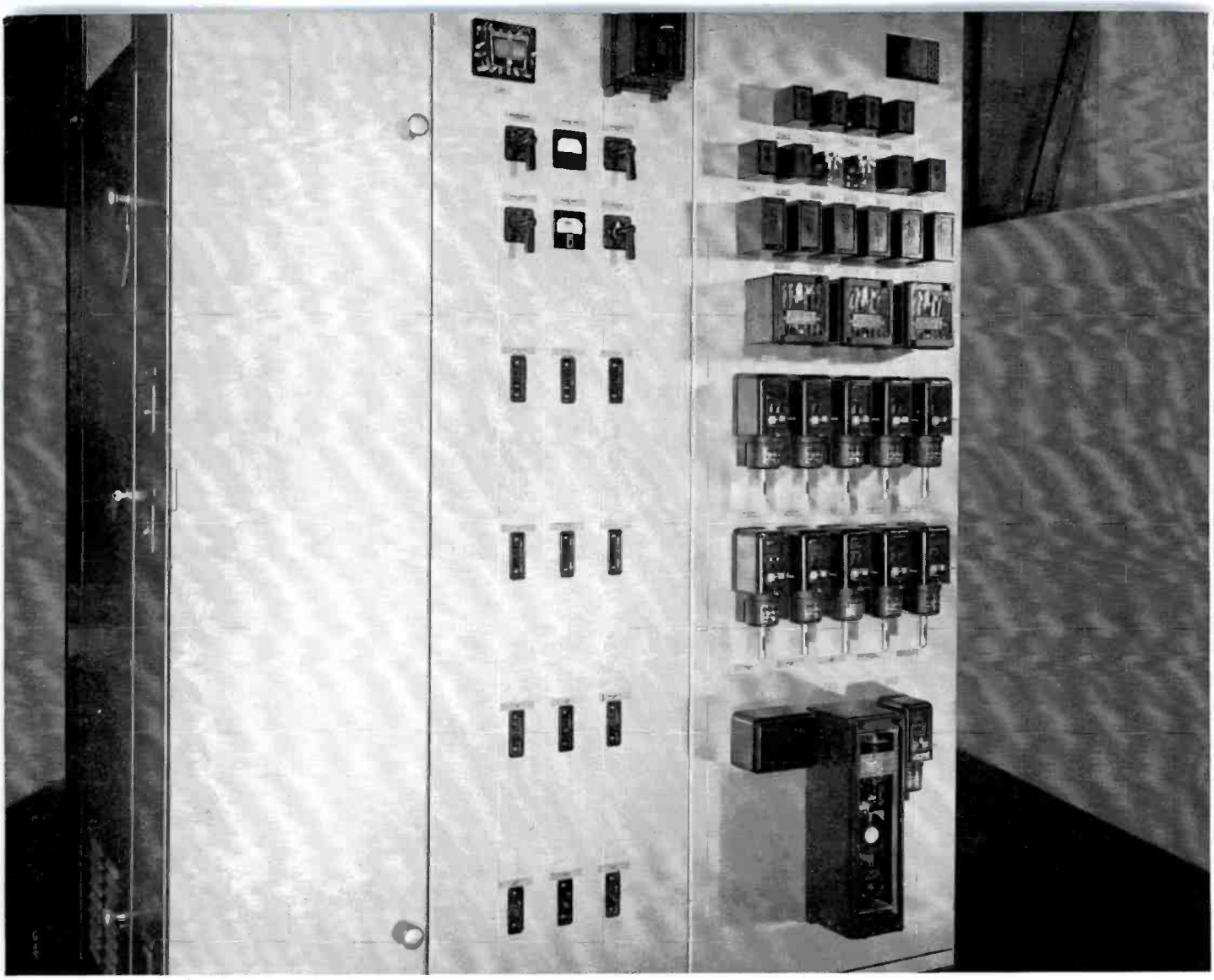


FIG. 11. *All time delay relays, overload relays and distribution circuit controls are mounted on the control and distribution unit which is located just inside the righthand door of the transmitter. This is a totally inclosed unit which is designed, manufactured, and assembled according to best switchgear practice. The BTA-50F includes more advanced and more complete protective and control circuits than any transmitter designed to date.*

will remove the carrier after the third attempt to return to the "On" position. This sequence relay is also tied in with the antenna monitoring rectifier circuit and, should the carrier in the tuning house be reduced below its normal value as a result of an arc over or ground, the carrier will be removed by removing the excitation momentarily. However, the plate supply is not interrupted unless the fault continues. This is provided to suppress arcs in the transmission line or terminating equipment caused by static charges or streaks of lightning.

The transmitter operates from a 460-volt, three-phase, three-wire 60-cycle power supply and at zero modulation the power consumption is 110 kilowatts at 90 per cent power factor. The transmitter can be adapted to 50-cycle supply with minor modifications. The use of 460-volt supply eliminates entirely the use of oil circuit breakers and, with the adaptation of air-type breakers, it is possible to obtain a much faster protection. The incoming power supply is terminated in the main air breaker located in the switch-gear unit. From here, the power is distributed to the electrically interlocked Delta-Wye switches and the main plate contactor. These five switches are all of the dead-front pull-out airbreaker type. This pull-out feature is of considerable convenience at the time of service.

There is supplied with each BTA-50F transmitter a two-stage hum feedback amplifier designed to cancel any one-hum frequency between 180 and 400 cycles. When the BTA-50F operates on a 60-cycle supply, the predominant hum frequency is 240 cycles and, when operated from a 50-cycle supply, it is 200 cycles. A small amount of modulated radio frequency is fed back to a rectifier circuit in this amplifier. Across the output of this rectifier is a potentiometer which controls the degeneration. The amplifier is resonated to the predominant hum frequency and the hum reduction is obtained by the correct setting of the regeneration and degeneration controls. This amplifier is mounted on a standard 36-A shelf and is normally located in the transmitter speech-input racks.

The MI-11621 Control Desk is modern in appearance and contains controls for both transmitter and audio channels. These

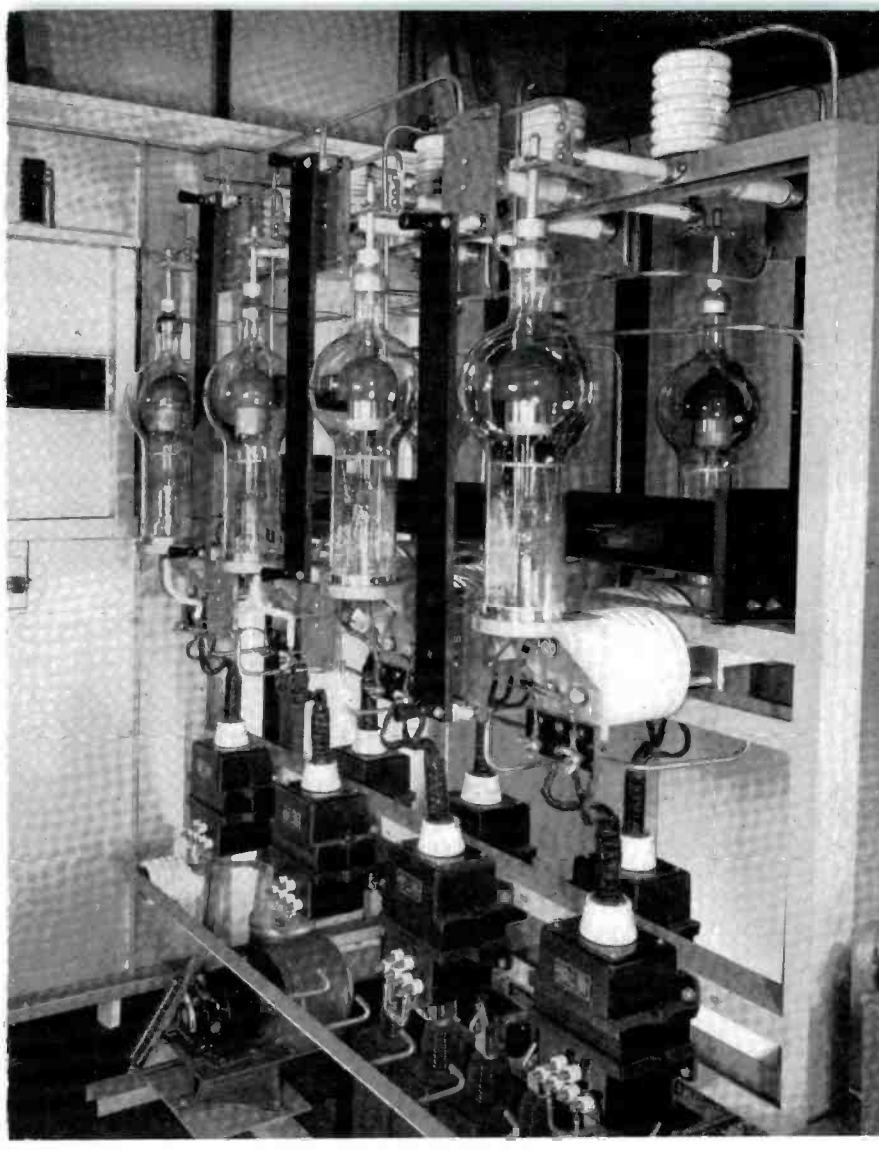


FIG. 12. *The high-voltage rectifier of the BTA-50F uses six RCA-857B's in a three-phase, full-wave circuit. A seventh tube—maintained at operating temperature at all times—may be quickly switched into the circuit whenever any of the six operating tubes becomes defective.*

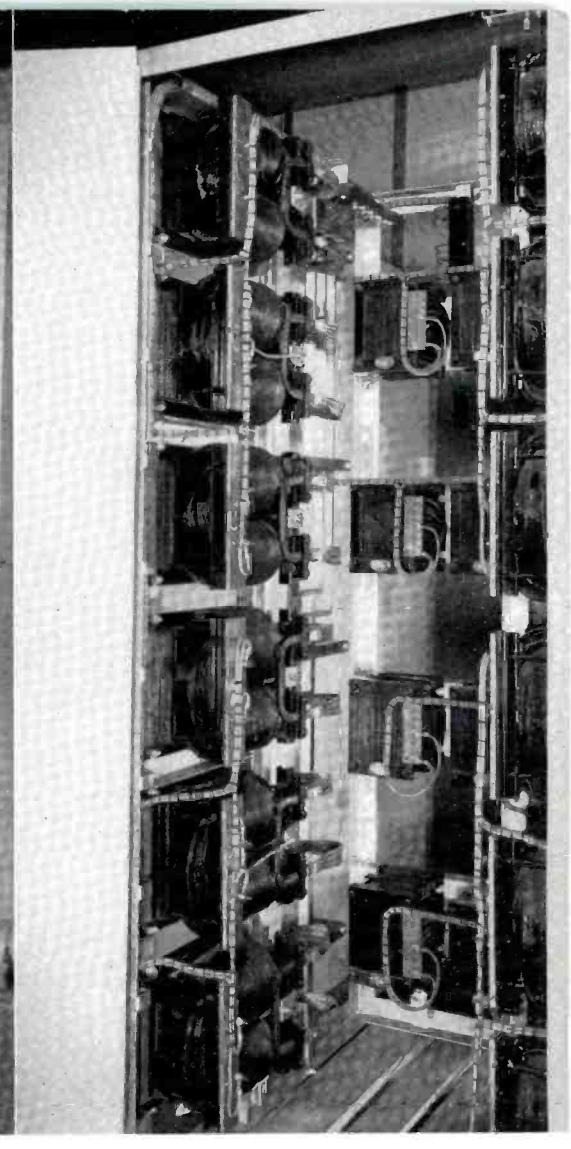


FIG. 13. *Filament transformers and reactors located in the filament power unit provide a high reactance for starting filaments thus dispensing with the need for step-starters.*

controls are mounted on three-hinged, sloping panels. The left panel contains the extension of pilot lamps, located on the front of the enclosure, plus overload relay indicator lights, overload reset relay pushbutton, and low-power plate and high-power plate rectifier switches.

The center position contains a VU meter, modulation monitor meter, time-of-outage clock, duration-of-outage clock and volume controls. The left panel is devoted to program and monitoring switching.

PERFORMANCE SPECIFICATIONS FOR BTA-50F

Radio Frequency Range.....Any specific frequency in the band from 540 to 1600 kc

R-F Power Output.....53 kw at transmitter terminals

Output Load Impedance.....230 +j0 or 50-70 +j0 as specified by user

Radio-Frequency Stability.....±10 cycles

Audio-Frequency Response...±1 db from 30 to 10,000 cycles from a reference level of 1000 cycles at 60% modulation

Audio Input Impedance.....600 ohms

Audio Input Level.....Plus 10 dbm at 100% modulation

Audio Distortion....Less than 3% rms from 50 to 7500 cycles at 90% modulation

Noise Level—rms.....60 db below 100% modulation

Carrier Shift.....Less than 5% up to 95% modulation

R-F Harmonics.....70 db below carrier fundamental measured at one mile

Power Consumption....110 kw at 97% P.F. without modulation
120 kw at 88% P.F. for 25% modulation
156 kw at 90% P.F. for 100% modulation

Power Supply Requirements.....460 volts, 60 cycles, 3 phase, 3 wire, with 5% maximum combined regulation and variation. The equipment can be adapted for 50-cycle operation by minor modification.

A NON-DIRECTIONAL ANTENNA FOR MOBILE FIELD STRENGTH MEASUREMENT IN THE FM BAND

by B. W. ROBINS
Test Engineering Section
Engineering Products Department

FCC "Standards" require the use of a *non-directional* receiving antenna when making field strength measurements of FM broadcast stations.[1] The RCA 301-B High Frequency Field Intensity Meter is designed to use a dipole receiving antenna. This is because the dipole, properly oriented, provides more gain and thereby makes possible measurements at much lower field strengths than would be possible with a non-directive type.

In the past the 301-B with a dipole has been successfully used in making FM surveys by providing some means of manually or automatically orienting the dipole to face the transmitter. Two such surveys were described in a recent issue of BROADCAST NEWS.[2, 3]

In view of the fact that the Commission now requires the use of a *non-directive* antenna—and since the use of such an antenna may simplify the survey work—the RCA Engineering Department has made a short investigation of the possibility of using such an antenna with the 301-B Field Intensity Meter. This work, which is here described, indicates that a very simple antenna arrangement will accomplish the desired results. However, this antenna must be more or less "tailor-made" for the vehicle on which it is to be mounted. For this reason, it is not planned to offer this antenna as a manufactured item. Instead, the full story of the experimental work done with it is presented here with the idea that station engineers, starting with the preliminary data included, will be able to "roll their own" to suit their particular requirements.

The object of the experimental work was, of course, to provide design information on a vehicle-mounted antenna which would accept horizontally polarized signals at a frequency in the FM band in a manner essentially independent of vehicle heading. Preliminary consideration indicated that the simplified turnstile antenna (disclosed in U. S. Patent No. 2,290,800, issued to Dr. G. H. Brown, RCA Laboratories) offered distinct possibilities for this use. As described in the patent, the simplified turnstile consists of two antenna elements, each bent at an angle of 90°, arranged in a horizontal plane. The bends are oppositely arranged so that from the transmission line the elements extend in opposite directions and then extend in parallel lines in the same direction. Figure 1 is a drawing representing the top view of such an antenna. For convenience, the dimension "A" will be called the *axial length*, and dimension "P" the *parallel length*. If the parallel length is made one-quarter wave and the axial any length up to one-quarter wave, the reception pattern in various directions in a horizontal plane through the antenna should be circular, as shown in Figure 2a. If A + P is made one-quarter wavelength the pattern should be elliptical, and the exact form of the ellipse may be controlled by changing the ratio of A to P. A typical elliptical pattern is shown in Figure 2b.

An investigation was made of the reception patterns of such an antenna with various dimensions. A 10-foot wooden pole was mounted in a wooden standard so that it could be rotated. A compass card on the standard and a pointer on the pole indicated azimuthal position. The antenna was mounted at the top of the pole, and the antenna elements were made of ¼-inch-

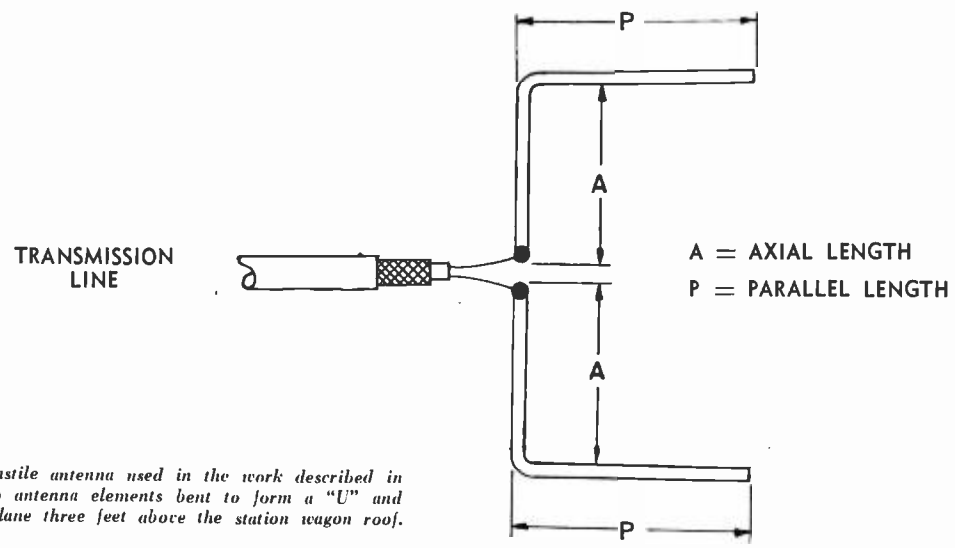


FIG. 1. *The simplified turnstile antenna used in the work described in this article consists of two antenna elements bent to form a "U" and mounted in a horizontal plane three feet above the station wagon roof.*

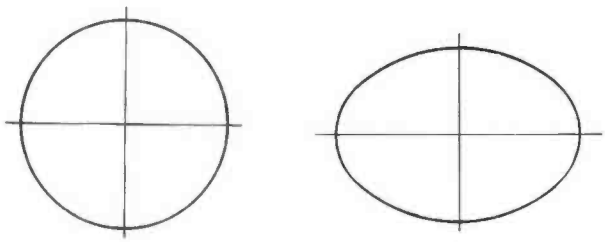


FIG. 2. *Theoretical patterns provided by the antenna, shown in Figure 1, when the axial and parallel lengths are varied as described in the text.*

diameter brass rod in threaded sections so that A and P could be varied in increments of one inch. The antenna elements were connected to one end of a flexible 2-conductor transmission line, the other end of which was connected to an RCA type 301-B Field Intensity Meter. The transmission line employed was identical with that normally used with the dipole antenna of the 301-B. Figure 3 is a picture of the antenna. The equipment was set up on a clear plot of ground which is approximately 4.5 miles southeast of the transmitting antenna of Station KYWFM (100.3 mcs.).

Patterns were taken by observing the 301-B output with the antenna oriented in different directions. Patterns were plotted for several combinations of lengths A and P. In a general way, performance agreed with the description above. By varying A and P it was not very difficult to arrive at an essentially circular pattern. The best pattern obtained in this manner exhibited 10% difference between maximum and minimum, which obviously means 5% maximum variation from a nominal. The average deviation from mean for the 16 directions observed was 2.5%.

The next step was to try the antenna mounted on a vehicle. It was placed two feet above the roof of a fabric-topped station

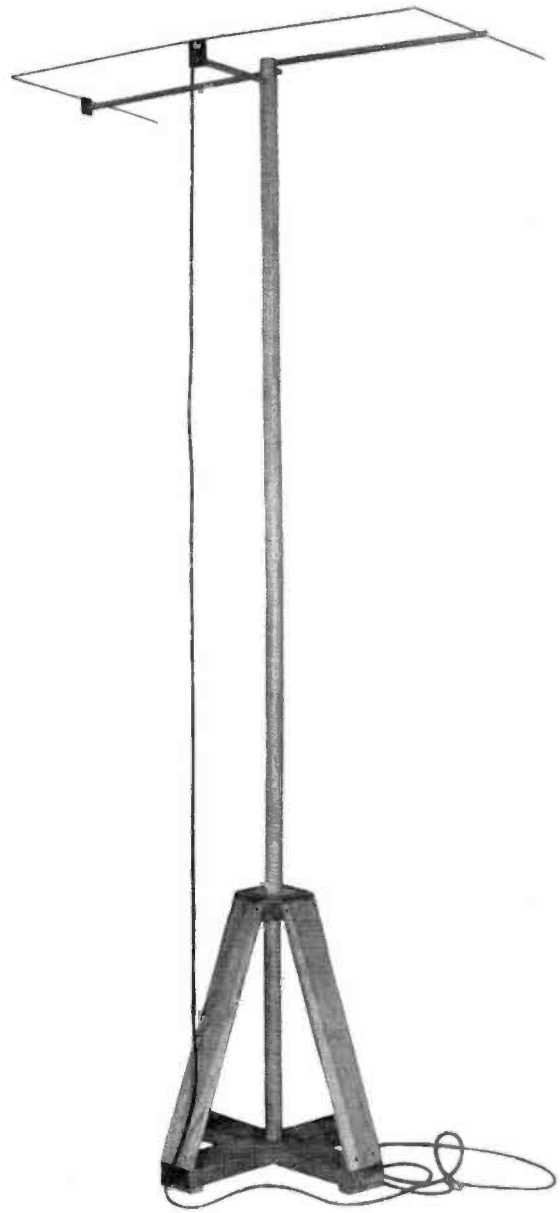
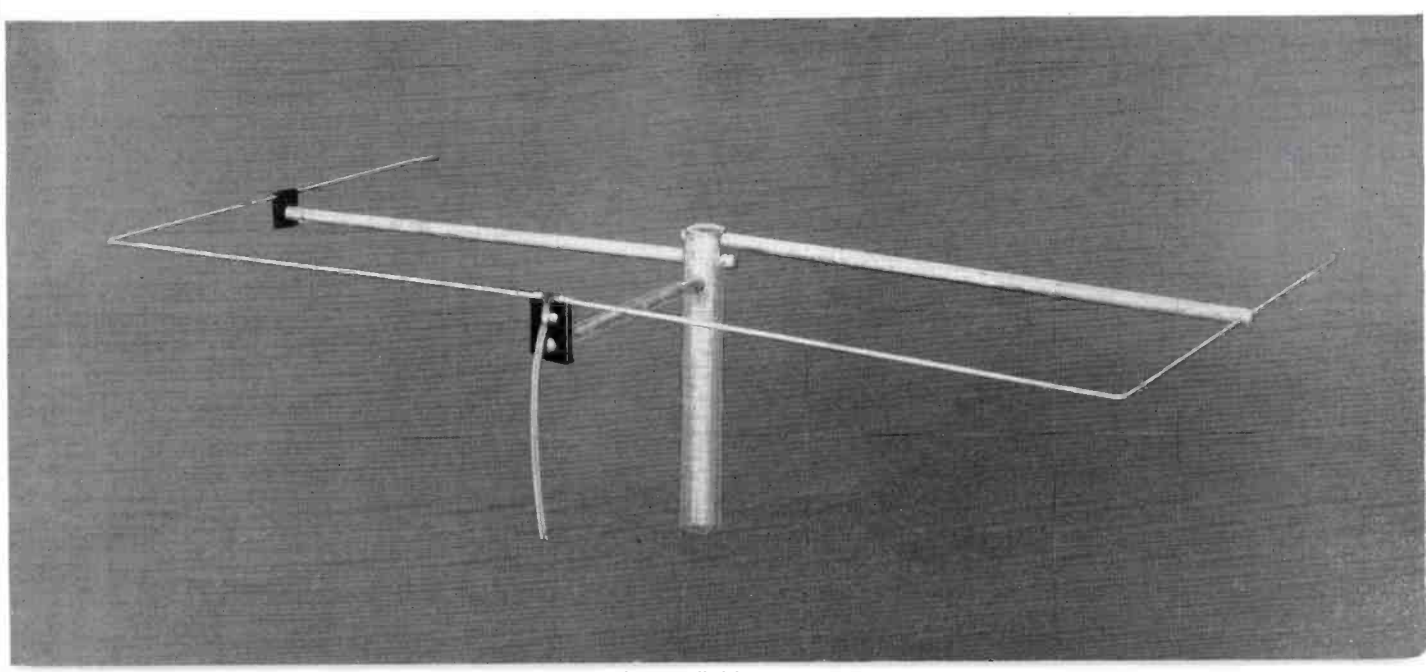


FIG. 3. (a) (Right) *This experimental antenna, mounted on a 10-foot pole, was used in making preliminary measurements to determine the approximate dimensions required for a non-directive pattern.*

FIG. 3. (b) (Below) *A close-up of the antenna elements showing details of construction. For a permanent installation elements made of one-half inch tubing would be preferable.*



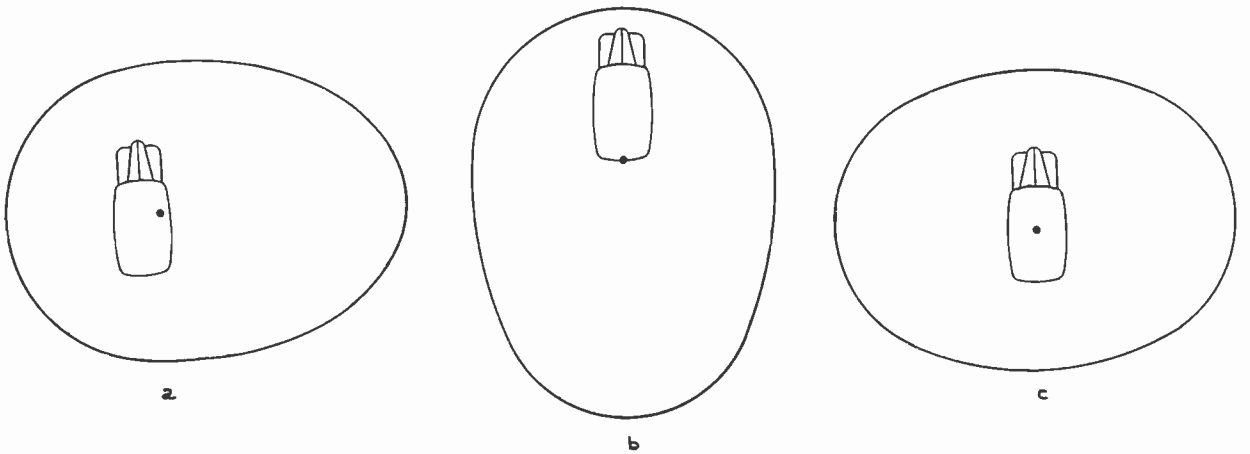


FIG. 4. *Patterns made with the antenna mounted at different positions on the car roof show the effect of the car body on the reception patterns. This may be compensated by changing the ratio of dimensions as described in the text.*

wagon. As might be expected, the effect of the station wagon was to distort the pattern rather seriously. It was found that with the antenna mounted at the extreme rear (still two feet above the top) of the station wagon, and with the wagon pointed directly at the transmitting station, the received signal was quite low. With the wagon stationary in this position the antenna could be rotated a full 360° without appreciably raising the signal. Thus, the station wagon can be considered as acting as a shield (or, alternatively, as a director of out-of-phase signal) when interposed between the transmitting and receiving antennas and near the receiving antenna.

Based upon the foregoing, it is logical to assume that with an antenna which provides a circular pattern over clear ground, mounted a few feet above the top of the vehicle, the expected patterns would be somewhat as shown in Figure 4. These curves are arbitrarily drawn; they do not represent direct experimental data. When the antenna is at the approximate center of the wagon an elliptical pattern (Figure 4c) would be expected. On the other hand, A and P may readily be proportioned so that the pattern over clear ground is also elliptical. If, then, this antenna is placed over the center of the vehicle and oriented so that its clear-field pattern major axis corresponds to the direction of the major shielding effect due to the presence of the vehicle, the resultant pattern should be generally circular.

This method of compensation was tried successfully. With A = 26 inches and P = 32 inches, an elliptical pattern had been obtained over clear ground, the higher response being in the directions to which the axial elements pointed. This pattern appeared to indicate that such an antenna mounted over the center of the station wagon would somewhat overcompensate the shielding effect. Consequently, the antenna was set up with A = 26 inches and P = 30 inches and placed 3 feet above the top of the vehicle, as shown in Figure 5. The pattern obtained is shown in Figure 6a, E_{max}/E_{min} being 1.31. The length, P, was then reduced by 1 inch to 29 inches and the pattern of Figure 6b obtained, E_{max}/E_{min} being 1.22. Since E_{max} occurred with the front of the vehicle toward the transmitting station, the antenna was then moved 17.5 inches toward the rear of the vehicle. E_{max}/E_{min} was still 1.22, but the pattern was nearly elliptical as shown in Figure 6c. Length P was then reduced 2 inches to 27 inches and the pattern of Figure 7b obtained. E_{max}/E_{min} was then 1.14, and maxima occurred with the *sides* of the vehicle toward the transmitter. The last step was to increase P by 1 inch to 28 inches. The pattern of Figure 7c was obtained, E_{max}/E_{min} being 1.12. A value of P somewhere between 27 and 28 inches, and/or a slight shift of antenna position, probably would have given a still better pattern; but, since the results obtained were considered satisfactory, no further refinement was attempted.

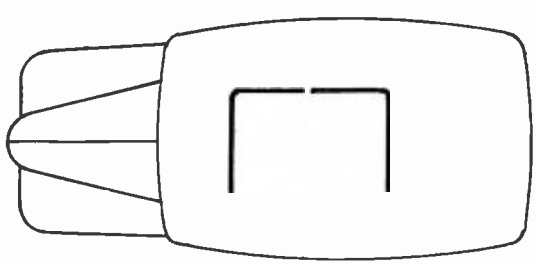


FIG. 5. *During the first series of measurments the supporting pole was at the center of the car body with the elements arranged as shown. For final measurements the pole was moved 17.5 inches toward rear with same relative arrangement of elements.*

The above detailed account of procedure followed is included with the thought that a thoroughly described example may be useful to any 301-B user wishing to effect a similar installation. Only the one installation has been made, but it seems likely that on any fabric-topped station wagon, and at any single frequency in the FM band, an essentially round pattern could be obtained readily by the same methods. A convenient procedure would be to make A approximately 0.22 wavelength and P approximately 0.235 wavelength, and mount the antenna about 3 feet above the vehicle top near the center. The initial pattern will then indicate any necessary changes to antenna position and/or length P, the proper adjustment of which should provide an essentially circular pattern. A comment on the method of taking data for pattern determination may be helpful. For a rough approximation the station wagon may be driven in a complete tight circle (steering wheel cramped hard right or left). Since uniform fields are rare, this method is usually inaccurate. To avoid the effect of a non-uniform field, a point was marked on the ground and the station wagon driven over it in various directions; each time the antenna was positioned over the point. Observations each 90° are satisfactory until the pattern approaches fairly closely to roundness, when two or more points should be taken in each quadrant. A method of determining the directivity and calibration factor was described in BROADCAST NEWS for June, 1946.[2]

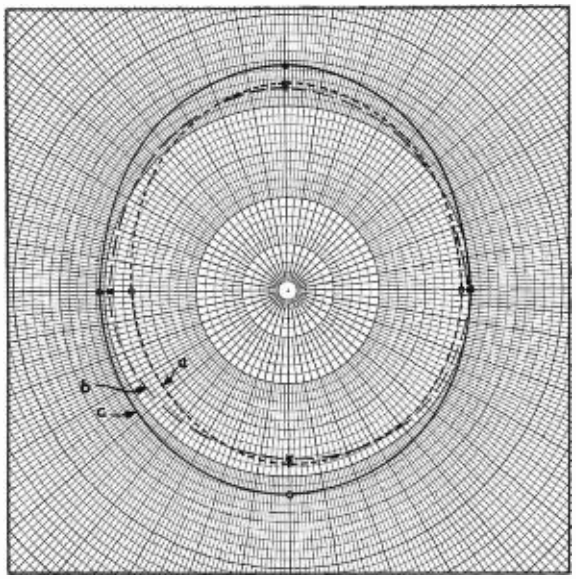


FIG. 6. *Patterns obtained with antenna arrangement shown in Figure 5. Curve a for A = 26" and P = 30". Curve b for A = 26", P = 29". Curve c, same as b, but antenna moved toward rear of car.*

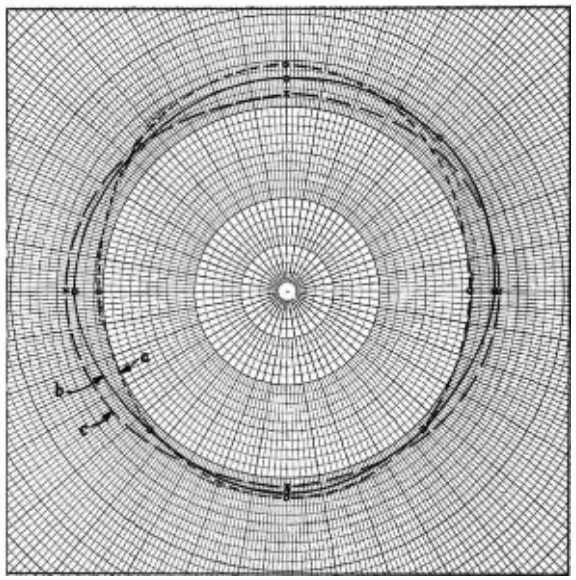


FIG. 7. *Patterns obtained when parallel length P was shortened. Curve a is for same length as Curve c of Figure 6. Curve b is for A = 26" and P = 27". Curve c is for A = 26" and P = 28".*

The average response of the antenna giving the roundest pattern over clear ground was 27% of that of the normal 301-B dipole oriented for maximum (both at a height of 10 feet). It is considered probable that an appreciable part of this reduction was due to a mismatch of impedance between the rather high antenna impendance and the transmission line. A tuning capacitor, placed across the antenna elements at their junction with the transmission line, had very little effect on either the pattern distribution or the average sensitivity. Since the final antenna on the station wagon at 9 feet above ground gave an average response of 23% of the dipole at 10 feet, the signal reducing effect of the vehicle was slight, being of the order of

$$\frac{(.9 \times 27) - 23}{.9 \times 27} = 5.3\%.$$

All of these results were obtained with a 30-foot transmission line. Reduction to 10 feet, which should be feasible in a mobile installation, should increase the 23% response to about 27%.

The field strength from KYWFM at the site employed was approximately 2280 microvolts per meter *at 10 feet.* This is roughly equivalent to 6840 μV/m *at 30 feet.* With this field strength and the final antenna on the station wagon (at 9 feet) the reading of the 301-B output meter was $5 \times 3.8 = 19$. The 301-B had been conventionally calibrated with the RESPONSE switch on SHARP, where it remained. With a field strength of 1000 μV/m at 30 feet, the 301-B output meter reading would then be approximately

$$\frac{1 \times 19}{6.84} = 1 \times 2.8$$

Thus radials can be taken from a transmitter for determining the contours at 1000 μV/m and higher levels if the transmitter is unmodulated during the test so that the 301-B may be used on SHARP response. Measurement with this antenna at 1000 μV/m field-strength on BROAD response was not undertaken, but its feasibility is doubtful.

At the frequencies involved, addition, removal, changes of configuration, or position of metal objects in or near the vehicle may have a marked effect upon the pattern. This should not be construed as a fault of the particular antenna system used, but rather as attributable to the inherent propagation characteristics of signals of such frequency. It is recommended that the field intensity meter, power supply, recording meter, transmission line, any portable tool boxes, or other similar material expected to be carried on surveys be mounted in their final position prior to final adjustment of the antenna. A metal screen or sheet placed over the vehicle top (or use of a metal-topped vehicle) to serve as a ground plane would greatly reduce the susceptibility of the pattern to such movement. However, due to road clearance restrictions, usually the antenna could be mounted only a few feet above such a shield. This method should provide such low pickup that it was not considered worth trying.

The question of spurious effects due to objects external to the vehicle naturally arises. This factor is important, but is generally uncontrollable. Reduction of effect from other vehicles may be accomplished by making surveys in the early morning when traffic is at a minimum.

Each of the following persons was present on one or more of the days upon which data were taken: Mr. W. C. Ellsworth, Headquarters Engineer, Westinghouse Radio Stations, Inc.; Mr. E. J. Cummings, Technical Staff, KYWFM; Mr. J. J. Michaels, Technical Staff, KYW; Mr. K. B. Redding, Test and Measuring Equipment Sales, RCA; and Mr. H. E. Paschon, Test and Measuring Equipment Engineering, RCA. The station wagon and 301-B used are the property of Radio Station KYWFM.

Bibliography

[1] FCC "Standards of Good Engineering Practice Concerning FM Broadcast Stations," Section 5. (This section is reprinted on Page 73 of BROADCAST NEWS, No. 43.)

[2] "How To Make A Field Survey Of An FM Station," Page 54, BROADCAST NEWS, No. 43.

[3] "FM Field Survey Techniques," Page 62, BROADCAST NEWS, No. 43.

[4] U. S. Patent No. 2,290,800, Dr. G. H. Brown, assigned to Radio Corporation of Americca.

[5] "The Type 301-B Field Intensity Meter," Page 69, BROADCAST NEWS, No. 43.

[6] "A Discussion of FM Field Survey Methods As Outlined In The FCC's 'Standards of Good Engineering Practice Concerning FM Broadcast Stations'," Page 72, BROADCAST NEWS, No. 43.

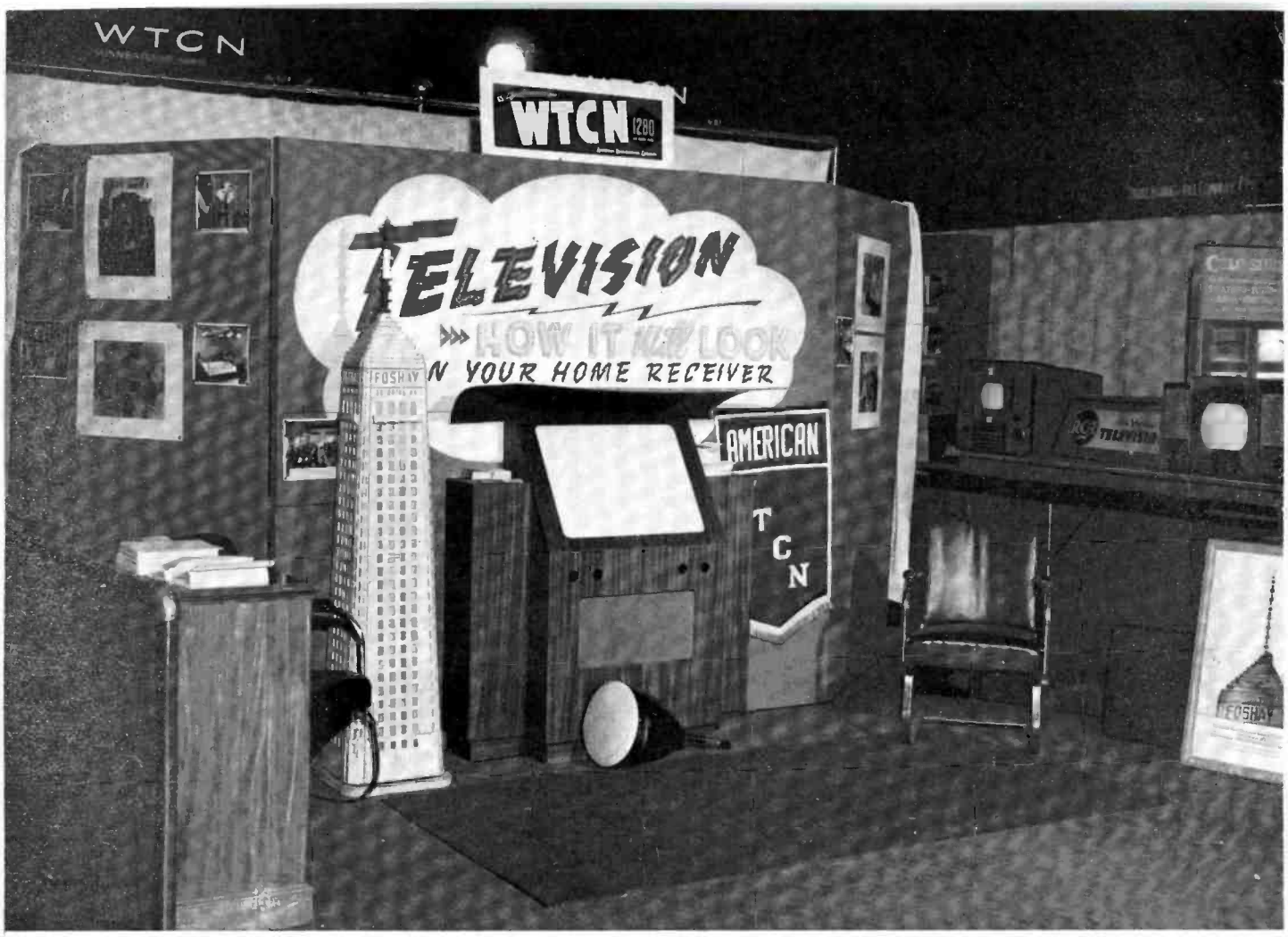


FIG. 1. (Above) *Typical installation of WTCN'S "mockup" television receiver display booth at various home shows and expositions. Films which have been televised by ABC are shown on the screen.*

WTCN PLANS TELEVISION

by CLIFFORD J. RIAN
Publicity Director, WTCN

WTCN, Minneapolis-St. Paul, Minnesota affiliate of ABC, which inaugurates regular Frequency Modulation broadcasts recently, is now definitely looking forward to Television.

With WTCN-FM an actuality, a growing list of commercial sponsors, and a considerable audience which is expanding, the station has established long-range plans for telecasting.

The first step in these plans was the leasing of space in and atop the Foshay Tower, tallest building in Minnesota and ideally suited for transmitter and antenna location. Rising 447 feet from the street level, the structure serves as base for the FM and TV antenna, which rises 80 feet above it. A long-term lease assures WTCN permanency at the Foshay Tower, which is considered by engineers to be the finest natural site for this use.

The second step involved filing of a construction permit application with the Federal Communications Commission, which granted the CP authorizing installation of an RCA type TT5A transmitter. This equipment will deliver 5 kilowatts video power and 2½ kilowatts audio power to the television antenna.

WTCN-TV has been allocated television channel No. 4, on the frequency between 66-72 megacycles. The RCA television antenna will have an effective height of 480 feet above the average terrain.

The third step in the station's planning was to place orders for an RCA Image-Orthicon camera chain and associated television transmitting equipment. This equipment is presently awaiting delivery.

The fourth step is being handled by Joseph Beck, television program planning director for WTCN. His department is establishing tentative program schedules which will include both remote and studio telecasts such as: sports events, fashion shows, dramatic productions, and special events.

The station promotion department has begun paving the way for actual telecasts by exhibiting a specially-constructed television "mockup" receiver at two city-wide "home" shows, at clubs, lodges and church

groups. Sound-on films, which have actually been televised by ABC and BBC, both in America and Britain, are shown on this "mockup".

A typical booth display at a recent "home" show in Minneapolis (Figure 1) exhibited the mockup receiver, two RCA television receivers, a model RCA kinescope, and descriptive literature. It is estimated that some 200,000 people have seen this type of display in the various shows and expositions in which it was presented.

The fifth step in WTCN's television planning is the engineering staff's projection of the actual installation. John Sherman, director of technical operations for AM, FM, and TV at WTCN, is currently laying plans for the delivery, installation, and operation of the RCA television camera and transmitting equipment which is now on order.

According to Sherman, the expected coverage (based on the television standards of the FCC) will include the area within a radius of 35-40 miles. This area includes approximately 1,200,000 residents. However, the actual coverage area of WTCN-FM, which has been in operation about 45 days, indicates that these advance estimates are far too low.

"We believe," said Sherman, "that Television signals will reach a much greater radius than 40 miles. Our FM broadcasts are received regularly at points exceeding 100 miles from our transmitter, and we are currently operating on low interim power."

"Once in operation," Sherman states, "after preliminary testing, we plan to relay remote television programs to transmitting equipment employing the facilities of the Telephone Company, as well as radio relay. The top of the Foshay Tower makes an ideal location for the television link equipment."

According to F. Van Konynenburg, manager of WTCN, television broadcasts are expected to begin shortly after delivery of RCA equipment.

FIG. 2. (Upper Right) *The 447 foot Foshay Tower in Minneapolis, on top of which will be WTCN's antenna rising 80 feet above the building which is Minnesota's tallest. Transmitting equipment for FM is on the 28th floor, TV equipment will also be housed there.*

FIG. 3 (Lower Right) *John Sherman, technical director for AM, FM and Television operations at WTCN.*

FIG. 1. *NAB members unable to get into crowded meeting room watch proceedings by television.*

Televising a Convention

Meeting Sessions Televised For Benefit Of Overflow Crowd Prove Feature Of NAB Convention

by JOHN P. TAYLOR
Engineering Products Department

It was amply demonstrated, during the last National Association of Broadcasters Convention at the Palmer House, that television is one way in which hotel meeting room capacities can be stretched to take care of the tremendous postwar increase in convention attendance.

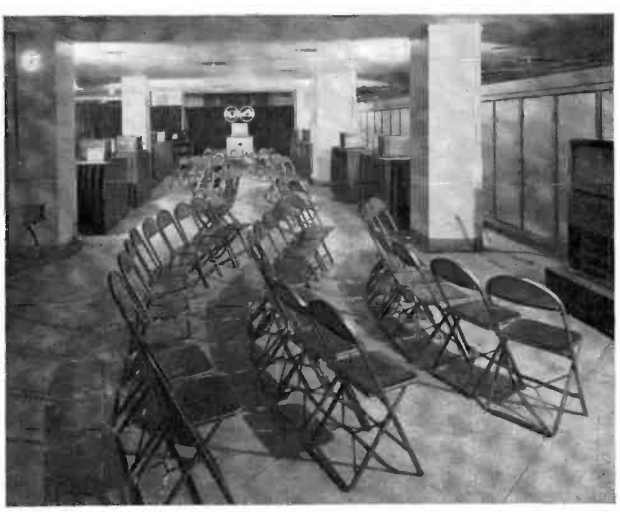
NAB's problem was similar to that faced during the last year by many trade associations. A total registration of some three thousand was expected. The largest individual meeting room in the Palmer House (the Red Lacquer Room) has a seating capacity of about nine hundred. And the Grand Ballroom, where the luncheon and dinner meetings were held, will satisfactorily accommodate only twelve hundred or so.

Of course, any seasoned convention-goer knows that many registrants attend only a few meetings and that the average attendance at meetings will be only a fraction of the total registration. However, experience has proved that there are always certain meetings—or more particularly certain speakers or panel discussions—which nearly everyone wishes to hear.

Recognizing this problem the NAB, through its secretary (and general convention manager) Mr. C. E. Arney, Jr., asked RCA to set up a "closed-circuit" television system which would allow those who could not get into the crowded meeting rooms to hear *and see* the speakers, as well as the floor proceedings. Ordinarily this would have been a rather large order. The time was short, the conditions (lighting, space, etc.) were far from ideal, and because of a preceding convention in the hotel, there was no chance for rehearsal or even for testing equipment ahead of time. However, because we were already planning to exhibit our new portable television pickup equipment at this convention, we were able to work out with the help of Mr. Arney and Mr. Chakow, chief engineer of the Palmer House, an arrangement which, for a first trial, operated in a very satisfactory manner.

FIG. 2. *Many, such as this group of consulting and station engineers, preferred televiewing to actual attendance.*

FIG. 3. (Right) *Television receivers set up in a large space in the exhibit hall provided means whereby the "overflow" from the crowded meetings could "look-in" with comfort. This view, taken before the start, shows about one hundred chairs in place. Later many more were added to take care of the "overflow" crowd, which reached a peak of several hundred during most interesting sessions.*



This arrangement, aptly dubbed a "television overflow meeting," entailed placing television cameras and microphones in the two meeting rooms in such positions that they could be used to televise the full proceedings. The pictures picked up by these cameras were then "piped" through flexible coaxial cables and suitable control equipment to a number of "televiewers" which were set up in a large area in the Exhibit Hall of the Palmer House. Thus, when the meeting rooms filled up to the point where no more could get in, the "overflow" could simply walk down the hall to the Exhibit Hall, take a chair in front of one of the "televiewers" and see and hear the proceedings in comfort and without strain. In fact, those watching by television were generally able to see the speaker better than those in the rear half of the meeting room.

The extent to which this new facility would be utilized by convention-goers was a subject of much pre-convention speculation. Although the feeling of "being there" imparted by the immediacy of television is well recognized, there was still a question as to whether it could substitute for actual attendance. On the first day of the convention the scheduled meetings were of only cursory interest and the capacity of the meeting rooms was not taxed. Attendance in the television overflow room was fairly good, but was attributed chiefly to curiosity.

The first real indication of usefulness came on the second day when the Hon. Charles Denny, Chairman of the Federal Com-

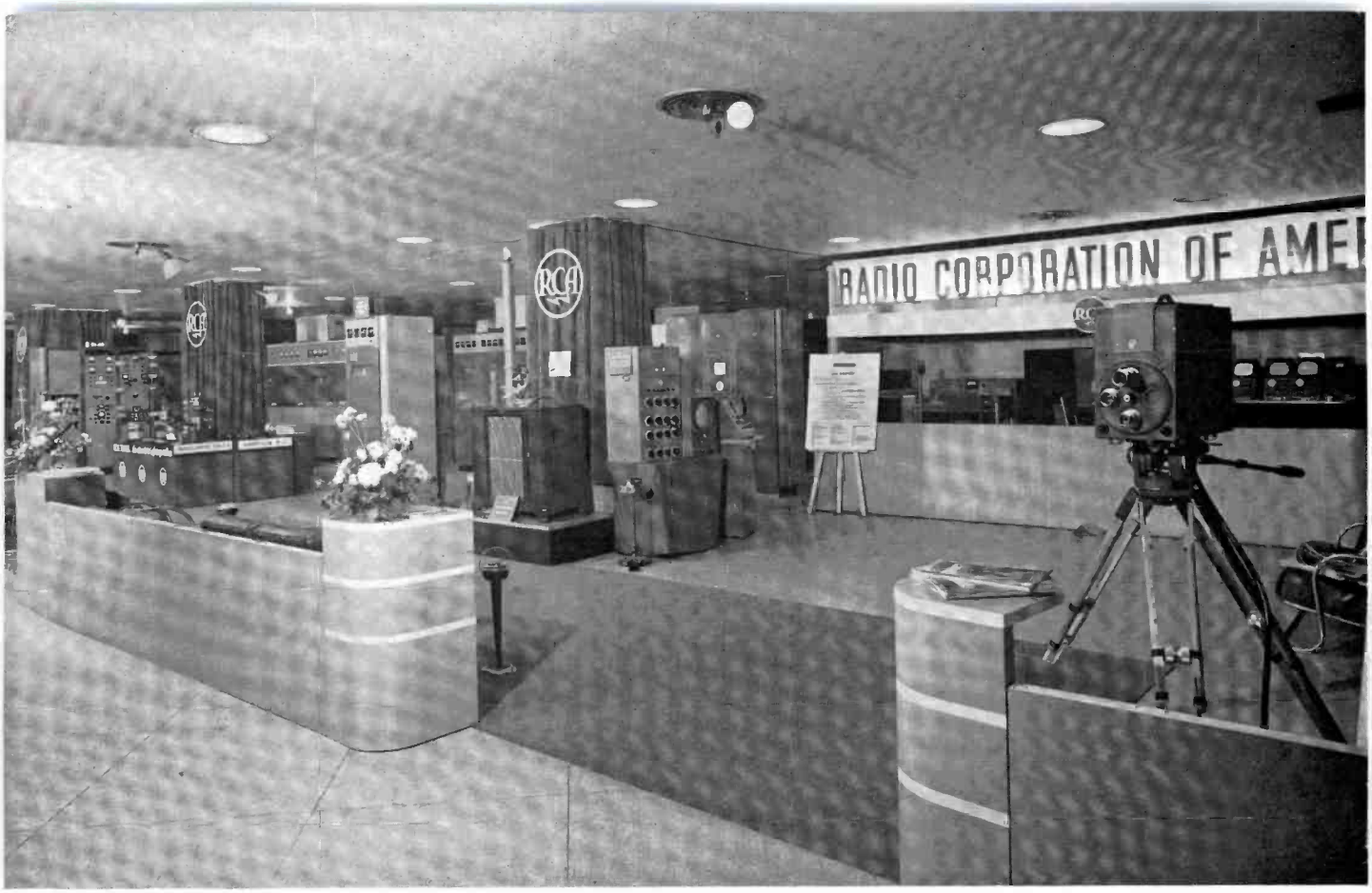


FIG. 4. *Television control equipment (right background) was set up as part of RCA's equipment exhibit. Also included were audio racks, tubes, a 5 KW AM transmitter, two FM transmitters, and various items of antenna and test equipment.*

munications Commission, was the featured speaker at the luncheon meeting. Mr. Denny, an exceedingly able speaker, is a key figure in the industry and his talks are always looked forward to with great expectancy. Nowhere near all those interested could be accommodated at the luncheon and it was noticeable that many, expecting this to happen, entered the television room some minutes before the scheduled time of Mr. Denny's speech. By the time he rose to speak, the television overflow room was filled and many were standing. At that point one wag suggested that we ought to have an "overflow meeting room for the overflow meeting room." From that time on during the remaining three days of the convention the "audience" in the television room ebbed and flowed with the general interest in the meeting. However, it was noticeable that the room was never empty. It soon became apparent that some of those in attendance at the convention actually preferred to follow the meetings by television rather than sit in on them directly. Several reasons for this were obvious. One was the relative informality of the television room. It was possible for members to drift in and out without the embarrassment often attendant in leaving a crowded meeting room. Groups could sit around and talk while listening to the speaker "with one ear." Moreover, as noted previously, in many cases both seeing and hearing were less of a strain than in the main hall.

The equipment which was used in televising the NAB Convention is RCA's new post-war television field equipment, which uses the highly sensitive Image Orthicon pickup tube developed during the war by RCA engineers. The Image Orthicon Cameras make it possible to pickup most scenes with ordinary room lighting. This feature is responsible for the fact that it is now practical to televise conventions and similar gatherings which were heretofore out of the question (because of the intense lighting required with the older iconoscope-type cameras).

The general arrangement of equipment, while somewhat influenced by the desire to have it on display (for our customers at this meeting), is typical of what would be involved in any general convention of this type. The accompanying illustrations show the equipment units at the various locations.

In the Red Lacquer Room, where most of the meetings were held, one television camera was mounted on a platform at the rear of the room in a position directly facing, and about sixty feet away from the speaker's rostrum (Figure 8). This camera was provided with lenses of several focal lengths (mounted in a rotating turret for quick change) so that it could be used either to "pan" the speaker's table (about thirty feet long) or to provide a closeup of the speaker's head and shoulders. A second camera position in the front part of the room made it possible to pickup the audience (with a wide lens) or a floor speaker (with a closeup). In first tests the regular room lighting was relied on. However, this was very poor for this purpose in that it came from ornate chandeliers in the center of the room and was badly positioned with respect to the relative positions of camera and speaker. Two spot lights were, therefore, mounted on the back wall and directed on the speaker's table. This arrangement provided a very good picture pickup. Had more time been available for testing, the same result could have been obtained by a rearrangement of the ordinary room lighting.

In the ballrom two cameras (Figure 6) were placed on the balcony in a position opposite to, and about eighty feet away

FIG. 5. *Closeup of television control equipment showing (left to right) monitoring loudspeaker, audio console, on-the-air and film monitors, and portable camera control equipment. "Window" at rear looks into television "overflow" room.*

from the speaker's table. Because of their high point, these cameras (with telephoto lenses) could be used to pick up a scene anywhere in the room. Thus they were used not only to televise the speaker, but also to pick up the "man-at-luncheon" interviews from the floor previous to the introduction of the speaker.

From the cameras in the meeting room and ballroom, cables (these cables are less than one inch in diameter and flexible so that they are easily handled) were run to the "control booth" which was set up as part of our equipment exhibit (Figure 5). Ordinarily, this control equipment would be located in a small anteroom where the operators would not be bothered by visitors. However, in this case, one of the objects was to show the operation and it was, therefore, placed in a conspicuous location. Similarly, the equipment is somewhat more elaborate than would be required for most conventions. Here again the purpose was demonstration. In addition to pickups from the meeting room we provided for picture inputs from a "demonstration" camera on the exhibit floor (Figure 9), from a film camera (far right in Figure 4), from a camera mounted on a truck outside the hotel entrance (Figure 10), and from local television station WBKB. These other pickups made it possible to provide a picture on the televiewers at times when meetings were not in progress and also to demonstrate the great flexibility of the equipment.

From the control booth output lines ran to (a) the televiewers in television overflow meeting room, (b) a televiewer in the press room and (c) to local television station WBKB which telecast many of the pickups.

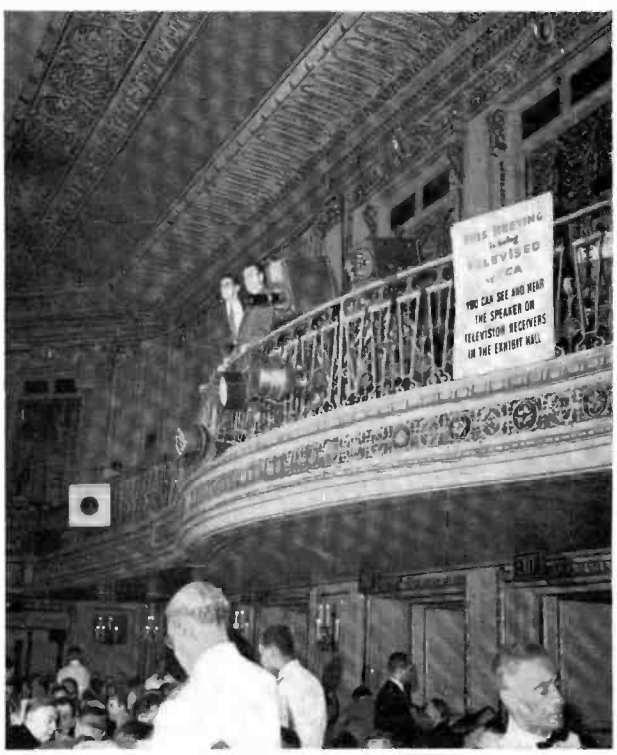


FIG. 6. *Two television cameras were placed on the balcony of main ballroom to pick up luncheon meetings. Signs (foreground) invited listeners to "see-it-by-television."*

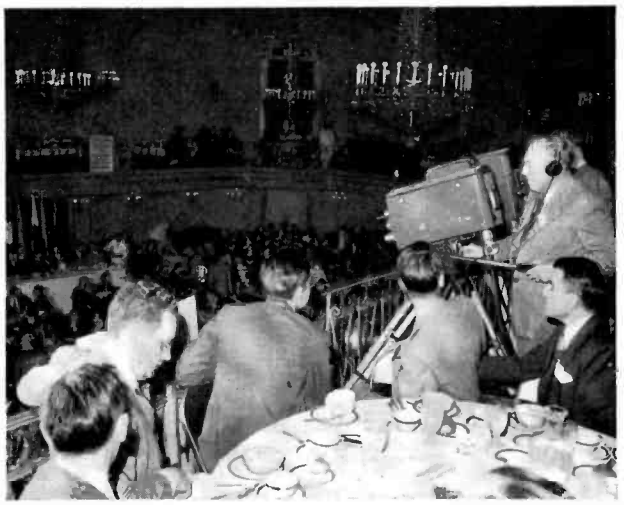


FIG. 7. *Cameras on balcony of ballroom were about eighty feet from speakers' table at the opposite side of the room. Height of cameras made it possible to pick up anything in room.*

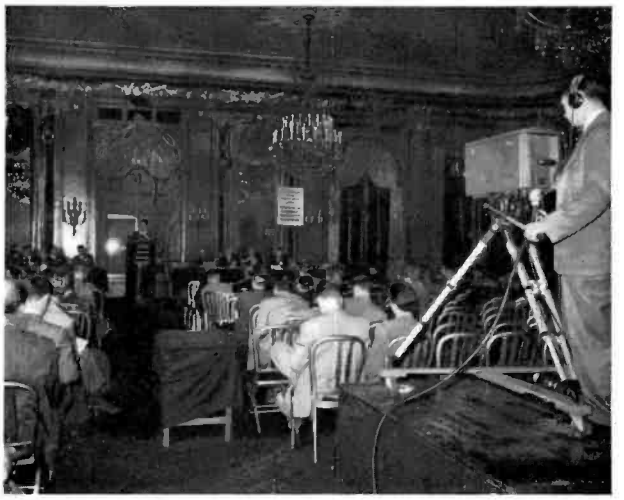


FIG. 8. *Camera in Red Lacquer Room, where most meetings were held, was mounted on 20-inch platform at rear of room and about sixty feet from the speaker's rostrum.*

FIG. 9. *An operating camera on the exhibit floor was used as "demonstrator" during exhibit hours and by WBKB (see above) to televise exhibits over their station.*

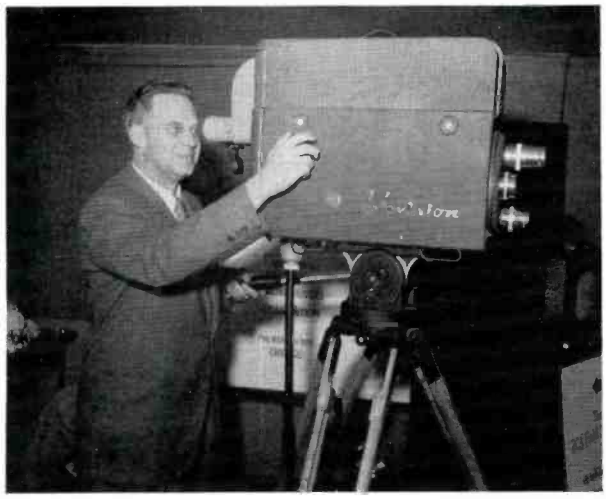
FIG. 10. *Another camera, mounted on RCA Mobile Unit, was used to pick up crowds at hotel entrance. Note relay transmitter on marquee. It was used to send convention pickups to WBKB for on-air telecasts.*

The "televiewers" used in the "overflow" room and the press room were simply standard television receivers in which the radio-frequency sections are shorted out—picture and sound signals being fed directly into the audio and video circuits. The receivers were arranged along both sides of the available space as shown in Figure 3. This picture, which was taken before the start, shows about one hundred chairs in place. Later more were added but even so it was impossible to accommodate the crowd at peak times.

Operating a television setup as elaborate as this one requires a considerable staff and some experience on the part of the personnel. For the NAB we were fortunate to have the help of Capt. W. C. Eddy, Director of Television Station WBKB (Balaban & Katz) and of Carl Myers, Technical Director of WGN (The Chicago Tribune). These gentlemen helped us make our plans and supplied the knowledge of local conditions which is indispensable in setting up such a show. In addition, they furnished the control operating crews—WBKB the video men, and WGN the audio men. That they did a fine job will be attested by anyone who attended the convention and watched them in operation.

Installation and maintenance of the equipment was supervised by a crew of RCA technicians headed by Mr. Glenn Beerbower. Production was directed by Joe Jenkins, who has made quite a reputation for himself as "producer" on RCA television shows. The overall exhibit and telcvision setup was planned and directed by Dick Hooper, manager of RCA's show department.

MORE!
CONVENTION PHOTOS
Pg. 29 to 35



Lewis S. Bookwalter, Chief Engineer of KOIN, Portland, Oregon, focuses the TK-30A Camera on something interesting.

C. M. Lewis, RCA, Chicago, and Tommy Rowe, Chief Engineer of WLS, Chicago, discussing the TK-30A Camera.

Henry Rhea, Gen. Mgr. WHOW, Clinton, Illinois, and Harold C. Burke, Gen. Mgr. WBAL, Baltimore, Md., looking at the image on the built-in viewfinder of the TK-30A Camera.

Eneas Machado de Assis, Secy. of the Inter-American Broadcasting Asso.; C. W. Slaybaugh; Goar Maestre, CMQ, Havana; Emilio Azcarraga, Mexico City; O. B. Hanson, NBC; T. A. Smith, RCA.

Eneas Machado de Assis; Lorenzo Balerio Sicco, President of the Inter-American Broadcasting Association; J. E. Young, RCA, Camden; Emilio Azcarraga, Radio Programas de Mexico.

Jim Price, RCA, Cleveland, and Wilbur Hudson, Ch. Engr. of WAVE, Louisville, Ky., inspecting the TK-30A. This camera, located in RCA's exhibit space, was a constant source of interest to the convention visitors.

C. W. Winkler, Ch. Engr. of KFOR, Lincoln, Nebr.; J. E. Young, RCA, Camden, and C. M. Lewis, RCA, Chicago, discussing 250-watt FM transmitter.

"Morrie" Pierce, V. Pres. and Director of Engineering of Stations WGAR, WJR, KMPC; Calvin Smith, KFAC, Los Angeles; Dana Pratt, A. R. Hopkins, RCA, Camden; and R. C. Dubois, RCA, Chicago.

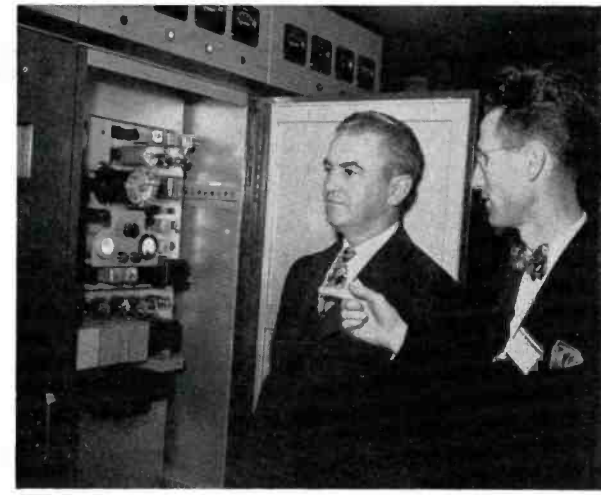
Frank Derringer, Ch. Engr. WFMJ, Youngstown, Ohio, discussing audio equipment with W. L. Lyndon of RCA's Engineering Department.

George G. Higgins, V. Pres. and Director, KSO, Des Moines, and C. M. Lewis, RCA, Chicago, inspect RCA 5-F Transmitter which was delivered to KSO immediately following the convention.

H. V. Sommerville, RCA, Cleveland, demonstrates RCA FM receiver for Dan Bell and W. A. Fraser of Telair Co.

Jack Frost, RCA, Los Angeles; Ron Oakley, Ch. Engr. KFAC; and Chet Davis, RCA, Camden, discussing large power tubes.

W. L. Lawrence, RCA, Camden; Mr. McMickel, Arthur Avery, and Carl Myers, of WGN, talking television.



Cecil Hoskins, Gen. Mgr. of WWNC, Asheville, N. C., and P. G. Walters, Jr., RCA, Atlanta, looking at the exciter unit of the RCA BTF-3B FM Transmitter.

Jim Keachie, RCA, Cleveland; Mr. Fessler, WHBC, Canton, Ohio; Mr. Ken Sliker, Ch. Engr. WHBC, and Mr. G. S. Brady, Coml. Mgr., WHBC, inspect the wire recorder.

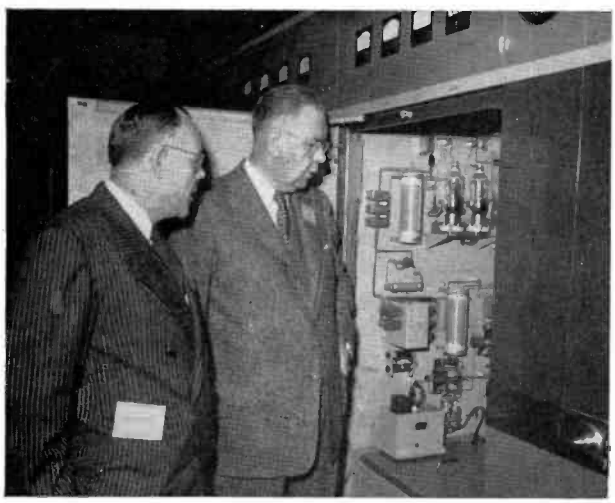
That inseparable team, W. D. Pyle, Pres., and T. C. Ekrem, Station Mgr., KVOD, Denver, Colo., talking with Bill Witty, of RCA's Dallas office.

Tom Hall, RCA, Camden; Gordon Brown, Pres. and Gen. Mgr. WSAY, Rochester; George Higgins, KSO, and Jim Price, RCA, Cleveland.

Mr. and Mrs. George P. Adair, Consulting Engr. (former Ch. Engr. for FCC), talking with V. E. Trouant, Mgr. RCA Broadcast and Industrial Engineering Section.

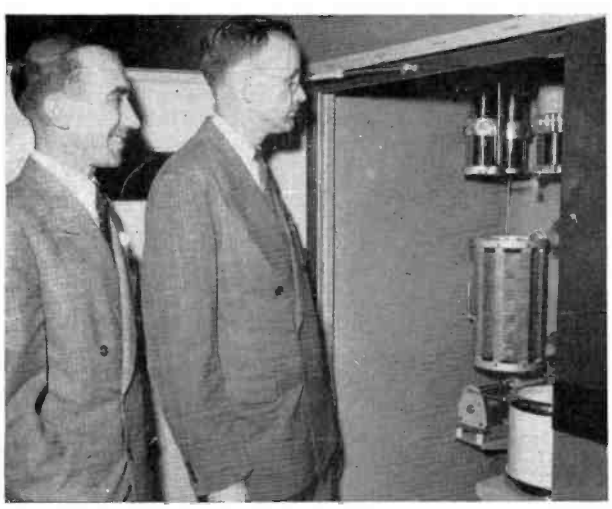
T. A. Smith, RCA, Camden; Colonel Wilder, WSYR, Syracuse, and John Fetzer, WKSO and WJEF, looking at RCA's new FM receiver.

Homer Corchene, WLS, was another who couldn't resist the temptation to try out the TK-30A Camera.



Robert Swintz, Gen. Mgr. and N. B. Welch, Coml Mgr. WSBT, South Bend, look at the low-power section of the 5-F.

J. B. Fuqua, V. Pres. and Gen. Mgr. WGAC, Augusta, Ga., and P. G. Walters, Jr., RCA, Atlanta, also inspected the 5-F (5 KW) AM Transmitter.



Tom Hall, RCA, Camden, and George Hixenbaugh, Ch. Engr. WMT, Cedar Rapids, Iowa, look at the high-power section of the 5-F.

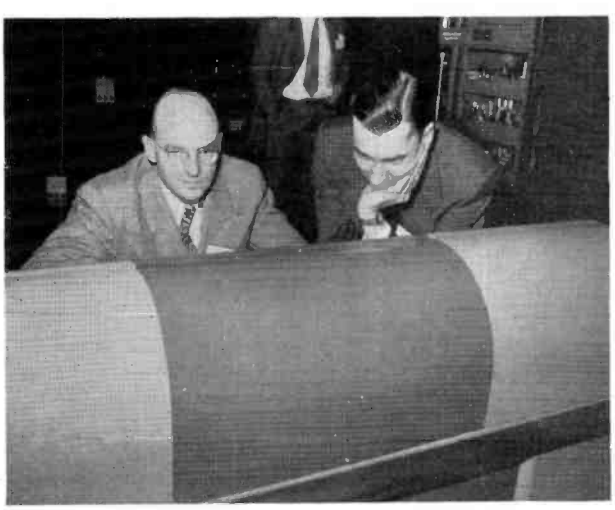
J. F. Palmquist (center) RCA engineer, demonstrating the 73-C Recorder for L. L. Lewis, (right) Ch. Engr. of WOI, Ames, Iowa.

Ted Chapeau, Mgr. WJHP, Jacksonville; Tom Gilchrist, Mgr. WTMC, Ocala, Fla., and P. G. Walters, Jr., RCA, Atlanta, make a wire recording.

George Higgins, KSO (right), owner of the 5-F which was on display, demonstrates that it really is a "walk-in" job.

L. M. Sepaugh, Mgr. WSLI, Jackson, Miss., talking to W. M. Witty, RCA, Dallas. L. L. Lewis, WOI, at right.

Henry Fletcher, Gen. Mgr. KSEI, Pocatello; O. P. Soule, Pres. KTFI, Twin Falls and KSEI, Pocatello, with Jack Frost, RCA, Los Angeles.



Dalton LeMasurier, KDAL and KILO, Duluth, and Bob Dettman, Ch. Engr. KDAL, studying 5-F Console.

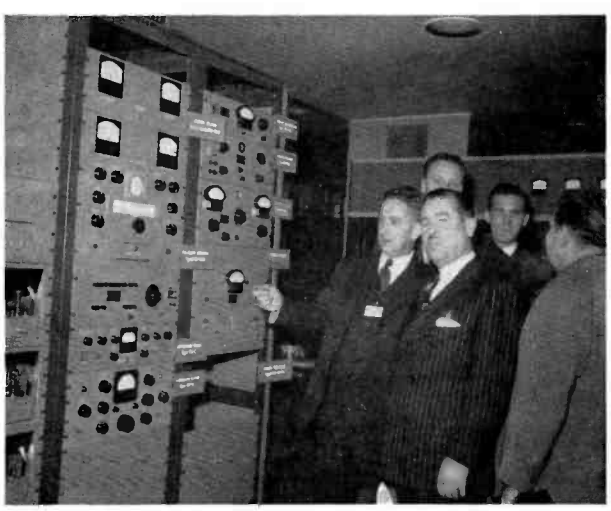
W. L. Lyndon, RCA Engineer, showing new FM Exciter Unit to George Lewis, Ch. Engr. WCAU, Philadelphia.

R. J. Palmasino, RCA, Atlanta, and Campbell Arnaux, Pres. and Gen. Mgr. WTAR, Norfolk, talking to C. W. Slaybaugh, RCA.

Jim Keachie (center) RCA, Cleveland, showing FM transmitter to A. G. Opperman, Ch. Engr., and Royal G. Lister, Pres. WCMW, Canton, Ohio.

J. A. Renhard, RCA, Camden, talking antennas with Wiley P. Harris, Director of WJDX, Jackson, Miss.

Tom Hall, RCA, Camden, and Leo Born, Tech. Director, Lee Radio Stations, examine 5-F Transmitter.



H. V. Sommerville, RCA, Cleveland, showing audio racks to Harold McCormick, Gen. Mgr., Pick Hotels Corp., Chicago, and J. J. Rehak, Mgr., Sound Product Dept., Hamburg Brothers, Pittsburgh.

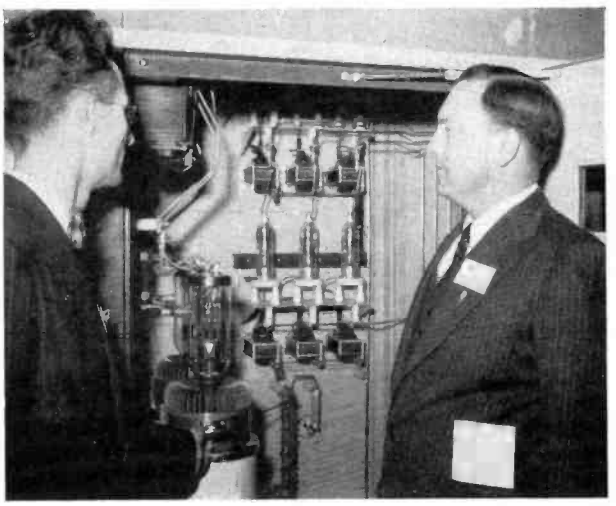
Mr. and Mrs. George P. Adair, Consulting Engr., and W. M. Witty, RCA, Dallas, examine 3 KW FM Transmitter.

R. M. Fitkin, KHON, Honolulu, Hawaii, and C. W. Slaybaugh, RCA International. The 5-F Transmitter is in the background.

Gordon P. Brown, WSAY, Rochester, N. Y., and Jim Keachie, RCA, Cleveland. In the background, the 76-B2 Consolette.

Comdr. John H. Allen, USN Bureau of Ships, Electronics Div., talking with P. B. Reed, RCA, Washington, and Fred Allman, Pres. and Gen. Mgr. WSVA, Harrisonburg, Va.

Allen Woodall, Pres. and Gen. Mgr. WDAK, Columbus, Ga., and P. G. Walters, Jr., RCA, Atlanta, admiring the RCA 612V3 FM Receiver-Phonograph combination which elicited much interest among FM broadcasters.



Ted Chapean, Gen. and Coml. Mgr. WJHP, Jacksonville, Fla., and P. G. Walters, Jr., RCA, Atlanta, looking over modulator stage of the 5-F Transmitter.

W. M. Witty, RCA, Dallas, showing the 5-F Console to Mr. and Mrs. Wayne Phelps, KHUZ, Borger, Texas.

Televising An Operation

In a three-day test (February 27-March 1) the Johns Hopkins University and Hospital in Baltimore, in cooperation with Radio Corporation America, televised an actual operation to test the practicability of television as a means of surgical teaching.

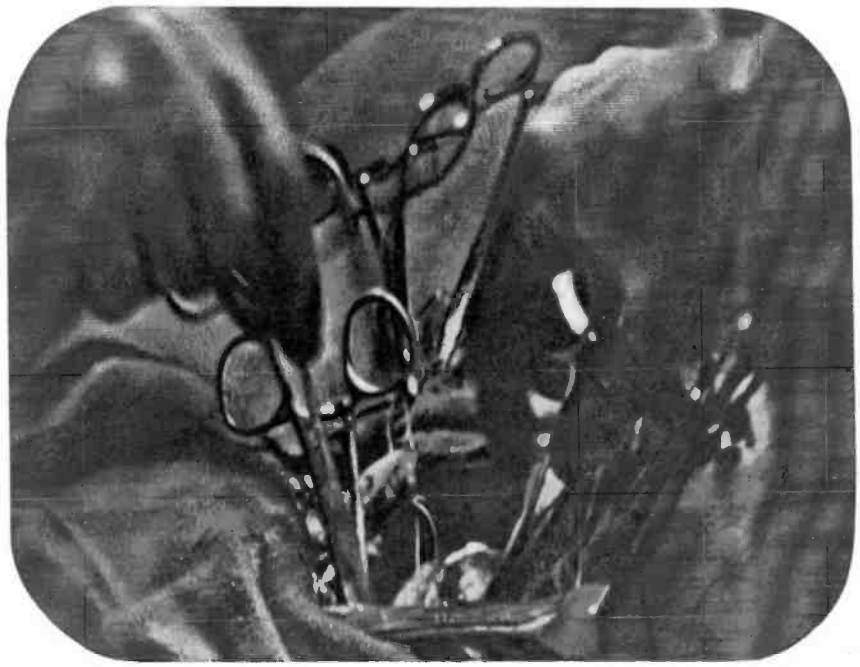
The immediate purpose of the experiment was an attempt to permit the members of the Johns Hopkins Medical and Surgical Association to view, at close range, one of the famous "blue baby" operations. The experiment was arranged by Dr. I. Ridgeway Trimble and Dr. Frederick M. Reese, members of the hospital staff, with the approval of Dr. Edwin L. Crosby, Director of the hospital.

The first operation to be televised, as a rehearsal for the equipment, was performed Thursday (February 27) and was the so-called "blue" baby operation. Three other operations, including another "blue" baby operation, were televised Friday. A third "blue" baby operation was televised Saturday morning. Reception was restricted to receivers in rooms on the operating floor of the hospital, as the telecast was designed for doctors and surgeons only.

Commenting on the experiment, Dr. Crosby said, "Adequate observation facilities to teach surgical techniques have long been a serious problem. The physical limitations of amphitheaters sharply restrict the visibility of the operating field. Television has brought the operative field within the critical sight of large numbers of doctors and students, and will permit them to witness many operations. The experience with this test, although short, indicates that television may be extremely valuable in this type of teaching."

Two Type TK-30 RCA Image Orthicon cameras were used. One was mounted on the operating room light fixture directly above (4½ feet) the operating field. This permitted a detailed view of the operation. The second camera, equipped with a telephoto lens, was set up in the gallery of the amphitheater.

The camera directly over the operating table was pre-set and was controlled automatically throughout the operation. A microphone above the table permitted the surgeon to comment as the operation was carried out.



This is a photograph made directly from the screen of one of the TS-630 (10-inch direct-view) receivers during the course of one of the operations. Eight TS-630 receivers and two large-screen projection receivers made it possible for as many as three hundred doctors to see, at closehand, an operation which only seven or eight, at most, could witness directly (see opposite page).

Camera control equipment was set up in an anteroom. RCA's television crew donned coats, caps, and masks for the duration. Shown in the group above are: (left to right, standing) Harold Desfor, Director of Publicity; W. L. Lawrence, Television Equipment Sales; F. J. Helgeson, RCA Service Co.; (seated, left to right) Norman S. Bean, Television engineer; Frank Jordon, RCA Service Co.; and Dick Hooper, Promotion Manager.

Televising the Bullfights

Televisions Mexican Debut The Hit Of Mexican Broadcast Congress

by **EDWARD K. PRICE**
RCA Service Company

At the first Inter-American Broadcast Congress in Mexico City October 1, 1946, delegates assembled from Mexico and nearly every South and Central American country were given a preview of postwar electronic developments. These included everything from lifeboat emergency transmitters, to portable television field pickup equipment. RCA and other manufacturers, Mexican as well as North American, were represented.

Television, as brought to Mexico for the first time by RCA, proved the magnet of the show. Six thousand persons paid a peso apiece to see television the first night the exhibition was thrown open to the public, and lines at the box office at times were a block long. Local police were wearing their best smiles as they watched themselves direct the crowds past the "see yourself" television receiver at the studio entrance.

The setting for television's premiere, south of the border, was Mexico City's swank new Hotel Del Prado. The hotel was so new, it wasn't even finished! For that reason the program of operations was carried on under some difficulties due to lack of elevators, moving equipment, power outlets, and 60-cycle-line power supply. The lobby and the mezzanine of the Del Prado housed the exhibits of RCA and other manufacturers. Five lighted displays dramatizing various aspects of television with commentary in Spanish were attractively arranged in the lobby. In addition to the displays there was an operating model of the electron microscope, marine radiotelephone and telegraph transmitters, recording equipment, and two broadcast transmitters—a 5 KW BTA-5F and a 250-watt FM job. The television equipment included eight receivers (six direct viewing and two projection types), and a set of the new image orthicon field equipment. A second image orthicon "chain" (i.e. camera plus camera control unit) was flown down from Camden for the opening date. Three days later the microwave relay link was flown from New York for the bullfight telecast.

Because of the lack of facilities in a building under construction, the physical problem of set-up and operation of all the equipment was considerable and rather time-consuming. Virtually all equipment had to be dragged up three and four floor levels from the street on boards and pieces of gaspipe. The municipal power supply in Mexico City being fifty cycles, we had to borrow auxiliary gasoline generators for the television equipment. Hauling them upstairs into place kept two dozen Mexican workmen busy all one morning. In getting set up about the only Spanish necessary with workmen and porters was one word "arriba" (up). "Arriba" was the password for the first two days.

FIG. 1. (Left) *RCA Image Orthicon Camera (lower right of picture) set up in the Plaza Mexico, world's largest "Plaza de Toros." A light rain which was falling at the time blurred this photograph but did not impair the telecast of the fights.*

FIG. 2. (Right) *Sword, cape—and camera. Mexican bullfighters being introduced to the Image Orthicon by RCA Show Manager, Dick Hooper. In the center rear, watching the proceedings, is Paco Malgesto, who provided the commentary for the televised "Corrida."*

From the auxiliary generators temporary wiring was run to the television receivers on the lobby level and to the field camera equipment on the mezzanine. Six receivers were installed behind what was to become the marble administrative counters of the hotel. Two additional receivers were installed for "see yourself on television" purposes; one outside the main studio and the other in Salinas y Rocha Department Store across the street. The receivers were parallel driven for audio and video and necessary cables were run from the sound and television studios on the mezzanine. In the proposed arrangement, use of the microwave link required that necessary video cable and twisted pair be run between the studios and the roof thirteen floors up.

The glassed-in video control room was incorporated as part of the Engineering Products exhibit booth and opposite it, across the television stage, the audio and broadcast studio was built under the supervision of RCA Victor Mexicana engineers. Popular Mexico City radio stations, such as XEQ, XEW, and XEB, used our studio for their scheduled musical programs following their nightly appearances on television.

Language turned out to be an easier problem than was at first anticipated. Although a knowledge of fluent Spanish, including local idioms, would have been very helpful, still the language of radio seems fairly universal. Through the medium of amateur radio, for one thing ("hams" are called "afficionados" in Latin America), our American radio and electrical terms have become general usage in Mexico. The common phraseology of radio—schematic diagrams—helped simplify or explain hook-up problems, various electrical controls on television receivers, cameras, etc. Technicians from RCA Victor Mexicana were very cooperative and helped our shorthanded crew in many ways during the programs.

Operation of the image orthicon camera equipment was very satisfactory with clean pictures on both indoor and outdoor scenes. In comparison with the prewar iconoscope equipment, lighting problems were greatly simplified. On evening programs, overhead indirect lighting was supplemented by one or two bird's-eye bulbs placed on either side of the performers fifteen to thirty feet away. During the day, with two hundred feet of camera

FIG. 3. (Left) *RCA's participation in the Congress was directed by Meade Brunet, Managing Director of RCA's International Division. In this picture, taken during the Congress Fiesta at Xochomilco, are John Royal, NBC Vice President, Emilio Azcarraga, Mexican radio leader (standing), Meade Brunet, and J. A. Miguel, Jr., Manager of RCA Victor Mexicana.*

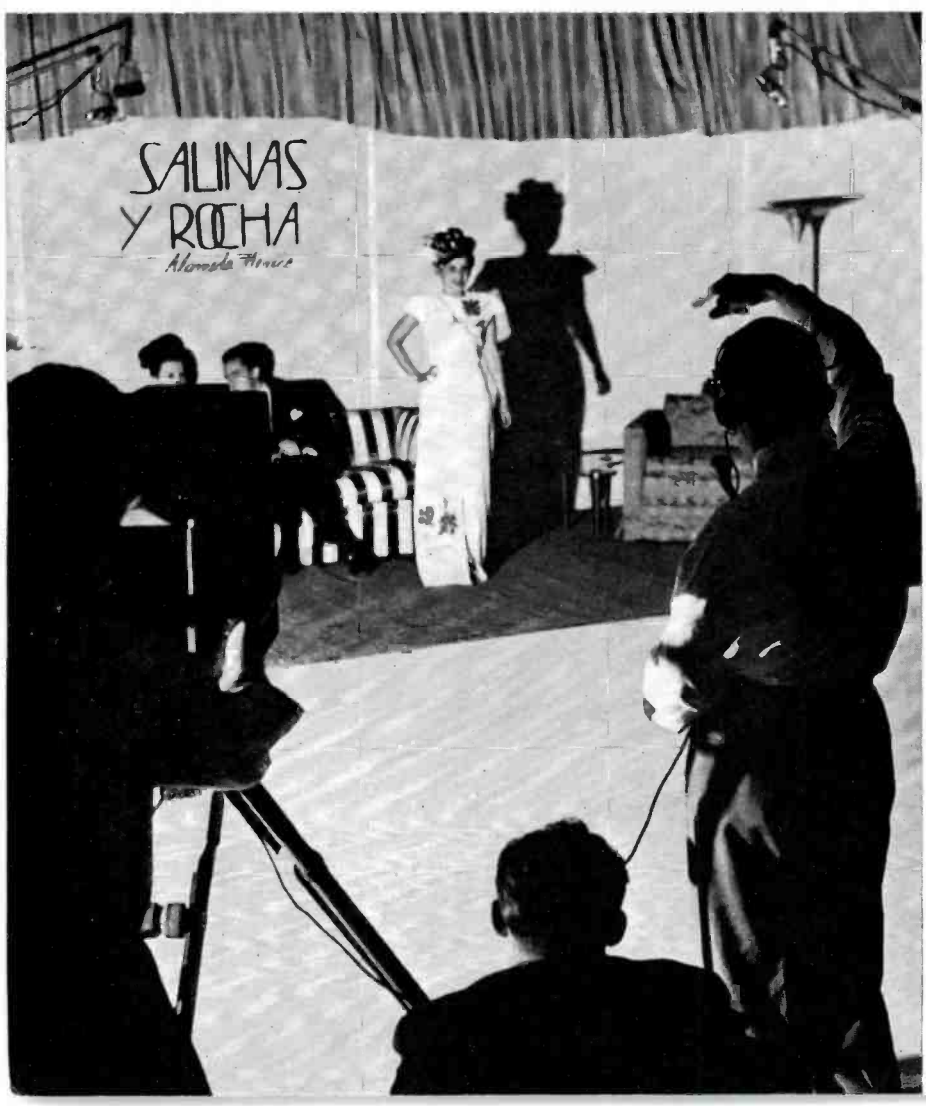


FIG. 4. (Lower Left) *The sign language of radio and television is the same in every country. Here Joe Jenkins, producer for RCA Television shows, is directing a fashion show pickup from Salinas y Rocha Department Store in Mexico City.*

cable available, the cameras were easily "dollied" from the studio out to the balcony for shots down on the city plaza and toward the store window across the street where one receiver was located. When the passing public found it could see itself looking into a television set, enthusiasm was rampant and the police were hard put to keep the crowd under control.

A highlight of RCA's participation in the broadcast congress was the telecasting of the bullfights on the evening of October 7th, using image orthicon and microwave relay equipment. That night over 7,500 persons crowded around and past the receivers in the el Prado to witness the world premiere of television bullfighting. From the upper rim of the Plaza Mexico—world's newest and largest "Plaza de Toros"—approximately seven line-of-sight-miles from the el Prado, the six fights were transmitted by 7,000 megacycle microwave, picked up by the parabolic receiver dish on the hotel roof, and "piped" to the telesites below. The pictures, clear and strong, brought home in compact close-ups all the drama and pageantry of this violent sport. One reporter, impressed by television's close-up presentation, said he felt as though he was right down there in the bull ring with his feet in the sand. (When we saw what the bulls did to some of the matadors, we North Americans were glad we weren't!)

The technical aspects of the bullfight show underscored the flexibility of a set of portable equipment for handling both studio and remote events. The setup was simply disconnected and the "suitcase" units picked up and carried downstairs to the "remote" truck parked on the street. The inside of the truck was used for a

FIG. 5. (Right) *Bullfight pictures from the Plaza Mexico, seven miles away, were transmitted to the hotel exposition area by standard RCA Microwave Relay Equipment. In this picture the relay equipment, flown in from New York for the occasion, is being tested before transportation to the Plaza. Note transmitter parabola on the truck and receiver parabola on the hotel parapet. Immediately following this test the transmitter was moved to the Plaza and the receiver to the hotel roof.*

control room with the camera and microwave transmitter set up on its roof. Initial tests were made locally, i.e., the receiving parabola and control equipment were erected on the hotel balcony with video output into a monitor receiver. The truck was parked across the street and, after successful video transmissions were made to the balcony, the receiving dish and associate equipment were moved up on to the hotel roof where further tests were completed. The truck—a converted moving van—was then driven out to the bull ring where the camera equipment and transmitter were to be set up.

The trip across town and out to the bull ring was quite an experience. When the Mexican boys around the exhibit found out the truck was going to the bullfight, we had plenty of help. At least twelve pairs of hands grabbed hold of the portable gasoline generator and followed it into the truck. Covered with shiny new "RCA Television Equipos Moviles" signs, and with personnel and equipment inside and out, the veteran "mobile unit" proceeded at a fifteen mile an our clip across town. Caution in driving was necessary in order to avoid low flung telephone and light wires strung every which way across suburban streets. Crowds gathered around every mile or so when the driver stopped to refill his boiling radiator from the public fountains. It was just getting dark when we arrived at the bull ring and less than forty minutes remained before the first fight.

The camera was located under the judges' box about a hundred yards up from the ring proper and faced the gate through which the bulls charged into the arena. The master monitor, power supply, and camera control were placed further up the side of the stadium. The transmitter control and parabola were set up on a parapet near the rim with the parabola facing out through a "porthole" in the big concrete stadium. This location was direct line-of-sight from the hotel across Mexico City. First contact was made with the hotel roof by Morse code flashing light—until telephone communication was established—as both dishes were oriented for maximum signal from the three-degree beam.

The first bull hit the receiver screens in the hotel within a few minutes after the beginning of the opening fight. At that point the crowds loosed a loud "Ole!", traditional vocal approval of the bullfight enthusiast, and for the ensuing two hours shouts of "Ole!" and other appropriate expletives rang through the corridors. The postwar model projection receiver was particularly outstanding in performance, and pictures from the fifteen-inch telephoto camera lens showed up with fine clarity.

A light rain, which started half way through the show, at first gave us concern. The weatherproof transmitter and receiver units, however, are really weatherproof so that the pictures suffered no change in quality right through to the program's finish.

KSD-TV INAUGURATES COMMERCIAL VIDEO SERVICE IN ST. LOUIS

Station KSD-TV inaugurated regular commercial television service in St. Louis on February 8, thus becoming the first newly equipped postwar television station to go on the air, and the first to be operated by a newspaper. Using entirely new equipment, the St. Louis Post-Dispatch station made a spectacular start in sight-and-sound broadcasting by programming 25 hours during Edison Centennial Week, February 10-17.

George M. Burbach, general manager of KSD, pointed out in the inaugural telecast that the Pulitzer Publishing Co., owner of KSD-TV, has pioneered in radio for 25 years. KSD was established in 1922 and, before the war, the Post-Dispatch was first in operating a regular daily newspaper by facsimile broadcast. To these "firsts", KSD now adds another—its greatest—"first with television."

St. Louisans had their initial glimpse of public telecasts February third and fourth. Operating on channel five, KSD-TV televised street interviews, puppet shows, the Golden Gloves fights, news, drama, and other programs for RCA-Victor dealers and guests at Hotel Statler.

In inaugurating T-Day in St. Louis, Dan Halpin, Manager of Television Receiver Sales for RCA, said: "St. Louis, the seventh American city to telecast, is definitely in front of the others on the basis of better sight and sound." He attributed the clear reproduction of KSD transmissions to the fact that, "KSD-TV is the first station to be completely equipped with postwar materials."

Sponsors for KSD-TV programs are already numerous. Thirteen advertisers bought program time for Edison Week and 51 programs were produced during this period. These were carried from noon to 3:30 p.m. Monday through Saturday, with some evening broadcasts. During Edison Week, more than 100 receivers were installed in homes, hotels, department stores, the

FIG. 1. (Below) *Studio scene during KSD-TV telecast, which inaugurated regular commercial television service on February 8. Harold Grams of KSD (center background) is interviewing Jack Marden (left) and Dan Halpin of RCA Victor's Television Receiver Department.*

FIG. 2. (Above) *The first home television set in operation in St. Louis at the residence of Dale Neiswander, RCA distributor, is tuned by Mrs. Neiswander for her troop of Brownies (junior girl scouts). Announcer Jay Faraghan of KSD-TV, new Post-Dispatch television station, is seen on the screen.*

FIG. 3. (Right) *Scene already common in St. Louis—and soon to become an everyday scene in many American cities. "Man on the street" is interviewed in the first public television demonstration in St. Louis by Frank Eschen, special events director for the new Post-Dispatch station KSD-TV. This program was televised for an audience of 750 RCA dealers and guests at Hotel Statler. They also viewed puppet shows, sporting events, news, films and dancing exhibitions on their television receivers. KSD-TV inaugurated its regular commercial programming on February 8, becoming the first new postwar television station in the country.*

Union Electric Co. lobby, and other public places. RCA placed 300 receivers on sale February 10 and several other manufacturers planned to have sets on sale soon.

Since some of KSD-TV's permanent equipment had not arrived, quick inauguration of telecasts was made possible by temporary equipment supplied by RCA, which also sent engineers to assist the station staff directed by Robert L. Coe. This equipment included a 500-watt development-model visual transmitter, with a range of about ten miles; an FM sound transmitter; a micro-wave relay transmitter; and a 3-bay super-turnstile antenna, which was mounted 180 feet from the street on top of the Post-Dispatch Building. Permanent transmitting equipment will be in use by May. This will include a tower 550 feet from the street, and an RCA model TT-5 transmitter with an effective power of 20,000 watts and a range of 35 to 40 miles.

The inaugural program on February 8 included an introduction by Frank Eschen, KSD special events director; films and a dancing exhibition by instructors from the Arthur Murray studios; and sports interviews with Freddie Hofmann, coach of the St. Louis Browns, Joe Garagiola, St. Louis Cardinal catcher, and Bill Longson, wrestler. The interviews were conducted by Harold Grams of KSD and J. Roy Stockton, Post-Dispatch sports editor.

Programs during Edison Week included drama, films, illustrated news, home economics, and a style show with creations by 81 fashion designers—more than in any show presented previously in the Midwest. One feature was a mystery drama in which the audience searched for clues. Another was a television version of a Broadway suspense hit of 1925, "R.U.R." A third was a "telequizzicalls" program, in which members of an audience in a department store answered telephone questions from the studio and were able to see the interviewer.

Adrien B. Rodner's new company, Television Advertising Productions, Chicago, was in charge of Edison Week programs. The organization was established to assist new video stations and advertising agencies in television programming. Besides Rodner, who has written and produced 200 television broadcasts, members of this experienced group who came to St. Louis were: Loraine Larson, director, Donovan Faust and Jack Gibney, producers, and Leonard Nathanson, writer.

KSD-TV already has agreements with local athletic directors to telecast baseball games of the Cardinals and Browns, wrestling, boxing, and sports of Washington and St. Louis Universities.

Sponsors of programs for the first week of television in St. Louis included Union Electric Co., Shell Oil Co., Bulova and Elgin (watches), Trimfoot and Rhythm Step (shoes), Hyde Park (beer), Botany (ties), Monsanto (chemicals), Bemis Bag Co., St. Louis Independent Packers and American Packing Co., and the Missouri-Kansas-Texas Railroad.

SCHEDULE OF KSD-TV TELEVISION PROGRAMS FOR WEEK OF FEBRUARY 10th

Monday, February 10

12:30 pm—Edison Centennial Week Inaugural—Talks by Mayor Kaufmann, Frank M. Mayfield, Chairman of the Board of Trade, and Judge McAfee, President of Union Electric Co.
12:45 pm—Counter Talk — Dramatic program presented by the Trimfoot Co.
1:00 pm—A film presentation.
1:15 pm—Meet St. Louis — A man-on-the-street program presented by Hyde Park Breweries Association, Inc.
1:45 pm—A film presentation.
2:00 pm—TeleQuiziCalls—A viewer audience participation quiz show presented by Union Electric Co.
2:30 pm—News and Views—newscast.
2:45 pm—A film presentation.
3:00 pm—Caught In the Act—A dramatized mystery-audience participation program—sponsorship open.
3:30 pm—The Gold In Meat—A film presentation of the American Meat Institute, sponsored by the American Packing Co.
4:00 pm—Sign Off.

Tuesday, February 11

12:30 pm—Dress Rehearsal—An educational semi-dramatized talk on the uses of newly-developed plastics and resins in the treatment of fabrics—presented by Monsanto Chemical Co.
1:00 pm—A film presentation
1:15 pm—Meet St. Louis — A man-on-the-street program—presented by Hyde Park Breweries Association, Inc.
1:45 pm—A film presentation.
2:00 pm—TeleQuiziCalls—A viewer audience participation quiz show presented by Union Electric Co.
2:30 pm—News and Views—newscast.
2:45 pm—A film presentation.
3:00 pm—Funtime—An audience participation stunt show presented by the Dazey Corporation.
3:30 pm—Sign Off.

Wednesday, February 12

12:30 pm—Counter Talk—A dramatic program presented by the Trimfoot Co.
12:45 pm—The Telephone Hour — A film presentation of the Southwestern Bell Telephone Co.
1:15 pm—Meet St. Louis — A man-on-the-street program presented by Hyde Park Breweries Association, Inc.
1:45 pm—A film presentation.
2:00 pm—TeleQuiziCalls—A viewer audience participation quiz show presented by Union Electric Co.
2:30 pm—News and Views—newscast.
2:45 pm—A film presentation.
3:00 pm—Caught In the Act—A dramatized mystery audience participation program—sponsorship open.
3:30 pm—Sign Off.

Thursday, February 13

12:30 pm—Dress Rehearsal—An educational semi-dramatized talk on the uses of newly-developed plastics and resins in the treatment of fabrics—presented by Monsanto Chemical Company.
1:00 pm—A film presentation.
1:15 pm—Meet St. Louis — A man-on-the-street program — presented by Hyde Park Breweries Association, Inc.
1:45 pm—A film presentation.
2:00 pm—TeleQuiziCalls—A viewer audience participation quiz show presented by Union Electric Co.
2:30 pm—News and Views—newscast.
2:45 pm—A film presentation.
3:00 pm—All American Gallery of Fashions Preview—A style show with a touch of Ziegfeld — presented by the St. Louis Fashion Creators, Inc.
4:00 pm—Sign Off.

Friday, February 14

12:30 pm—Rhythm Steps—A dance presentation by Arthur Murray Instructors, sponsored by Johnson-Stephens & Shinkle Shoe Co.
12:45 pm—World Series of 1946 — A film presentation.
1:15 pm—Meet St. Louis — A man-on-the-street program, presented by Hyde Park Breweries Association, Inc.
1:45 pm—A film presentation.
2:00 pm—TeleQuiziCalls—A viewer audience participation quiz show presented by Union Electric Co.
2:30 pm—News and Views—newscast.
2:45 pm—A film presentation.
3:00 pm—Caught In the Act — A dramatized mystery audience participation program—sponsorship open.
3:30 pm—Sign Off.
8:30 pm—St. Louis U.-Oklahoma Aggies basketball game—sponsored by Shell Oil Co.

Saturday, February 15

12:30 pm—Food for Thought—A home economics program — presented by St. Louis Independent Packing Co.
12:50 pm—A film presentation—sponsored by the Bemis Bag Co.
1:15 pm—Meet St. Louis — A man-on-the-street program, presented by Hyde Park Breweries Association, Inc.
1:45 pm—A film presentation.
2:00 pm—TeleQuiziCalls—A viewer audience participation quiz show presented by Union Electric Co.
2:30 pm—News and Views—newscast.
2:45 pm—A film presentation.
3:00 pm—R U R—A dramatic program, presented by the St. Louis Community Playhouse, and sponsored by the Missouri-Kansas-Texas Railroad.
4:00 pm—Sign Off.

MERRILL TRAINER APPOINTED MANAGER OF TELEVISION EQUIPMENT SALES

Appointment of Merrill A. Trainer, pioneer in television research and development, as Manager of RCA Television Equipment Sales has been announced by T. A. Smith, General Sales Manager of the RCA Engineering Products Department. Mr. Trainer will supervise the sale of television transmitters, studio equipment, antennas, television microwave relay equipment, and other components used by television broadcast stations. Prior to his appointment, he was in charge of the company's television terminal equipment development.

Mr. Trainer entered the television field in 1927 and during the next three years was associated with Dr. E. F. W. Alexanderson in television research at the General Electric Company. Since 1930 he has been a member of the RCA television engineering staff and has been intimately associated with most of the major RCA television developments.

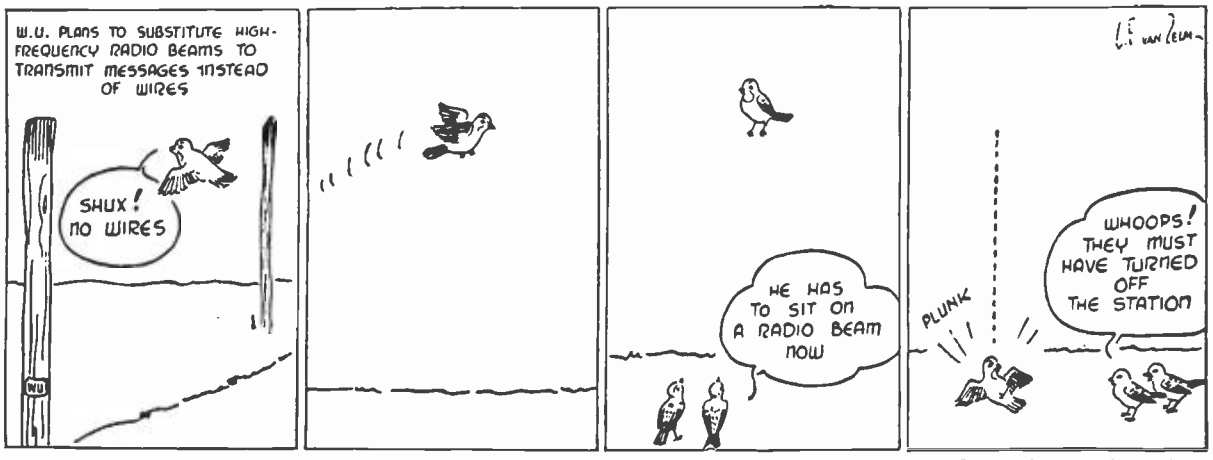
In 1932 Mr. Trainer assisted in the first successful television relaying between Philadelphia and New York. In 1933, he helped produce the first iconoscope camera, the type which has been used for studio and film purposes right up to the present. Three years later, Mr. Trainer participated in designing, building, and installing NBC's pioneer television station WNBT, in New York. In 1937 he was engaged in RCA's program for perfecting all-electronic television, one of the most revolutionary improvements in the industry. Mr. Trainer also helped design the television studio equipment installed in Moscow in 1938.

In 1940 Mr. Trainer was appointed Supervising Engineer of RCA's Television Terminal Equipment Section. During the war he supervised the company's development of airborne television equipment, and television-guided missiles for the military services.

A native of Philadelphia, Mr. Trainer was graduated from the Drexel Institute of Technology with a degree in Electrical Engineering. He is a senior member of the Institute of Radio Engineers, a member of Tau Beta Pi, honorary engineering society, the Franklin Institute, and has served on several committees of the Radio Manufacturer's Association.

MERRILL A. TRAINER

In his new position, Mr. Trainer succeeds Henry Rhea, who has left the RCA Engineering Products Department to go into business for himself. Mr. Rhea will manage Radio Station WHOW in his home town, Clinton, Illinois.



Courtesy of Christian Science Monitor

KSD-TV

A POST-WAR TELEVISION STATION

by ROBERT L. COE
St. Louis Post-Dispatch Radio Stations

EDITOR'S NOTE: *The following article describing the KSD-TV facilities was written in December. At that time this station was not yet on the air, although field equipment was being used in closed circuit presentations. Since then the installation has gone forward rapidly, and on February 8 KSD-TV started regular programming (see Page 42). Mr. Coe would have preferred to wait until the station was complete and operating before writing a story about it. However, it seemed to us that everything about KSD-TV, including the original planning and some of the installation problems, would be of interest. With that in mind, we persuaded him to write this preliminary account. Originally we had expected to have this issue of BROADCAST NEWS in the mails by the first of February. Like everyone else we've been delayed; nevertheless, we think this story is still of great interest. And we promise that, in a forthcoming issue, we will carry a second installment of the St. Louis story in which we will present KSD-TV in its finished form.*

One of the pioneer stations of the country, the ST. LOUIS POST-DISPATCH Radio Station KSD, is celebrating its twenty-fifth anniversary this spring by presenting two new services to the St. Louis Area; KSD-FM and KSD-TV. The equipment will be RCA all the way, from the 44-BX Microphone and TK130A Cameras, to the Super Turnstile Antenna, 545 feet above the street.

In planning the transmitter and studio facilities for St. Louis' first television station, the almost complete lack of information of the type needed was soon apparent. The very few existing television stations were using equipment considerably different from the postwar models that are being manufactured for KSD-TV, and studies indicated that our programming policy would necessarily be quite different. So, the construction of KSD-TV has proceeded without benefit of many guide posts. For this reason our studio facilities in particular are designed

FIG. 1. (Left) *KSD-TV's temporary "workshop" studio is 25 feet wide, 45 feet deep, and 21 feet high. Walls are covered with one-inch rock-wool blanket, the ceiling with J-M "Fibracoustic." Sets and props are depended on to "liven up" the studio.*

FIG. 2. (Below) *Control position for KSD-TV studio. Audio control position is at left. Master monitor and film camera monitor are mounted in center console. Desk at right contains camera control and switching units of portable equipment.*

solely as a "work shop" in which can be developed the facilities and techniques required for television service in St. Louis.

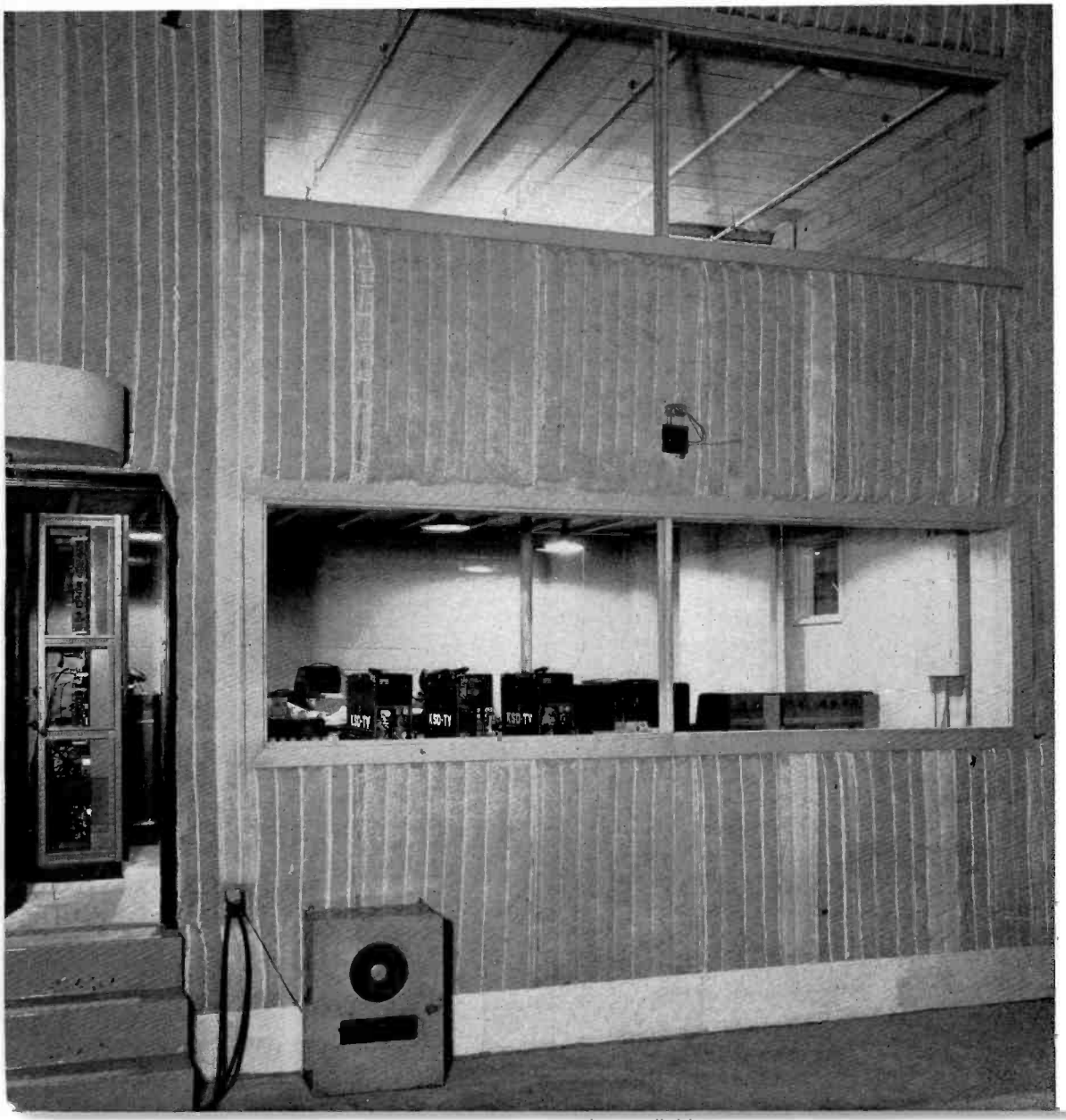
The site of the KSD-TV transmitter was selected on the basis of advantages which appear to be very desirable. (1) It is located in almost the exact geographical center of the St. Louis Metropolitan District, which the predicted 5.0 mv/m contour covers nicely. (2) It is located in the heart of the congested area, so that the transmitter will deliver high signal intensities where they are most needed. (3) It is on the roof of the Post-Dispatch Annex, eliminating the need of acquiring or leasing any additional property. (4) The temporary television studio is in the same building. The permanent studio, which will be completed next year, will be in the main Post-Dispatch building; so, there will be no need for a studio-transmitter radio relay link or special telephone circuits.

A 450-foot Ideco tower is being erected on the roof of our mechanical annex. On top of this will be mounted an RCA Super Turnstile television antenna. This combination places the top of the antenna approximately 545 feet above the street level and well above any nearby structure. It gives an elevation above the average ten-mile elevation of about 527 feet. With the RCA TT-5A transmitter, which will be installed shortly, the predicted 0.5 mv/m contour has a radius of about 40 miles. This area embraces 4,300 square miles and an estimated population of 1,461,000.

This same antenna system will be used for KSD-FM by means of the triplexing system recently announced by RCA. With the television transmitter operating on Channel No. 5, and the FM transmitter on Channel No. 27—93.3 Mc., the estimated antenna power gain is 4.3 and 5.3 for television and FM respectively.

A penthouse approximately 44 by 54 feet is being constructed on the roof of the Post-Dispatch Annex, which will house the television and FM transmitters with the antenna tower located alongside. The building is divided into an equipment room, a

FIG. 3. (Below) *View looking from the KSD-TV studio into the control room (and observation booth above). In order to improve visibility, the control room floor is two feet above studio floor. Direct access from studio to control room is provided by the door at left. Video equipment racks at the side of the control room can be seen through the open door.*



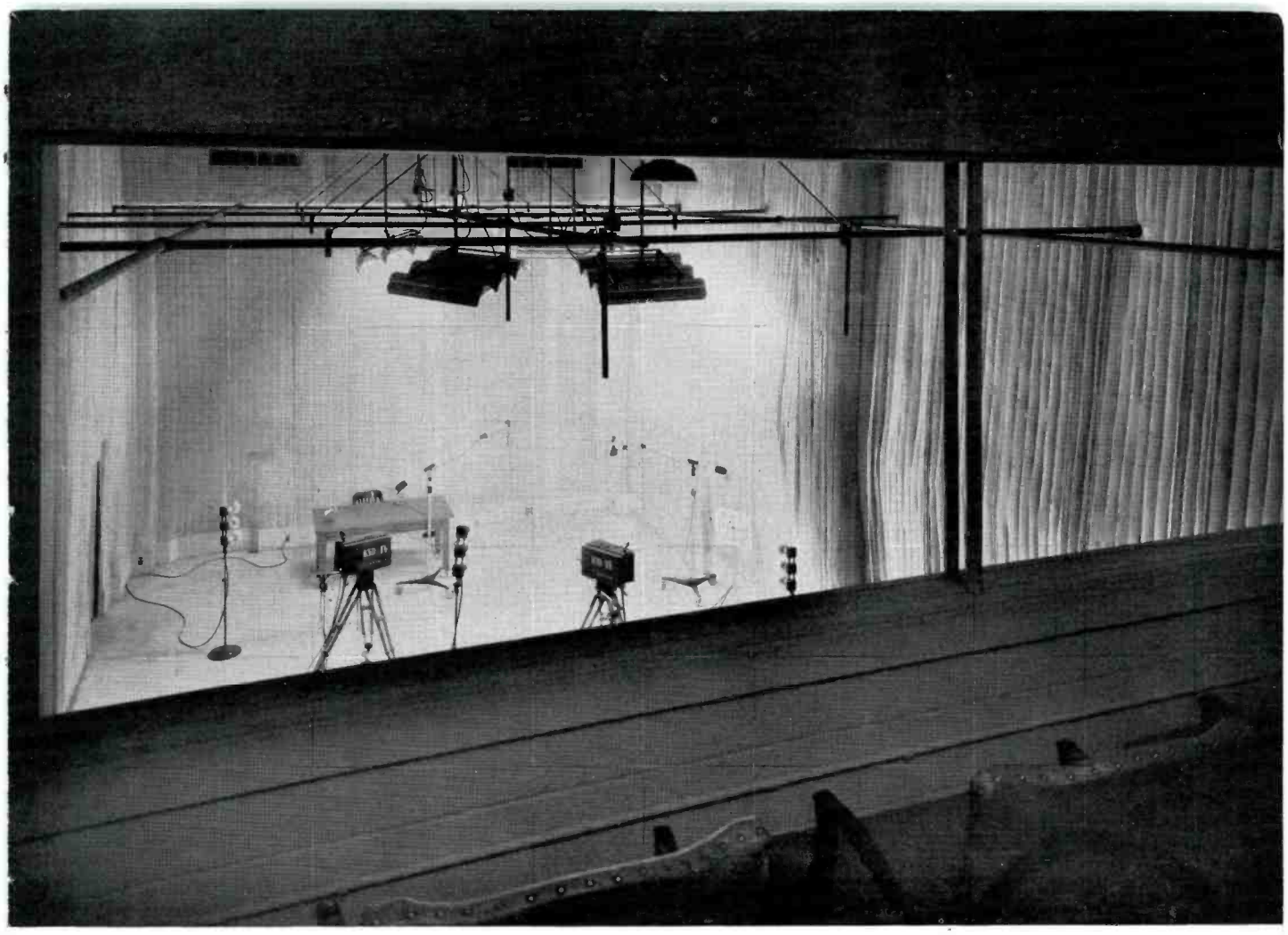


FIG. 4. *This is the view looking into the studio from the observation booth which is located directly over the control room. Particularly evident in this illustration is the lighting system. It consists largely of fluorescent lamp assemblies which are attached to the overhead pipe grill in such manner as to be easily moveable.*

monitoring room, shop, storage room, and toilet facilities. The monitoring room and shop will be air-conditioned and the air inlet to the equipment room well filtered. Filtered air is important for any space housing electronic equipment, and our experience indicates this is doubly important in the case of television equipment.

The RCA TT-5A Television Transmitter and BTF-10B FM transmitter will be incorporated into the wall dividing the equipment and monitoring rooms. A tube storage cabinet is located between the transmitters, with doors matching those on the transmitters. Looking at the transmitters from the monitoring position, the television transmitter is on the left. This arrangement permits short and direct runs of the output lines to the triplexer unit from both the television diplexer and the FM transmitter. From the triplexer, two 3⅛" lines feed the output of all three transmitters to the Super Turnstile Antenna atop the tower.

Both transmitters are almost entirely self-contained, but ample space has been allowed for the necessary external equipment in the equipment room. The overhead clearance, while limited because of building restrictions, will accommodate all of the various lines connecting the equipment. An air intake unit, with a capacity of 9000 cfm, is equipped with a filter in addition to those incorporated in the transmitter units themselves. It is also equipped with a heating unit for extremely cold weather and for during off-air periods. Two exhaust fans have a combined capacity of 9000 cfm. These are located as close to the ceiling as the concrete beam construction of the penthouse will allow. The main power distribution panel for the entire installation is also located in the equipment room. The total power requirement for both transmitters and associated equipment, tower light, de-icers, and building lights, is 103 KVA.

The monitoring room, approximately 15 by 52 feet, accommodates monitoring positions for both television and FM. A lighting trough, extending the length of the transmitters and located immediately above the transmitter panels, will provide ample illumination on the equipment. The general light intensity in the monitoring room will be held to a relatively low value to facilitate video monitoring. Control consoles are being provided for both TV and FM with tower lights and de-icers controlled from either position. Video and audio equipment not contained in the consoles is mounted in standard racks located nearby. The installation of a wiring trough in the floor, which connects all TV and FM units and carries power, video, audio and control circuits, provides a flexible and economical installation.

Planning of television studio facilities must be preceded by some estimate as to the probable program policy of the station.

FIG. 5. *KSD-TV has been using its portable equipment on closed circuit presentations since last October, when it picked up the Veiled Prophet's Parade (above) and reproduced the picture on receivers set up in the Post-Dispatch building.*

In the case of KSD-TV, we believe that a major portion of our live talent programs will originate outside the studio and depend principally on news, special events and sports. Eventually, of course, some sort of syndicated program service must be developed, probably by means of a combination of film and coaxial or radio relay networks. Under such a policy the studio will be used for limited studio productions, commercial shorts, and of course, film. And, too, in the early days at least, some of the programs broadcast by KSD and KSD-FM can be adapted to simultaneous telecasting.

The KSD-TV studio and field equipment has been selected, and the studio constructed, with this policy in mind. All of the television equipment is being manufactured by RCA. The heart of the system is the two-camera chain of TK-30A Image Orthicon cameras. These have been in operation at KSD-TV since October 1 and have been used on numerous demonstrations. Their performance is truly remarkable and has lived up to every expectation. They are to be used for both studio and outside pickups. Figures 5 and 6 show this equipment in operation on the first KSD-TV pickup, the Veiled Prophet's Parade on October 8, 1946.

Any idea that a television pickup is comparable to the present day AM or FM job, should be dismissed immediately. Or, if you "have to be shown," just try ONE! Oldtimers who can remember the remotes of twenty or twenty-five years ago when storage batteries, B batteries, bulky haywire amplifiers, etc., had to be hauled around, may have some idea of what it's like. It will suffice to say here that it takes a lot of equipment to make the average television pickup, and it isn't particularly light. Forget any idea of grabbing a couple of suitcases, a little wire and a taxi. You can't even get all of the equipment into a taxi, to say nothing of the minimum of about four people needed to handle the job. At KSD-TV we had the idea of using a station wagon for television remotes, but one job convinced us that something heavier would be required. So, we have ordered one of the new RCA Mobile Units, exhibited for the first time at the recent NAB Convention. This unit has the added advantage that the equipment can be mounted in the unit in an operating position. Thus, on many remotes it will only be necessary to set up the cameras, hook up to the power and make a connection to the telephone line or relay transmitter. It takes time and space to set up all of the control equipment, and we believe this feature alone makes the unit very worthwhile.

There is also the problem of transmitting the program back to the studio or transmitter. Either telephone lines or radio relay equipment may be used. There still seems to be a quite general impression that ordinary telephone circuits cannot be used; that a coaxial line is required. Actually, we are told that the telephone companies in any of the larger cities are prepared now to furnish a television circuit of anything up to ten miles. At least that is the case in St. Louis. But, it isn't as easy or as cheap as it may

FIG. 6. *KSD-TV's portable equipment set up for the Veiled Prophet's pickup. Mr. Coe, shown here observing the operation, believes that a major portion of KSD-TV's live talent programs will originate outside the studio.*

sound! Specially selected and routed cable pairs must be used. The high equalization required means high transmission loss, which means repeaters at least every mile. But the results are very good, and we certainly intend to use such circuits from locations where programs are available with sufficient frequency to justify the rather high cost.

An example of such a circuit, as has been used at KSD-TV, may be of interest in that it will give some idea of the cost and capabilities of this type of service. This circuit runs from the Municipal Auditorium to the KSD-TV studio. The airline distance is one-half mile, but charges are based on the length of cable run, which is one mile. This circuit is equalized to have a substantially flat characteristic from 50 cycles to 4 megacycles. No difference can be noted between the transmitted and received pictures. The circuit has a loss of 80 db. This is made up by terminal amplifiers at both ends of the circuit, which are supplied by the telephone company. The system requires one-volt input at the remote end and delivers one-volt output at the studio equipment. This lies well within the capabilities of the RCA field equipment, and the output at the studio is sufficient for any purpose desired. We have operated three RCA ten-inch receivers directly from the output of this system with no difficulty.

The charges for this line were $1000 for installation and a monthly rental of $280. After installation, and when not actually in use, the circuit can be maintained on a "stand-by" basis for one-half the normal monthly rental or $140. These are, of course, "first" costs and will undoubtedly be reduced as telecasting develops. Eventually, television stations will probably supply their own terminal amplifiers and equalizers, which should reduce the installation and rental costs materially. Incidentally, these amplifiers are rather bulky, so in planning the control room, space must be allowed for them. At the present time one is required for each incoming video line.

Any television station will find that frequently programs must be originated from locations where, either lines are not available or the cost cannot possibly be justified. For such cases some type of radio relay equipment is a "must." The RCA microwave television relay appears to be ideal for this purpose and is relatively low in cost. A set of this apparatus is on order for KSD-TV to complete our field equipment. This system was described in some detail in the October 1946 issue of BROADCAST NEWS.

As has been stated, the KSD-TV studio is considered to be a "workshop" from which we hope eventually to determine what our requirements of a more permanent nature should be. This theory fitted in admirably with our plans for the eventual remodeling of the first two floors of the Post-Dispatch Building to provide AM, FM and permanent TV facilities. A temporary

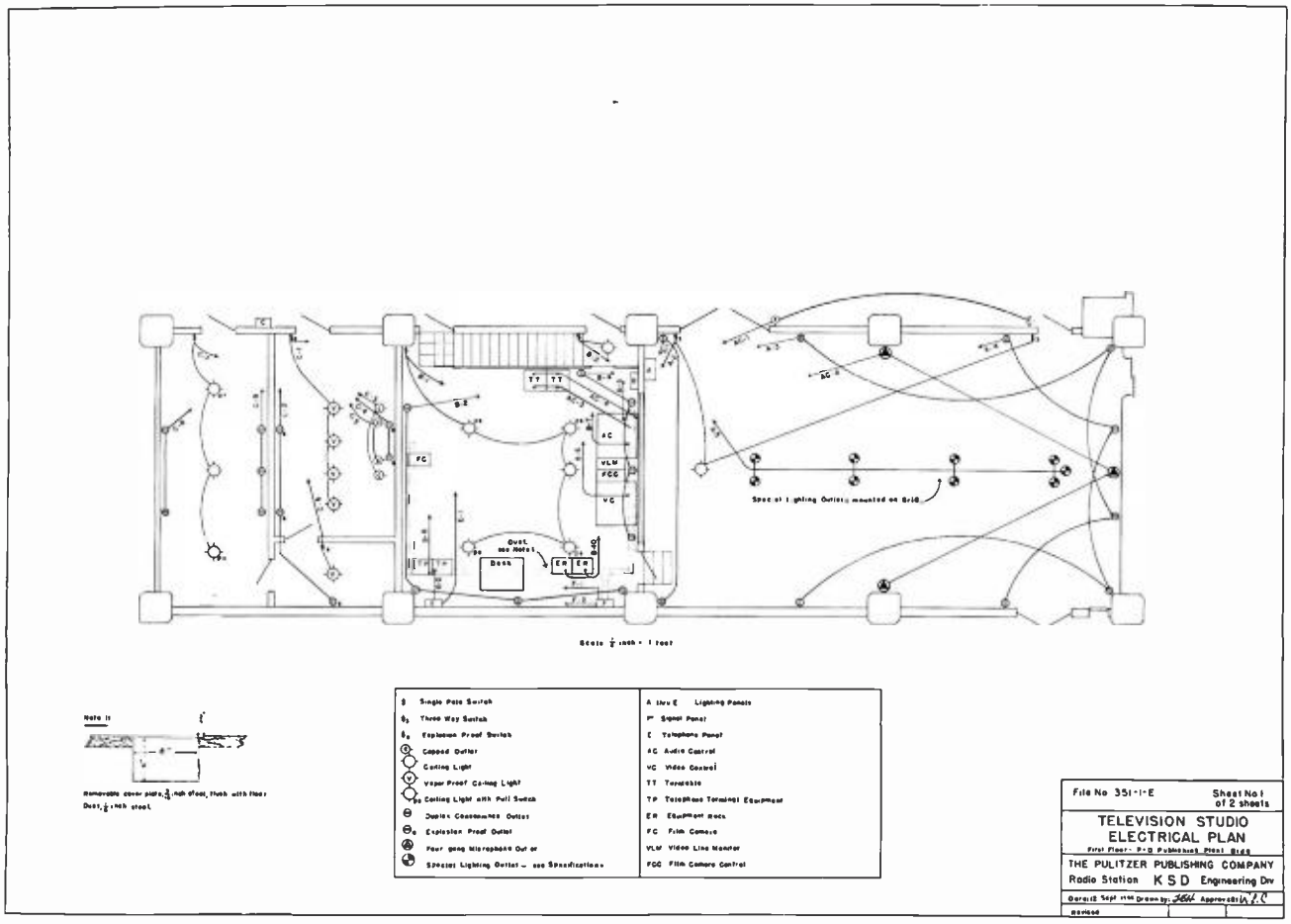


FIG. 7. *Floor layout of KSD-TV's temporary setup showing, left to right, the workshop, telefilm room, control room, and studio proper. Location of main equipment items, outlets, and connections is indicated by symbols which are identified in the legend.*

television studio has been constructed in the annex next door to the main Post-Dispatch building.

Fortunately, there was available space in the annex well suited to the construction of temporary television studio facilities. The ceiling height of 21 feet over most of the area was ideal for studio purposes and permitted the construction of an observation room over the control room. The floor of the latter is raised two feet above the studio floor. Figures 1-4 show in some detail how the space has been utilized.

The studio itself is approximately 25 by 45 feet. The ceiling has been covered with JM "Fibracoustic" and the walls hung with one-inch rock wool blanket. A greater thickness of material on the walls was desired, but was not available; the intention being to insure maximum absorption at all frequencies, with the walls of the program "sets" relied upon to "liven" up the actual sound pickup. No decorative treatment or covering of any kind is used over the wall blankets. These are simply hung from the ceiling line and cut off a short distance above the floor.

The control room, approximately 22 by 22 feet, may at first glance seem rather large. But, here again, much more equipment is involved than is the case in AM or FM, and a minimum of three people must be provided for. Figure 7 shows the layout of this equipment. All controls are located in front of the studio window. From left to right are the 76-B2 Consolette for sound, the master monitor on the video line running to the transmitter, the film camera controls and the TK-30A camera controls and switching unit. The latter are, of course, removed for outside pickups, but the system is designed so that film programs can be telecast without the use of any of the field equipment.

In the control room are also located two RCA 70-C2 transcription turntables, telephone company terminal equipment, and racks for the video equipment not included in the control consoles. Two racks are provided at present, one containing the studio synch generator and power supply, and the other a monoscope unit, distribution amplifier, jack panel power supplies, etc. As in the case of the transmitter, a wire trough in the floor connecting all units, simplifies installation and the inevitable changes and additions. The distribution amplifier is provided primarily to feed monitoring receivers located in the observation room and in the principal offices.

In drawing up the plans for this studio probably more time was spent studying and discussing the various types of lighting than on any other one feature. Studio lighting is, of course, of the utmost importance even where, as in our case, the TK-30A Image Orthicon camera is to be used. As we wanted to avoid the necessity of a special air-conditioning unit and use the existing system, we finally decided on fluorescent fixtures for the main overhead lights supplemented by such incandescent floods and spots as were needed. For the purpose of estimating the fluorescent requirements, 100 foot-candles was established as the

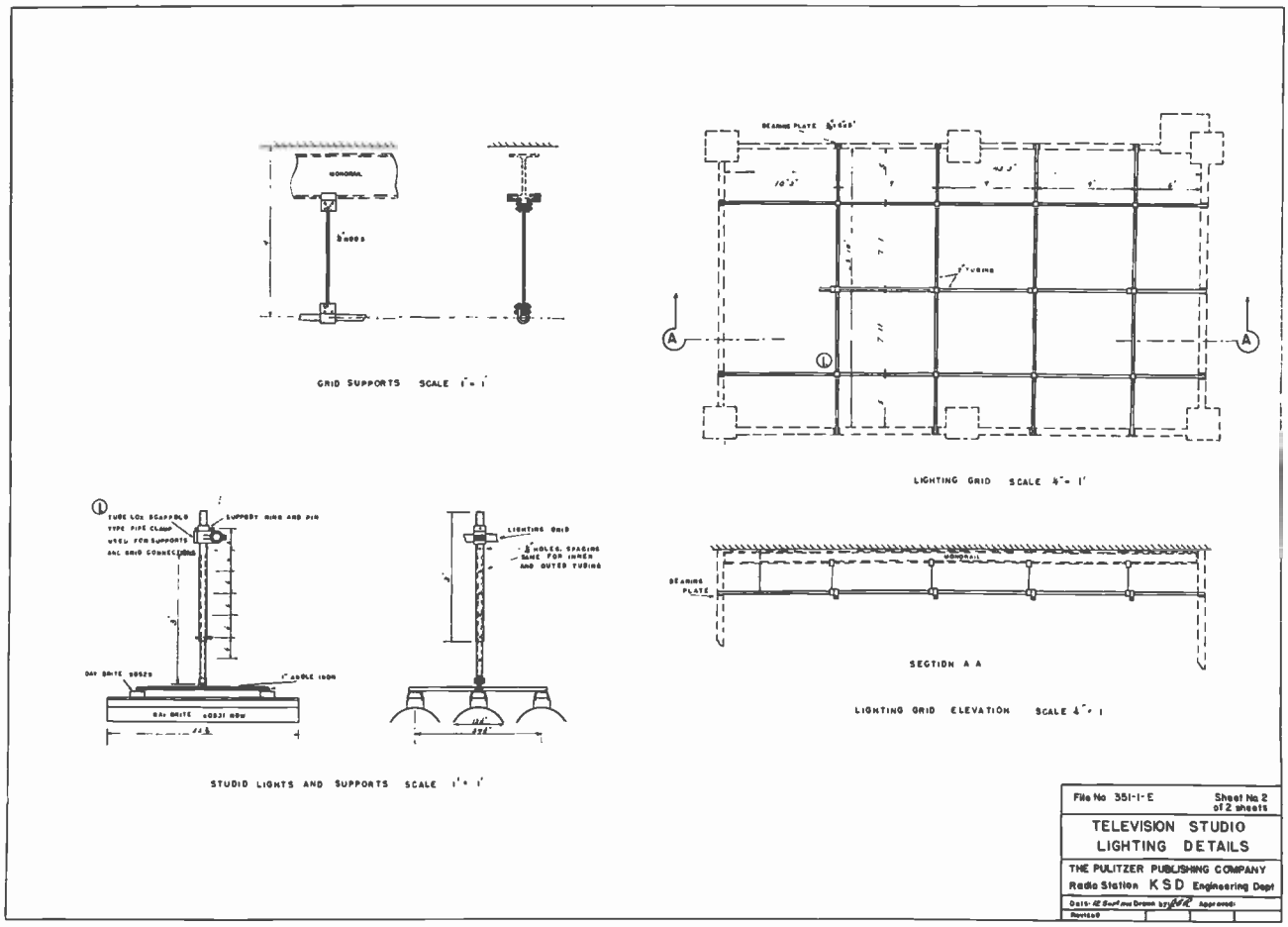


FIG. 8. *Construction details of the overhead light banks and iron-pipe grill which is used to support them. Light banks were assembled from available commercial-type fluorescent fixtures. They can be detached quickly from the grill and moved about as desired.*

desired light intensity at the floor. This figure was the mean of a number of values suggested by various sources.

Figure 8 shows some of the constructional details of the overhead light banks which were assembled from available commercial-type fluorescent fixtures. Each bank consists of three standard fixtures, each of which holds three 40-watt lamps, or a total of 360 watts per bank. A total of seven such banks are provided, and each can be adjusted as to height and tilted and rotated as desired. The banks are not fastened permanently in place, but can be quickly detached and moved to any location on the grid. Switches are provided for each of the units comprising the banks, all being in one main lighting panel located on the studio wall to the right of the control room window. A generous supply of floor outlets has been provided, which are also controlled from the main lighting panel.

Figure 8 also shows the details of the grid, which is made up of 2-inch iron pipe and hung about 4 feet below the studio ceiling. This grid, in addition to serving as a support for the overhead lights, can also be used for supporting back drops, flys and a variety of other purposes that will suggest themselves.

Film certainly is an important source of program material, and we are confident it will become increasingly so. Both 35 and 16 mm projectors are being installed with provision for additional equipment when required. Slide projectors are also provided. These are located next to the control room. Openings in the rear wall of the control room and a track mounted on the wall permit the film camera to be moved in front of the projector in use. A word of warning as to the design and construction of the "telefilm room," which is what we prefer to call the room housing the film projection equipment; most city building codes include very rigid requirements as to the construction of projection booths or blocks. No design should be attempted without first studying carefully local building requirements. And, that is no mean task in itself!

It will be noted that a work shop is provided in the rear of the "telefilm room." This is no afterthought or utilization of leftover space, but is regarded as another "must" along with a rather complete set of test equipment.

Dressing rooms, offices, and storage space must, of course, be provided, but need not be adjacent to the studio. Generally, space can be found nearby which can be used for these purposes. At least, such is the case at KSD-TV.

Finally, let it be emphasized that the foregoing has not been written with any idea that it describes the ultimate in TV station construction, or that it constitutes a pattern for others to follow. It is presented solely as a summary of the KSD-TV plans for the inauguration of telecasting at the earliest possible date. The management of KSD believes that television IS HERE, and that the time for talking is past. What we need now are postwar television stations ON THE AIR.

MILWAUKEE JOURNAL PLANS INSTALLATION OF RCA TELEVISION TRANSMITTER

will also expand FM coverage with a new FM station at Wassau and installation of RCA 50KW FM equipment at WTMJ-FM

by **BEATRICE ANN GEHRUNG**
Publicity Dept., WTMJ, Milwaukee, Wis.

The Milwaukee Journal, in disclosing postwar plans for broadcasting service to the state of Wisconsin both in television and frequency modulation, has announced it is filing applications for a commercial television station in Milwaukee and an FM station in Green Bay.

Long aware of the significance of television The Journal applied for and received a permit for a low-band black and white station before the war. Studio facilities and a tower for television were provided in the new Radio City construction.

With the advent of war, however, The Journal was unable to complete its television station. In view of the fact that color television was so close at hand The Journal decided earlier this year to withdraw its application for a low-band black and white television station, but at the same time it filed application and received permission for experimentation in high-frequency color television.

The Journal since has revised its plans and reapplied for low-band black and white television, at the same time continuing the high-frequency experimentation in order to be ready for color television when it comes.

Chief among the factors which influenced The Journal's reapplication were developments which indicate that black and white television receiving sets will not be made obsolete by color, network advancement in programming, and the stepped-up production of transmission facilities.

The Journal has mapped its future television progress in three steps:

First, the installation of necessary basic equipment which will permit The Journal to get on the air with simple television programming.

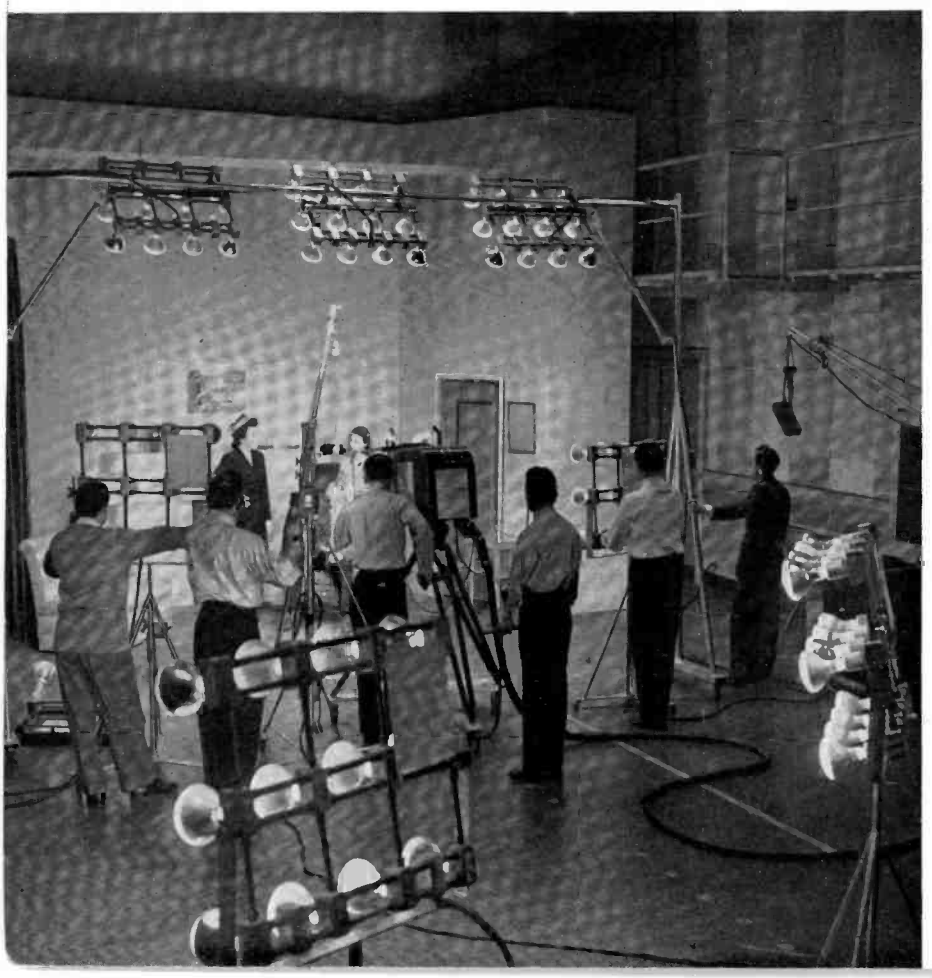
Second, purchase of complete studio camera and control equipment as it becomes available in order to present more elaborate live programs. This step also encompasses the installation of a 500-foot television tower which would replace the 300-foot tower presently just behind Radio City. The 500-foot tower would give The Journal television transmission radius of 34 miles.

The third step proposes remodeling of Radio City for studios and office space incident to a full schedule of television operations.

According to present estimates the first step would be completed by the end of 1947, the second about the middle of 1948 depending on availability of network facilities and equipment, and the third about 1949. The final step is dependent entirely on commercial expansion of television operation.

The Journal also pioneered in frequency modulation, WTMJ-FM in Milwaukee being the first FM station west of the Alleghenies.

September 3 of last year the FCC granted WTMJ-FM the authority to extend its coverage by operating a trans-



LEFT—*WTMJ purchased RCA television field equipment before the war and has used this equipment for experimental and demonstration programming. This is a view of WTMJ's television studio.*

mitter which will cover all of southeastern Wisconsin. This, along with the extended coverage of WTMJ-FM, placed the company in a position to consider its final plans for FM coverage in Wisconsin.

With WTMJ-FM and the new Wausau station, to be known as WMJT, in operation, there still would be no FM coverage in the lower Fox River Valley.

Consequently The Journal is filing application for an FM station in Green Bay, thus also covering northeastern Wisconsin.

Both the Wausau FM station and the proposed Green Bay station would be operated as local stations and they would be programmed independently with the exception of certain programs of interest to the entire state.

RIGHT — *Milwaukee's Radio City houses WTMJ, WTMJ-FM, and a television studio. The studio and a 300-foot tower (see above) form the nucleus for WTMJ-TV.*

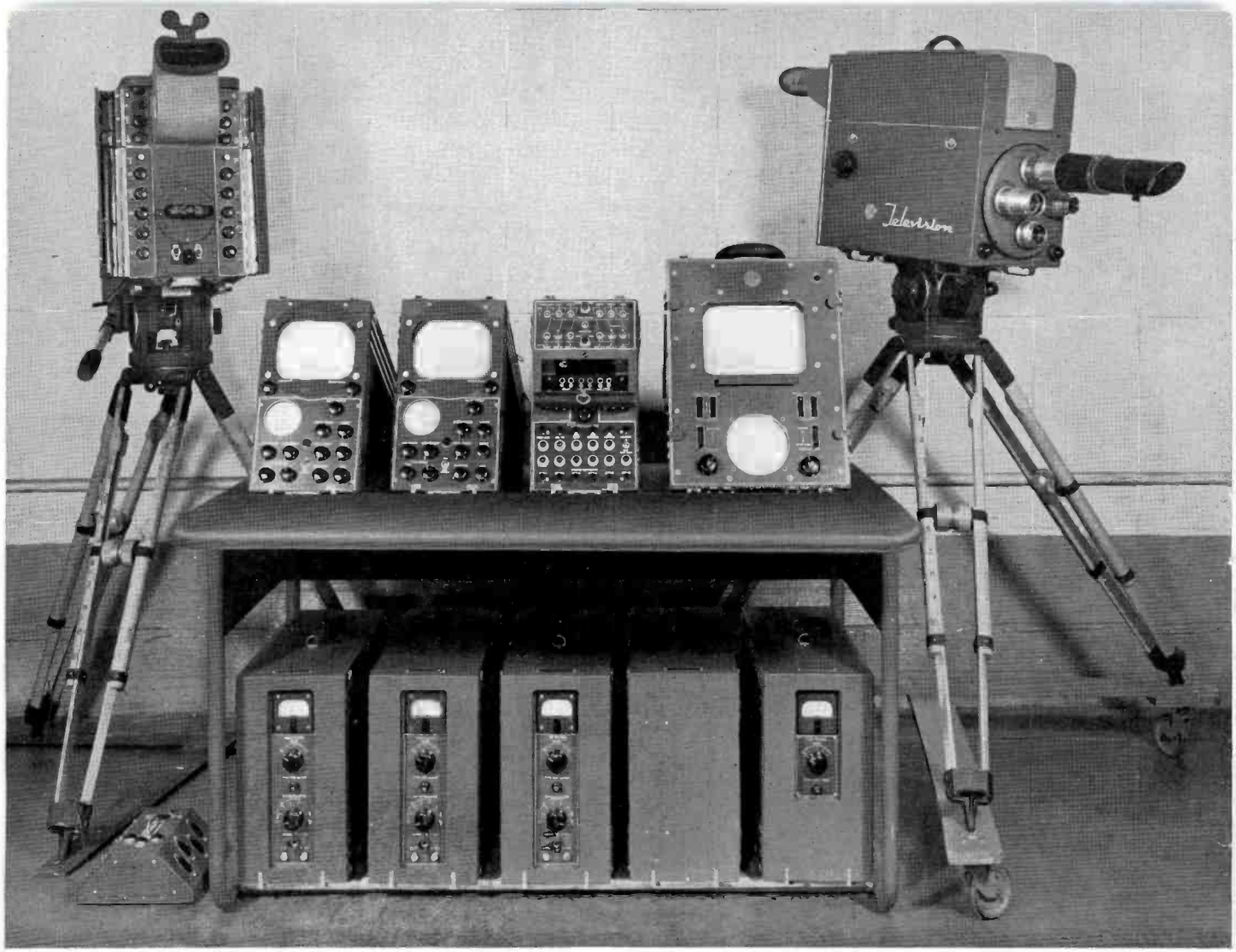


FIG. 1. (Above) *This is a complete two-camera field equipment (less cables) set up on the special field control desk. The two Image Orthicon cameras, with built-in electronic viewfinders, are shown at the left and right of the desk. The camera at the left has the rear control doors open to show position of minor controls used in making initial adjustments. The units on the desk are, left to right, Camera Control No. 1, Camera Control No. 2, Switcher and Master Monitor. Those under the desk are, left to right, Power Supply for Camera No. 1, Power Supply for Camera No. 2, Power Supply for Switcher and Monitor, and the two units containing the Synchronizing Generator. On the floor, at the left of the table, is the junction box for a-c power connections. Not shown are the interconnecting and camera cables, which are also furnished.*

FIG. 2. (Left) *The field equipment as it appears when mounted in the television truck illustrated on the opposite page. The units shown are the same as those identified in Figure 1 (above), with the addition of the two audio units (the well-known OP-6 and OP-7) at the left of the monitor and the microwave relay transmitter control on the shelf above.*

IMAGE ORTHICON FIELD EQUIPMENT

by JOHN H. ROE*
Television Terminal Equipment Section
Engineering Products Department

Field-type television equipment units designed for use with the RCA-developed Image Orthicon Camera (described in the October issue of BROADCAST NEWS) are now in quantity production. These equipment units are intended for portable or field use in picking up programs such as sporting events, parades, outdoor or indoor shows, and other special events in places where permanent television installations are not available. The general arrangement of this equipment is similar to that of the RCA prewar field equipment (which was described in BROADCAST NEWS, No. 39). However, whereas the prewar equipment was designed around the orthicon pickup tube, the design of the new equipment is centered around the RCA 2P23 Image Orthicon camera tube which is so sensitive that it may be used with incident illumination on the scene as low as approximately one foot candle, and which is entirely free of any blocking or "charging-up" effect from flashes of excess light which paralyze other types of orthicons.

The new field equipment includes such important features as a four-position lens turret on each camera, an individual picture monitor permanently associated with each camera, an electronic viewfinder in each camera, instantaneous camera switching without loss of the d-c component, an extra-large "on-the-air" picture

* The equipment described here was designed by the Television Terminal Equipment Section of the Engineering Department. This section, formerly headed by Mr. M. A. Trainer, is now under the direction of Mr. W. J. Poch. Members of this group who contributed to the design of the field equipment include, in addition to Mr. Roe, the following: L. E. Anderson, N. S. Bean, S. L. Bendell, J. M. Brunbaugh, F. E. Cone, B. L. Patton, H. M. Potter, and R. J. Smith.

FIG. 3. (Below) *This television mobile unit, especially developed to transport the field equipment, is now available as a standard equipment item. The rear part, glass enclosed, is designed for convenient mounting of operating units (see illustration on opposite page).*

monitor with means for calibrating signal levels, a complete telephone intercommunication system with self-contained power supply and with means for distribution of the program sound to each operator, accessibility of all operating controls at the central control position, accessibility of tubes, components and circuits for easy servicing, and many other features described in this article.

For easy portability, the equipment has been divided into relatively small units with emphasis placed on keeping the number of major pieces to a minimum, at the same time keeping reliability and flexibility in operation as important features. Wherever possible the major units have the shape and approximate size of a medium-sized suitcase. The camera, viewfinder, and master monitor are the only exceptions. Each unit is provided with one or more carrying handles, as well as covers and shock mounts to protect equipment during transportation. All interconnections are made with cables and plugs which may be connected or disconnected in a few minutes.

A general practice has been followed of making all electrical connections through receptacles mounted on the rear panels of the suitcase units. An exception exists in the case of intercommunication headsets which are plugged into jacks on the front of the field switching system. Whenever possible, multiple conductor cables are used so that the number of cable connections is kept to a minimum consistent with flexibility of the equipment. With few exceptions, the connectors used have single-turn locking rings which prevent accidental disconnecting of the cables.

Careful consideration has been given to conservative design in the selection of high-quality components and in allowing ample reserve in ratings. Attention has also been given to providing rugged construction and secure mountings so that the equipment will stand the wear and tear of daily use over long periods of time.

The field equipment is designed so that it may be set up for temporary operation on a table or desk. A special field control desk (Figure 1) is available if it is desired to make a semipermanent installation of this equipment for studio use. In such a case, the desk and control units comprise a simple operating console. The equipment may also be used in conjunction with a mobile television unit (Figure 3) in which the suitcases may be installed to form a mobile television studio.

The major units which make up a complete field equipment are as follows:

(a) One or More Type TK-30A Field Camera Chains

Each camera chain includes a camera, a camera control, and

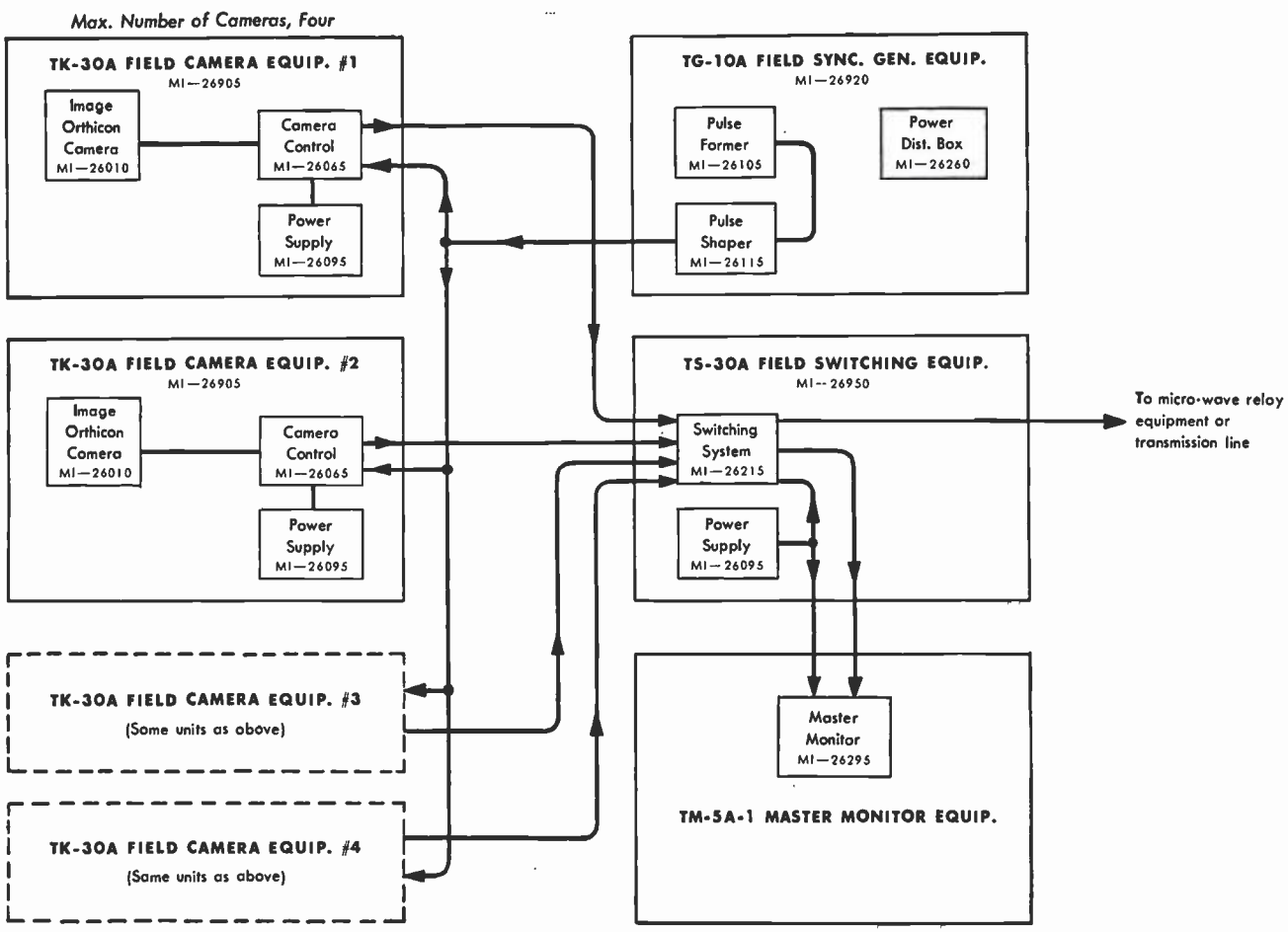


FIG. 4. *Simplified diagram showing arrangement of the units that make up the field equipment and the connections between units. Designed primarily for one to four camera setups the equipment can, if required, be used with six Type TK-30A Camera Equipments.*

a power supply. One such chain is required for each camera used in any setup.

(b) One Type TG-10A Field Synchronizing Generator

This generator (which consists of two separate units, the pulse former and the pulse shaper) furnishes all the timing signals required for operation according to RMA standards. One field generator is required for each setup, regardless of the number of cameras used.

(c) One Type TS-30A Field Switching System

This unit povides video and audio switching of camera outputs and also intercom circuits necessary for best operation. One such unit is required for any multiple-camera setup.

(d) One Optional Type TM-5A Master Monitor

This unit, which contains a 10-inch picture tube and a 5-inch oscilloscope, is used when critical monitoring of output is desirable. In combination with the switching system it provides the field equivalent of the director's console. While use of such a monitor is not a necessity, it is considered good practice in multiple-camera setups.

(e) One MI-26095 Field Power Supply

This electronically regulated power supply furnishes plate power for the signal amplifier in the switching system and for the master monitor (if used). One additional power supply of identical type is supplied as a part of each camera chain. The synchronizing generator has a built-in power supply.

(f) One MI-26260 Power Distribution Box

This is an a-c outlet box which forms a convenient method of connecting the several power cables to the source of a-c power. One is required for each setup whether of single or multiple-camera type.

Various arrangements of the units listed above may be used according to requirements of the event to be picked up. Figure 4 shows some typical setups for two-camera and multiple-camera use. Operation of the individual units is described on following pages.

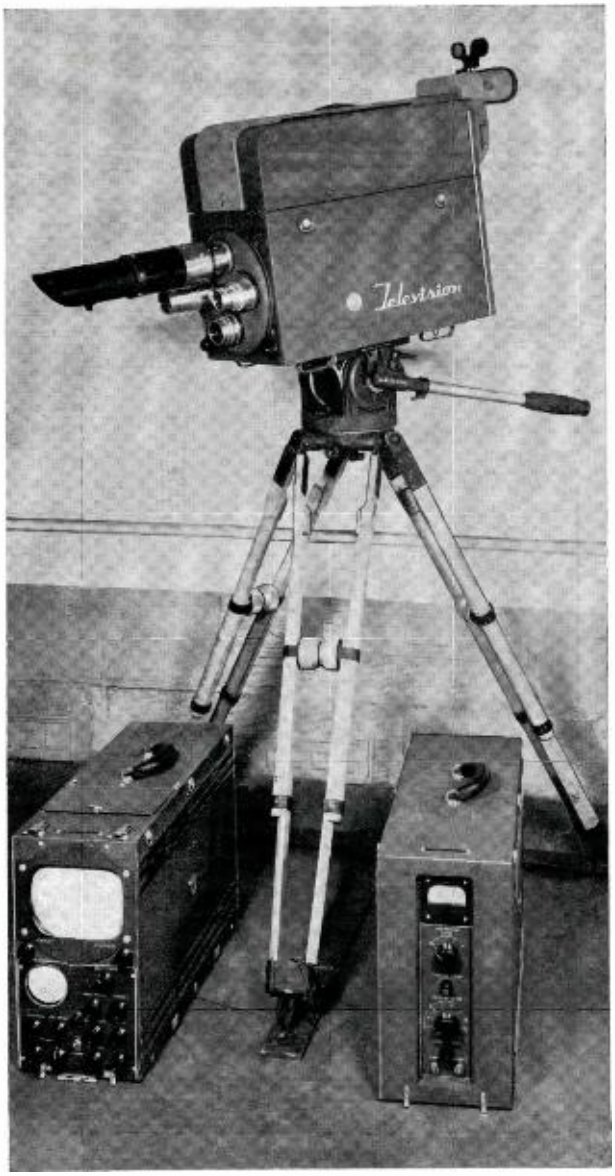


FIG. 5. (Above) *Illustrated here is a complete Type TK-30A Camera Equipment. This grouping, often referred to as a "camera chain," is a complete operating unit in itself (except that it must receive synch signal from an external source). When a three-camera setup is desired the equipment units shown above must be added to the equipment grouping shown in Figure 1. For a four-camera setup, two complete groupings, as shown above, must be added.*

FIG. 6. (Left) *This view of the rear of the camera control unit shows how the power and interconnections are made by means of standard plugs and receptacles. All necessary cables, complete with connectors, are furnished. Power and intercom cables are shielded multiple-conductor cables using synthetic insulation and jackets. Video connections are made by means of flexible coaxial cables of standard types having polythylene cores and vinyl jackets as developed for military use during the war. The camera cable is a special cable containing three 50-ohm coaxials and twenty-one other conductors each of seven strands of #30 gauge copper wire. This cable has an overall shield and a neoprene jacket with an outside diameter of 0.940 inch. It is extremely flexible, small, and light in weight compared with any previous equivalent camera cable. The weight-per-foot is 0.4 lb. It is available in standard lengths of 50, 100 and 200 feet, each fitted with matching connectors.*

TYPE TK-30A CAMERA CHAIN

The TK-30A camera chain includes the units shown in Figure 5—viz., the camera proper, the view finder, the tripod, the camera control, and the power supply. The camera, view finder and tripod have been previously described (see "The TK-30A Image Orthicon Camera," BROADCAST NEWS, No. 43).

The field camera control (Figures 7, 8) provides, in one unit, means for observing and controlling the quality of the picture signal generated in the camera with which it is associated. The unit includes two cathode-ray tubes, which serve as indicators of the picture quality. A 7-inch kinescope (RCA-7CP4) is used as a picture monitor, and a 3-inch oscilloscope (RCA-3KP1) is used as a waveform monitor. The circuits in the unit include a picture signal amplifier driven by the preamplifier in the camera, pulse line amplifiers to feed driving signals to the camera, deflection generators for the kinescope and oscilloscope tubes, a high voltage supply for the accelerating potentials in these tubes, and several controls directly associated with the operating of circuits in the camera.

Two pulse line amplifiers provide for feeding the two driving signals over the coaxial conductors in the camera cable to the deflection and blanking circuits in the camera. This cable may be as much as 1000 feet long. The use of such pulse line amplifiers makes it possible to operate several cameras from a single sync. generator.

Controls are segregated both as to function and frequency of use. Those requiring frequent adjustment, viz.: picture signal gain, blanking amplitude, beam (image orth. bias), orthicon focus, image focus, target, and multiplier focus, are grouped in the lower right hand part of the front panel with the most frequently used controls at the bottom. The four controls associated with the oscilloscope, (focus, brightness, sweep, and range switch) are grouped under the RCA-3KP1 tube.

The brightness and contrast controls for the kinescope are located under the RCA-7CP4. The main power switch for the camera chain is also located on the front panel of the camera control. This switch operates a heavy duty relay located in the field power supply. Controls of secondary importance have been located under a small trap door on the top of the field camera control. These may be reached easily from the operator's position.

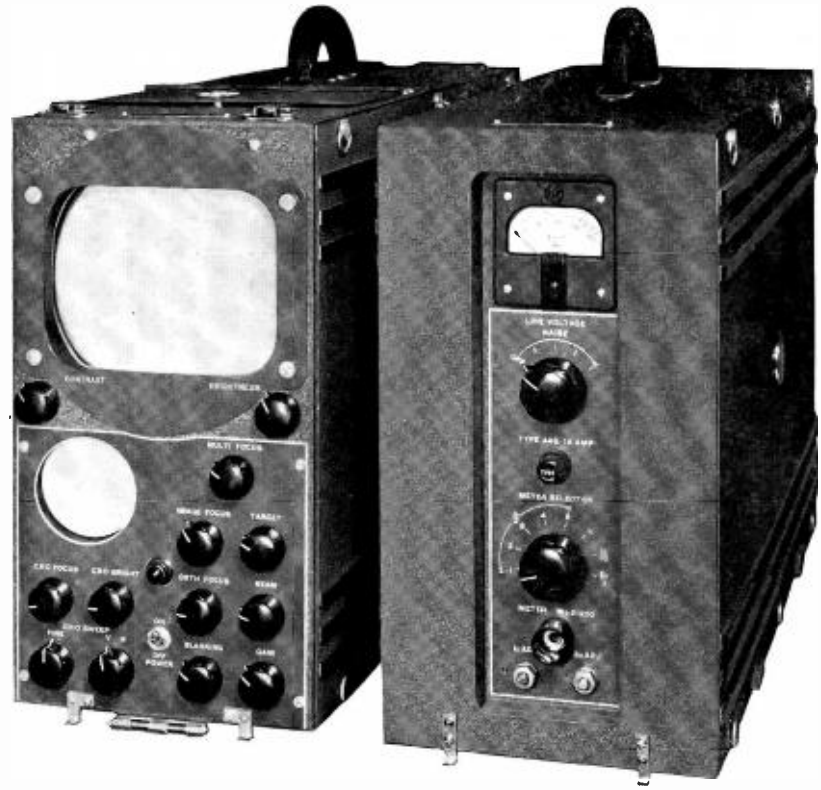


FIG. 7. *Camera control unit (left) and power supply unit which furnishes all voltages for the camera control unit and the camera.*

Side covers are interlocked in such a way that only the high voltage is cut off when the tube side of the unit is opened, and all power is cut off when the wiring or circuit side is opened. Auxiliary links for the interlocks are stored in spring clips so that power may be restored to the unit, at the discretion of the operator, for servicing purposes.

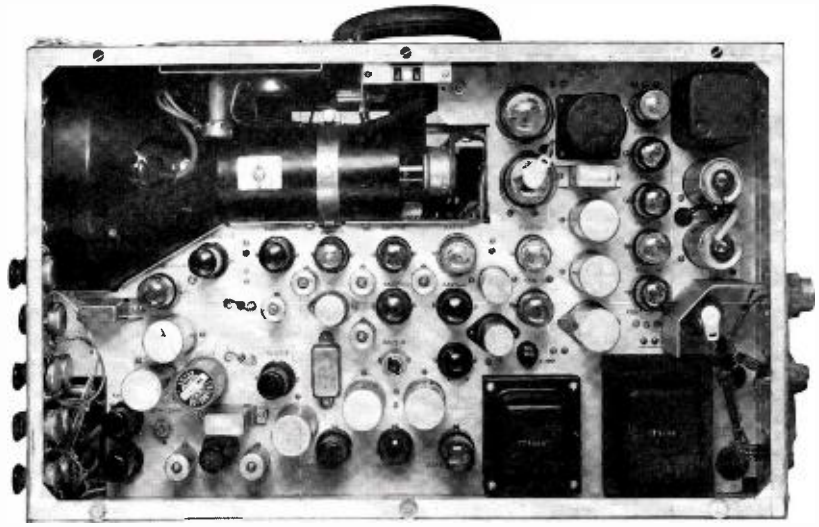


FIG. 8. (Right) *Camera control unit with left side cover removed. All components (except controls, connections, and cathode-ray tubes) are mounted on a vertical chassis. Wiring is on the opposite side of the chassis with all connections easily accessible.*

TYPE TG-10A SYNCHRONIZING GENERATOR

The field synchronizing generator, shown in the illustrations on this page, is the heart of the field pickup equipment. Its function is to provide all the timing information, in the form of electrical pulse signals, required for controlling and synchronizing the scanning processes in both the pickup equipment and the receivers. It generates four separate signals, which are used in various ways to produce the RMA standard television signal. These four signals are those required for a 525-line interlaced system, as recommended by the RMA subcommittee on studio facilities on the drawing entitled, "Recommended Synchronizing Generator Waveforms," and dated January 22, 1946.

The signals are usually designated as follows:

1. synchronizing (or sync.).
2. picture blanking.
3. vertical driving (at field frequency, 60 cycles).
4. horizontal driving (at line frequency, 15750 cycles).

The first two of these signals, sync. and picture blanking, are used directly in composing the final picture signal fed to the output of the system. In other words, they appear as parts of the composite picture signal. The last two signals, horizontal and vertical driving, are used indirectly in the pickup equipment only. Their principal function is to trigger deflection generators in cameras and monitors. They are also used for keying signals in "clamp" circuits and for blanking signals in the camera.

To keep the weight and size per unit within reasonable limits, the field synchronizing generator has been divided into two separate suitcases called respectively the field pulse former and the field pulse shaper, (Figure 9).

One suitcase contains the timing circuits required in the system, including the master oscillator which operates at twice line frequency (31500 cycles), a series of counters for stepping this master frequency down to line frequency (15750 cycles) and to field frequency (60 cycles), and an automatic frequency control circuit for locking the sync. generator to the power supply frequency. A crystal oscillator operating at 94.5 kc. is provided as an alternative means of stabilizing the generator where the power supply system is not stable enough to serve as a reference.

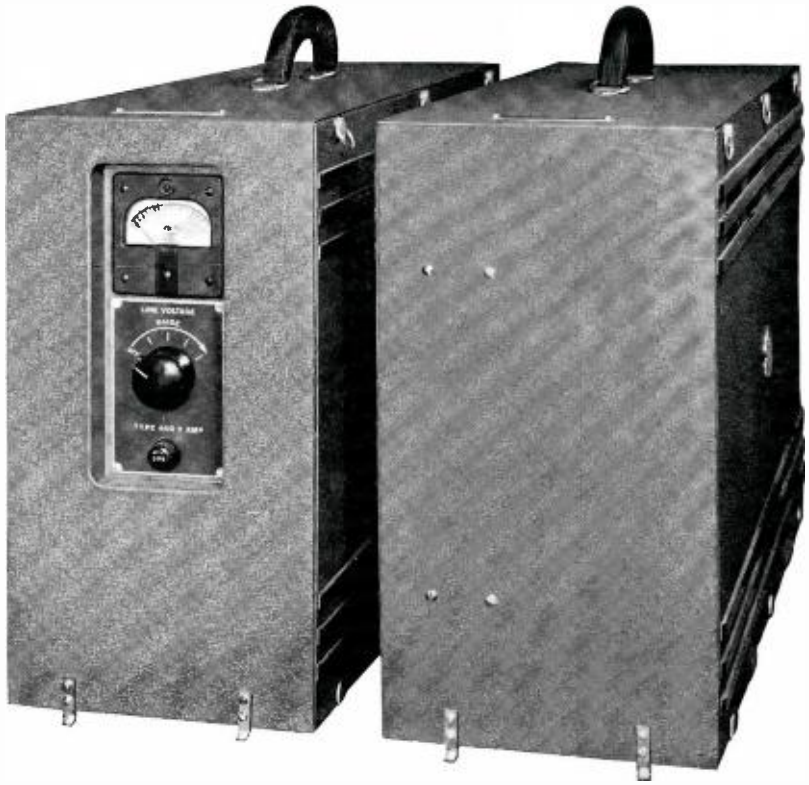


FIG. 9. *The TG-10A Synchronizing Generator consists of the two units shown here. It includes its own built-in, electronically-regulated power supply.*

All circuits necessary for shaping, mixing, and pulse-width control to produce the four generator output signals are included in the other suitcase. Pulse widths are adjusted with screw-driver type controls which may be locked in position.

Two separate cables carry the signals to other units in the system. One multiple cable, consisting of several coaxials, carries the picture blanking, the horizontal and vertical driving signals to the field camera controls. The second is a single coaxial which carries the sync. signal.

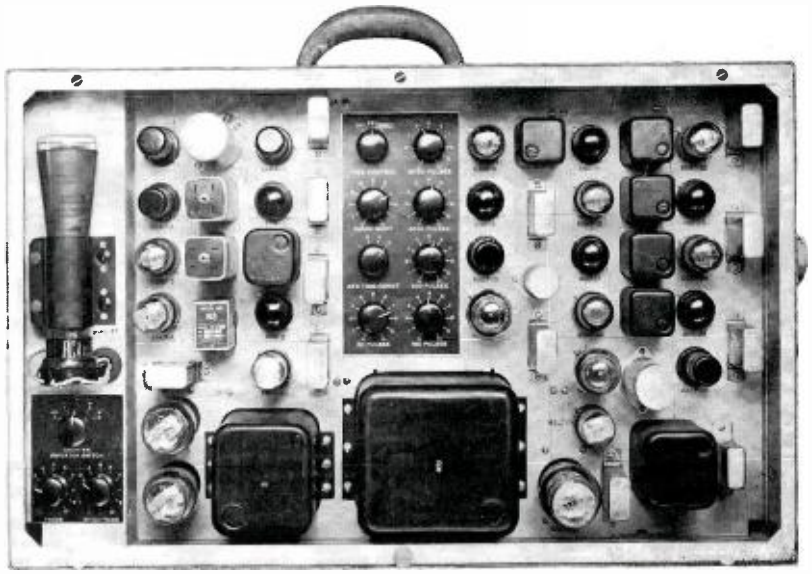


FIG. 10. *The pulse shaper unit (of the Synchronizing Generator) with left side cover removed. The small cathode-ray tube at left is used in making initial circuit adjustments.*

TYPE TS-30A
FIELD SWITCHING SYSTEM

The field switching system, when used in combination with the field master monitor, is the equivalent, in the field equipment, of the director's console in a studio. It provides two major services in a setup involving more than one camera. The first is, of course, a means of switching between cameras and of monitoring the outgoing signal. The second is the provision of an intercommunication center for the telephone system which enables all operating personnel to talk with each other.

The picture signal circuits (Figure 11) provide for switching between four cameras and two incoming auxiliary lines, or in unusual cases, between six cameras. Communication circuits are limited to a maximum of four cameras.

Two sets of push-button switches are provided for picture switching. One set, located at the bottom of the front panel and marked CAMERA SWITCHING, switches the input of a wide band picture amplifier between terminations of the coaxial lines from the cameras and auxiliary inputs. The second set is marked MONITOR SWITCHING and provides for switching the field master monitor among five points in the system as follows: 1. Outgoing picture line. 2. Monitor output of relay transmitter. 3. Incoming auxiliary line five. 4. Incoming auxiliary line six. 5. Spare input to monitor.

Each push button has an associated tally. Camera switching tallies operate in conjunction with tallies in the cameras and camera controls. The switches have multiple contacts which provide for remote operation of tally relays in the other units.

The intercommunication system provides talking circuits between the camera men, the camera control operator, the technical director, the program director, and any assistant production personnel who may be stationed near the cameras. It provides also a circuit for distribution of the program sound to all the operators of the system. Each operator may be provided with a telephone set consisting of a double earphone headband and a microphone. One earphone in each set reproduces the program sound, and the other reproduces the operators' conversation. This arrangement requires a five-wire system, which extends through the cables connecting the various units in the setup.

FIG. 11. *The TS-30A Field Switching Equipment consists of the switcher (left) and a standard power supply unit, which also furnishes all voltages required for operation of a TM-5A Monitor Unit.*

Recessed under the front panel of the field switching system is a jack board with accommodations for six telephone sets. Four of these provide individual circuits to each of four cameras. One provides a circuit for the program director, and the last one provides a talking circuit only (no program sound) to the relay transmitter.

A group of toggle switches on the upper part of the front panel provides means for making several circuit combinations in the intercommunication system.

FIG. 12. *The switching unit with left side cover removed. Intercom switching circuits are mounted in upper part of unit; video switching circuits in lower part.*

TYPE TM-5A MASTER MONITOR

The Type TM-5A Master Monitor (Figure 13) provides a complete monitoring unit adaptable to the supervision of composite picture signals at any stage of transmission, from camera pickup to relay transmitter or line input. It may be used for both kinescope and oscilloscope monitoring of signals from the individual camera control units, from auxiliary lines, or the output of the switching unit.

The unit employs a 10-inch kinescope (with aluminum backing, which makes possible a bright picture) for direct picture monitoring, and a 5-inch oscilloscope for signal component analysis. Input circuits are arranged to permit the same or different picture signals to appear on the kinescope and oscilloscope screens at the same time.

A calibration circuit is included to establish a definite voltage level on the oscilloscope screen for measuring purposes. The horizontal scanning frequency of the oscilloscope tube is automatically half that of the kinescope and results in two cycles of either horizontal or vertical pulses (as may be selected by the operator) appearing on the oscilloscope screen.

The vertical front panel of the monitor is arranged with an opening at the top center, fitted with a rectangular mask, for the 10-inch kinescope to present the picture screen. The screen of the 5-inch oscilloscope is arranged immediately below the kinescope screen in a 5-inch circular opening. The lower section of the panel carries the switches and controls, conveniently grouped.

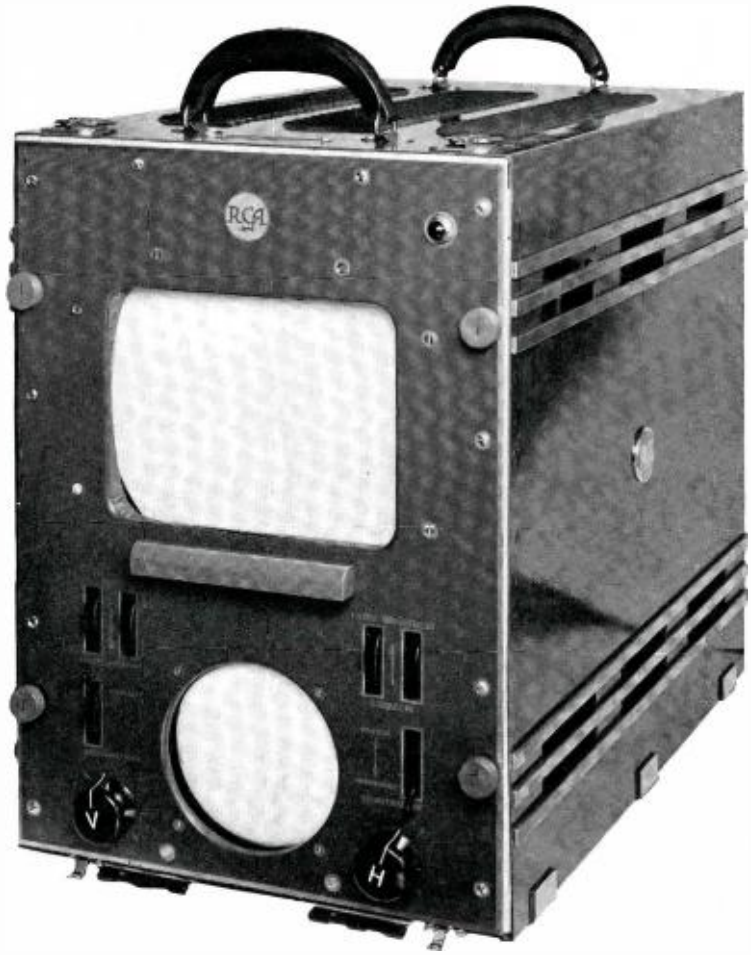


FIG. 13. *The TM-5A Master Monitor mounted in a field carrying case is shown here. This unit, the chassis of which is identical with that of console and rack-type monitors, makes use of a 10-inch kinescope and hence requires a somewhat larger case than the other units. It obtains required operating voltages from the power supply unit used with the TS-30A Switching System.*

MI-26095 FIELD POWER SUPPLY

The MI-26095 Field Power Supply (Figure 14) is a suitcase unit capable of providing all the d.c. required by the circuits in a complete field camera chain. One such unit is supplied as a part of each chain. An additional MI-26095 unit is needed for supplying the combined d.c. requirements of the Field Switching System and the Field Master Monitor.

The output voltage of this power supply is electronically regulated within very close limits. It is capable of delivering 1 ampere at a maximum of 285 volts. The internal impedance of the power supply is less than 0.25 ohm.

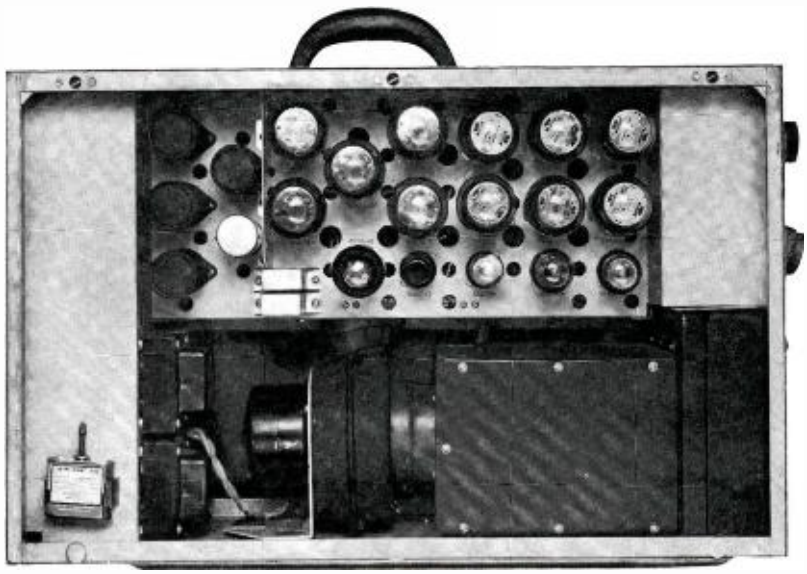


FIG. 14. *This is a side view (with cover removed) of the MI-26095 Power Supply. This is a standard unit used in both camera and switching systems.*

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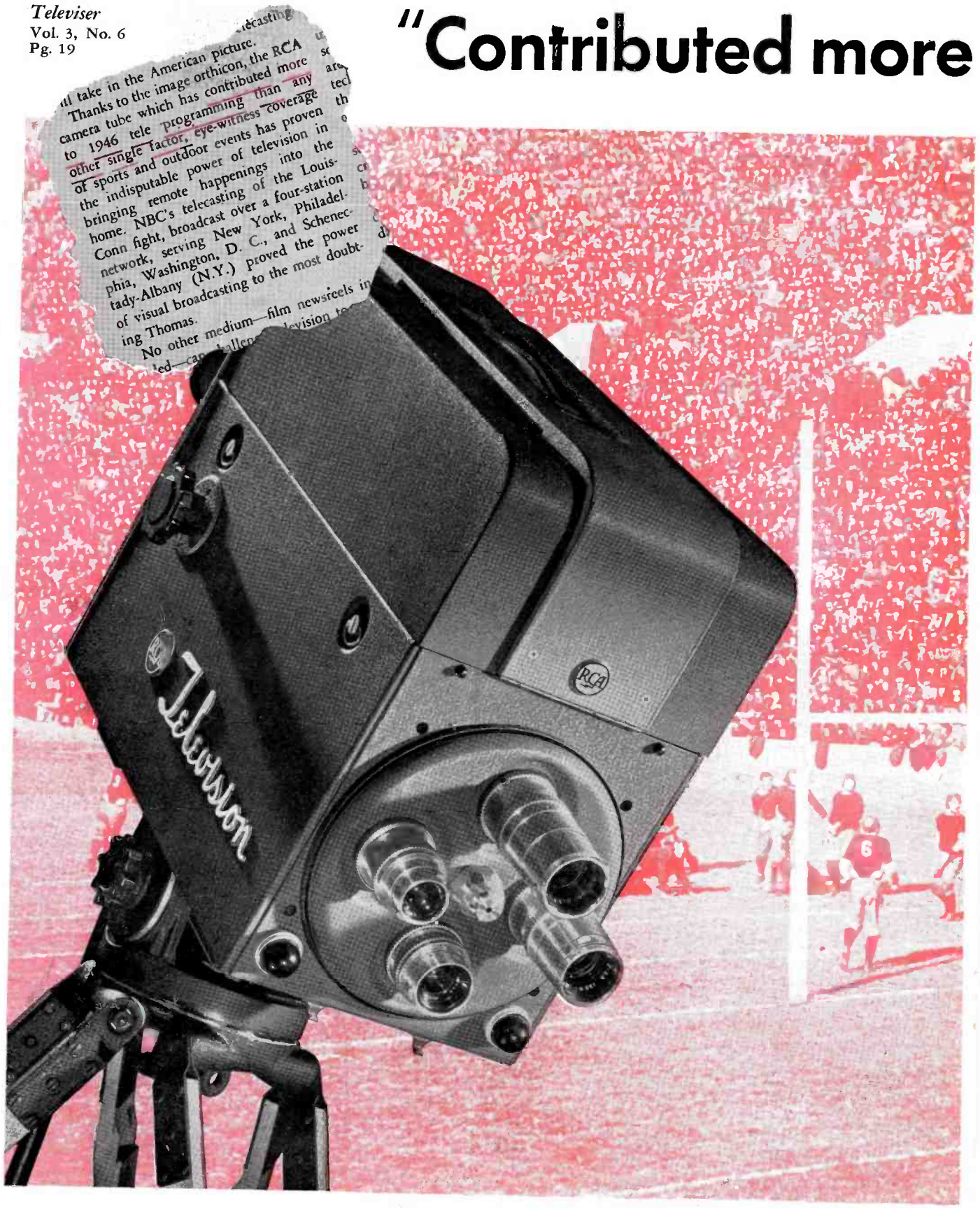
"Contributed more



THE RCA IMAGE-ORTHICON TELEVISION CAMERA

to 1946 tele programming than any other single factor"

56 RCA Image-Orthicon Cameras now being used for eye-witness news coverage

This is the camera that has been making television history. Pick-ups such as the Louis-Conn fight, UN meetings, and the Army-Navy game dramatically demonstrated its ability to deliver brighter, clearer, steadier television pictures. Rivaling the human eye in sensitivity, it assured, for the first time, excellent shadow detail and depth of focus. Lighting problems were minimized. Programming costs were cut.

Telecasters across the country agree that RCA's image-orthicon camera is easy to use. The operator sees, on a fluorescent viewfinder, exactly what he is picking up. He can quickly and accurately pan to new pick-up points with a polaroid gun sight. Switching to a new lens position and refocusing can be done in one-and-a-half seconds! The 50mm, 90mm, 135mm, and telephoto lenses cover all field requirements.

The operator is free at all times to follow the action . . . keep the scene in focus. *Initial* settings are made on a built-in control panel. Any adjustments required during operation are made at a remote monitoring position.

The camera without tripod weighs only 100 pounds—divides into two units for easy carrying. Although designed especially for field use, excellent results can also be obtained in the studio. The only camera connection needed is a one-inch-diameter, plug-in cable to the control equipment. Camera can be as much as 1000 feet from the control position. RCA image-orthicon cameras—plus easy-to-set-up, portable field equipment to go with them—are now in quantity production. An immediate order will assure early delivery. Write Dept. 18-D.

RCA

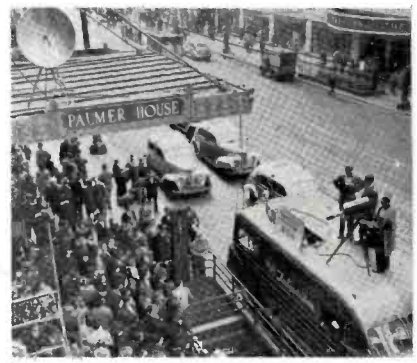
TELEVISION BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

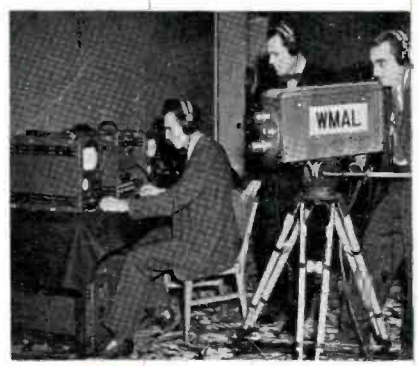
In Canada: RCA VICTOR Company Limited, Montreal

WPTZ—The RCA image-orthicon camera picks up a Penn football game from the announcer's booth at Franklin Field, Philadelphia.



WGN—The camera, mounted atop RCA's new "television studio on wheels," picks up a few "off-the-cuff" sidelights at the NAB Convention.

WNBT—Two RCA image-orthicon cameras, operated from a specially erected television platform, help bring the Navy-Duke football game to televiewers in the New York area.



WMAL, Washington, D. C., picks up an indoor event with its new image-orthicon camera. Monitoring is done at the easy-to-carry, suitcase-type control units.

KSD-TV, St. Louis' new television station, makes its first remote pick-up—the Veiled Prophets' Parade, October 8, 1946.

WBKB telecasts a Northwestern football game from the Southwest Tower of Dyche Stadium. Portable field equipment is shown at right.

112307

IT'S NEW!

ANOTHER COMPLETE AIRCRAFT RADIO SYSTEM by RCA...

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AVR-22 AIRCRAFT RECEIVER
Less than half ATR size! Weighs only 21 lbs. complete. Designed to operate with Model AVA-62 loop antenna for aural direction finding.

AVT-49 AIRCRAFT TRANSMITTER
High-power output, per pound, per channel. Four pre-set frequencies. Weighs only 42 lbs. installed. Full 50-watt output.

AVR-21 AUTOMATIC DIRECTION FINDER
One-half the size, two-thirds the weight of similar equipment. You can have dual ADF operation for nearly the weight and size of existing single installations.

AVT-49

AVR-21

Here it is! A complete radio communication and navigation system for use on scheduled or non-scheduled aircraft—from executive aircraft to transoceanic freighters.

RCA has designed and developed this new radio equipment to combine lightweight, smaller sizes, attractive styling, with high-power output, wide-range operation and low maintenance cost. This entire new family of RCA Aviation Equipment meets every requirement for CAA Type Certification.

Each unit of the equipment is engineered, styled, and manufactured as part of a complete, integrated aircraft radio system. Basic units, however, are self-contained and may be installed separately for independent operation.

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