

**FMA**  
AUGUST 1946

# AND TELEVISION

WIDE - BAND  
RELAY TUBE



Emergency Station Directory, Part 2

★ ★ Edited by Milton B. Sleeper ★ ★



# Here's why **MYCALEX 410**

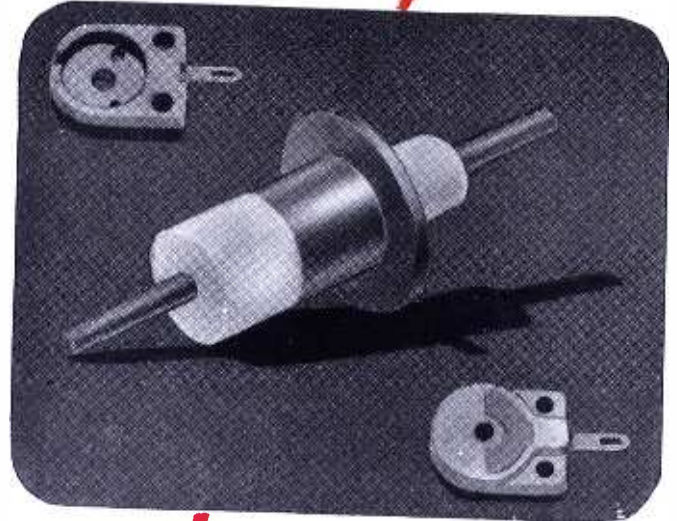
## is the "Last Word" in low loss insulation

For more than 27 years MYCALEX has consistently demonstrated its superiority as an insulating material — supplanting one old-fashioned material after another as electronic advancements have made insulating needs more exacting.

MYCALEX excels wherever high dielectric strength and extremely low loss factor are important . . . where resistance to arcing and high temperature is desired . . . where imperviousness to oil and water must be virtually 100%.

Latest and greatest of MYCALEX advancement is MYCALEX 410 (Molded Mycalex). This highly perfected insulation, together with our exclusive injection-molding techniques, now makes available a wide variety of unusual or intricate shapes . . . especially with metal inserts or electrodes molded in to form a perfect bond or hermetic seal.

Our engineers invite your inquiries on all insulating problems.



### SOME PROPERTIES OF MYCALEX 410

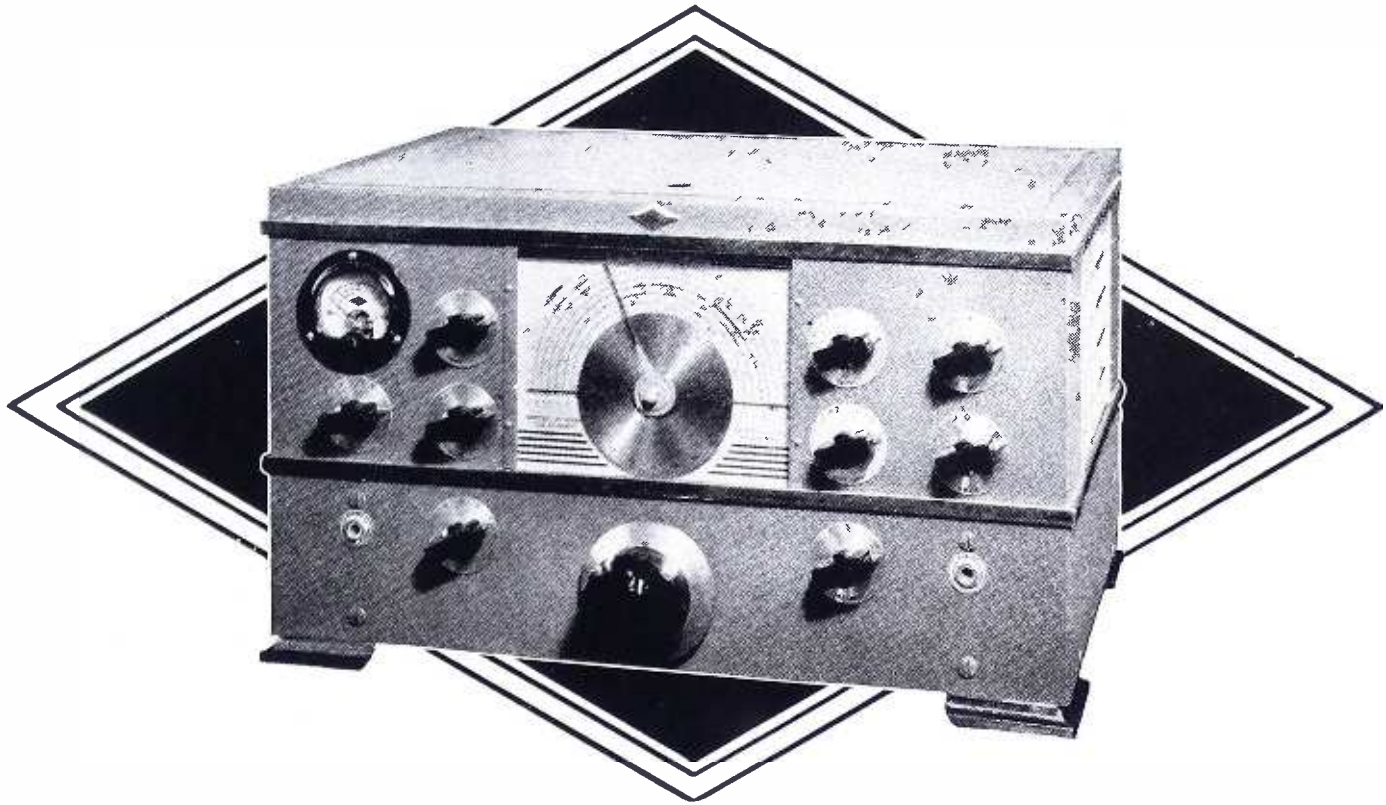
<i>Electrical Properties</i>	
Power factor, 1 megacycle, dry . . . . .	0.0015
Dielectric constant, 1 megacycle . . . . .	8.3
Volume resistivity, ohm-cm . . . . .	$6.0 \times 10^{17}$
Arc resistance, ASTM seconds . . . . .	250
Dielectric strength, volts/mil. . . . .	400
<i>Mechanical Properties</i>	
Flexural strength, psi . . . . .	13,000
Tensile strength, psi . . . . .	6,000
Compressive strength, psi . . . . .	20,000
Hardness, Brinell . . . . .	150
Modulus of elasticity, psi . . . . .	$8 \times 10^6$
Maximum safe operating temperature, °C . . . . .	400
Density, lb./cu. in. . . . .	0.136
Specific gravity . . . . .	3.8

**MYCALEX CORPORATION OF AMERICA**

"Owners of 'MYCALEX' Patents"

Plant and General Offices CLIFTON, N. J.

Executive Offices, 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.



## THE NC-2-40C RECEIVER

Back of the superb NC-2-40C receiver stand National's twenty-five years of experience in building to the highest quality. In the NC-2-40C as in other products, National has excellence for sale. Stability and sensitivity are outstanding. Controls are convenient to the hand and smooth in operation. All important auxiliary circuits—wide range crystal filter, noise limiter, S-meter, beat oscillator, AVC—are present in advanced design. You will find the operation of the NC-2-40C a gratifying pleasure and its ownership a source of pride. See it at your dealer's.

**NATIONAL COMPANY, INC.**



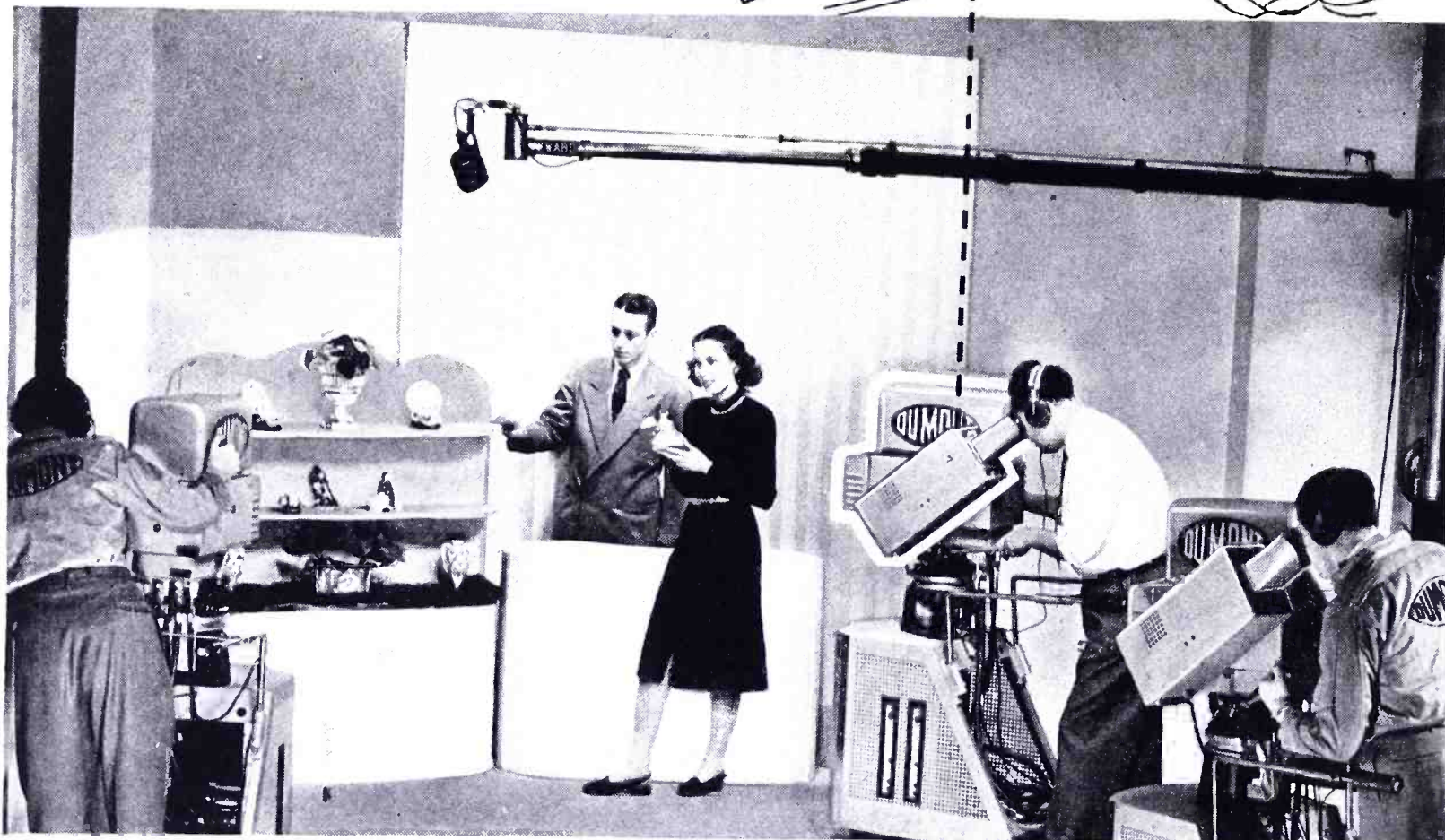
**MALDEN, MASSACHUSETTS**





# IN TELEVISION PROGRAMMING

... It's the Du Mont  
Electronic Viewfinder



Cameramen see the "televised picture" in the Du Mont Electronic Viewfinder exactly as it goes on the air. This advantage, important at any time, is vital to good "pickup" under low lighting conditions which have been opened to television programming by the Image Orthicon.

With the Electronic Viewfinder, an exclusive feature of all Du Mont Television Cameras, the operator can meet changing conditions instantly, countering excessive light, focusing continuously, centering and framing his pictures independently of a mechanically controlled optical system. With it he can obtain the iris control needed for field pickups

of high quality. And no adjustment is required for use with the telephoto lens.

Du Mont's Electronic Viewfinder, and scores of other Du Mont "firsts," are the fruit of 15 years of building precision electronic instruments, television and radar... of building more television stations than any other company... of Du Mont's 5-year operation of its own television broadcasting stations, including the world's largest and most completely equipped studios. We want to tell you more about Du Mont's Electronic Viewfinder... about all of Du Mont's television broadcasting equipment. Write for literature *today*.



ALLEN B. DU MONT LABORATORIES, INC. • GENERAL TELEVISION SALES OFFICES AND STATION WABD, 515 MADISON AVE., N. Y. 22, N. Y.  
DU MONT'S JOHN WANAMAKER TELEVISION STUDIOS, WANAMAKER PLACE, NEW YORK 3, N. Y. • HOME OFFICES AND PLANTS, PASSAIC, N. J.

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# AND TELEVISION

FORMERLY: FM MAGAZINE and FM RADIO-ELECTRONICS

VOL. 6

AUGUST, 1946

NO. 8

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★ ★ ★ ★ ★

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final manuscripts.



### THIS MONTH'S COVER

The only limit on the expansion of radio service is in thinking of new things to attempt. Ask for it, and someone comes up with the answer. Latest example is this month's cover, with a picture of Dr. J. R. Pierce, of Bell Telephone Laboratories, holding a new tube for use in broad-band micro-wave relay systems.

Developed by Dr. Pierce in collaboration with Dr. L. M. Field and F. H. Best, the conservative rating of this tube is 10,000 times power gain, over an 800-mc. band. This compares to a standard pentode with a gain of 10 over a 20-mc. band. Theoretically, the new tube can handle 10,000 telephone conversations on a single relay circuit.

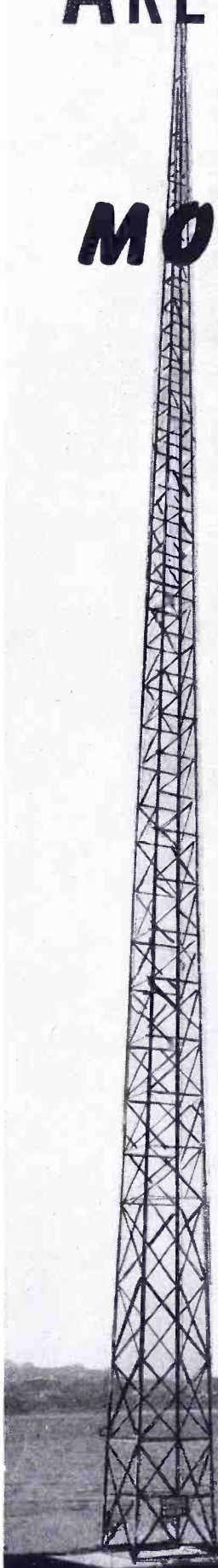
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MEMBER,  
AUDIT  
BUREAU OF  
CIRCULATIONS



# ARE YOU PLANNING TO GIVE MORE LISTENERS BETTER RECEPTION?



If you're planning to add load to your output, you can take a load off your shoulders by turning your antenna problem over to Blaw-Knox.

Unequaled experience in this field—backed by thousands of successful installations ranging in size up to 1000 feet—means that you can rely on Blaw-Knox for full responsibility in the fabrication of FM and Television Towers.

**BLAW-KNOX DIVISION**  
of Blaw-Knox Company  
2046 FARMERS BANK BUILDING  
PITTSBURGH, PENNSYLVANIA

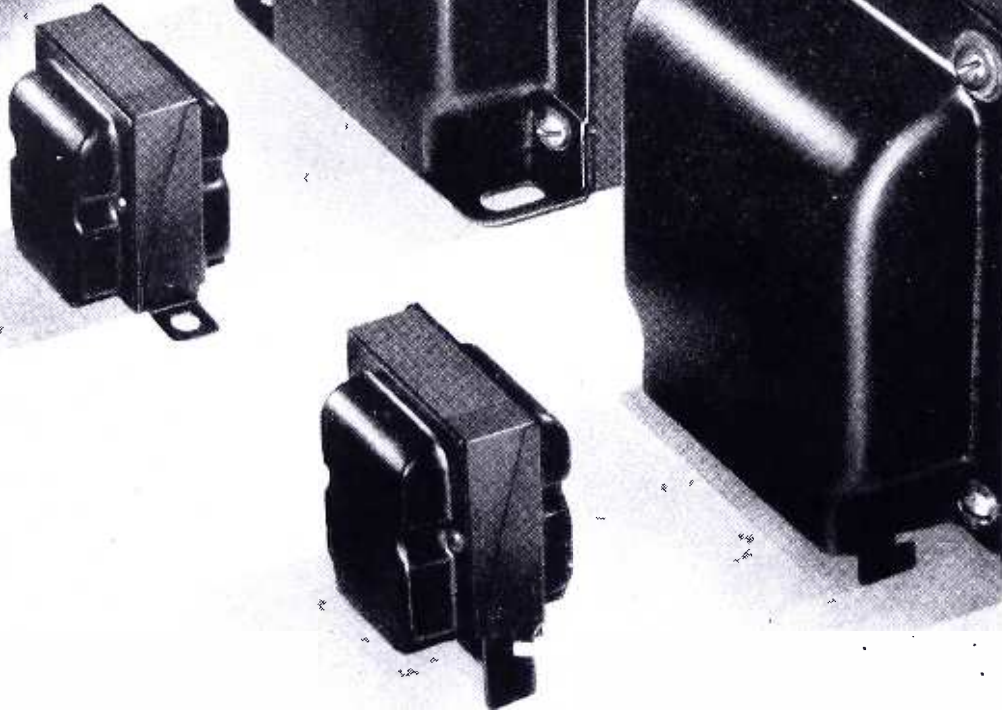
# BLAW-KNOX

## VERTICAL RADIATORS

### FM and TELEVISION TOWERS



The  
SMALL  
like the  
LARGE....



## in *Vertical* FULLY MOUNTED TRANSFORMERS

**F**IVE newly-developed vertical shields, accommodating core stacks with  $\frac{1}{2}$ " to  $\frac{7}{8}$ " center legs, now make it possible for Chicago Transformer to fully-mount both small and large transformers with uniformity.

Now, in radio chassis and similar applications, both small and large units can be vertically-mounted with standardized assembly techniques—with uniform appearance in the finished product.

Adaptable to many variations, Chicago Transformer's complete line of vertical shields allows for either screw or twist-lug mountings and for lead exits through either sides or bottoms of the shields.

# CHICAGO TRANSFORMER



DIVISION OF ESSEX WIRE CORPORATION

3501 WEST ADDISON STREET

CHICAGO, 18



TRADE MARK REG.

## WHAT'S NEW THIS MONTH

1. BEHIND THE SCENES

2. NO BLUFFING ALLOWED

**1.** According to our good friend T. R. Kennedy, Jr., of *The New York Times*, FM broadcasting has reached an impasse, and "listening audiences of a majority of the stations here have dropped perilously near the vanishing point. The same must be true in other parts of the Country."

Tom Kennedy is an old-timer in radio, and is generally pretty well informed. But in this case we do not hesitate to take issue with him.

We are reminded that not long ago, in 1942, to be exact, we were losing the war, according to the New York newspapers. Many people were convinced that it was so, for the papers presented irrefutable evidence in pictures of ships sunk off the Atlantic coast within sight of the shore.

As if that was not enough to dismay those who still hoped the newspapers were wrong, an ordinance was passed requiring all windows above the lower floors to be blacked out at night because German subs aimed their torpedoes by watching ships as they passed lights showing in New York's tall buildings. So that proved we were losing the war. Or did it?

No, it only proved we had a late start, and that we had an enormous but not impossible task to catch up with the Germans. But at that time, it must have given the Germans quite a lift to hear about U. S. camps where indignant draftees were forced to train with sticks instead of guns.

Tom Kennedy's FM impasse closely parallels conditions in the dark and early days of the war. Then, there weren't enough ships. Now, there aren't enough transmitters. Four years ago, there were too few rifles. Likewise, in the few months since the ban on producing home radios was lifted, the number of FM sets totals only a drop in the bucket of public demand.

Looking back to 1938, we can see how the lack of realistic thinking delayed the start of our military preparations. Of course, we won in the end, for the whole Axis plan was unsound, and the performance of their military machine could not equal ours.

The FM situation was slightly different. Transmitters and receivers were already developed when VJ-Day came, and could have been revised quickly to cover

(CONTINUED ON PAGE 37)



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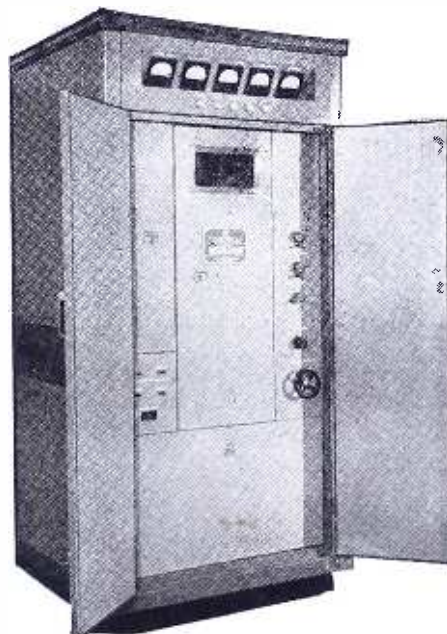
# AND NOW—11 NEW **REL** 1 KW FM TRANSMITTERS IN OPERATION!

**The first  
ten:**

W2XMN (WFMN)—Alpine, N. J.  
W3XO—Washington, D. C. (WINX)  
WDRC-FM—Hartford, Conn.  
WTIC-FM—Hartford, Conn.  
WENA—Detroit, Mich.  
WNBF-FM—Binghamton, N. Y.  
WGTR—Paxton, Mass.  
WMIT—Winston Salem, N. C.  
WIL-FM—St. Louis, Missouri  
WRCM—New Orleans, La.

**No. 11—**

To WRAL, owned and operated by the Capitol Broadcasting Company. First FM station in Raleigh, N. C. On the air August 7, 1946.



REL is now delivering FM Broadcast Equipment including Transmitters, FM Monitors, Speech Consoles, and a compact turnstile Antenna with Power Gain of 2. Consult us if you have any problems with delivery of your new FM Broadcast Equipment.

PIONEER MANUFACTURERS OF FM TRANSMITTERS EMPLOYING ARMSTRONG PHASE-SHIFT MODULATION

**RADIO ENGINEERING LABS., INC.**  
*Long Island City, N.Y.*



# YOU CAN NOW GET THESE DAILY ESSENTIALS



(32-JPI)

## INSTRUMENT & TESTER SWITCHES

12-14 and 20 position. Shorting; non-shorting 1-6 decks.

## OPERATING TEMPERATURE TESTERS

Automatically compensated, typical range for ovens, 0-650°F.

## 400 CYCLE PORTABLES

Accuracy to  $\pm 0.3\%$ ; pocket size metal case; other ranges.

## VACUUM-TUBE FREQUENCY METERS

Accuracy,  $\pm 0.25\%$ ; six specific bands, to 3600 cps. No drift.

## MOST COMPACT FREQUENCY METERS

Matches standard 2½" panel instruments. 60, 120 cps.

## ELAPSED TIME—FREQUENCY METERS

¾" mounting; encourages periodic servicing and tube-life checking.

## MULTIPLE RANGE PORTABLES

Standard—4 frequency groups at 3 voltages. Many special order variations.

## POTENTIOMETER-PYROMETERS

Measures and follows temperatures continuously after initial balancing.



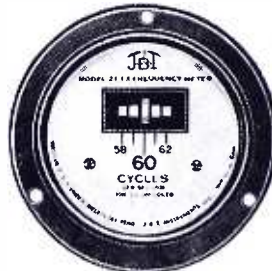
(70-PO)



(SS-14-2)



(33-FP9-400 cy.)



(21-FX-60 cy.)



(60-FP)

... many of these, and others from the J-B-T line, are now stocked by leading jobbers.

## J-B-T INSTRUMENTS, INC.

473 CHAPEL STREET • NEW HAVEN 8, CONNECTICUT

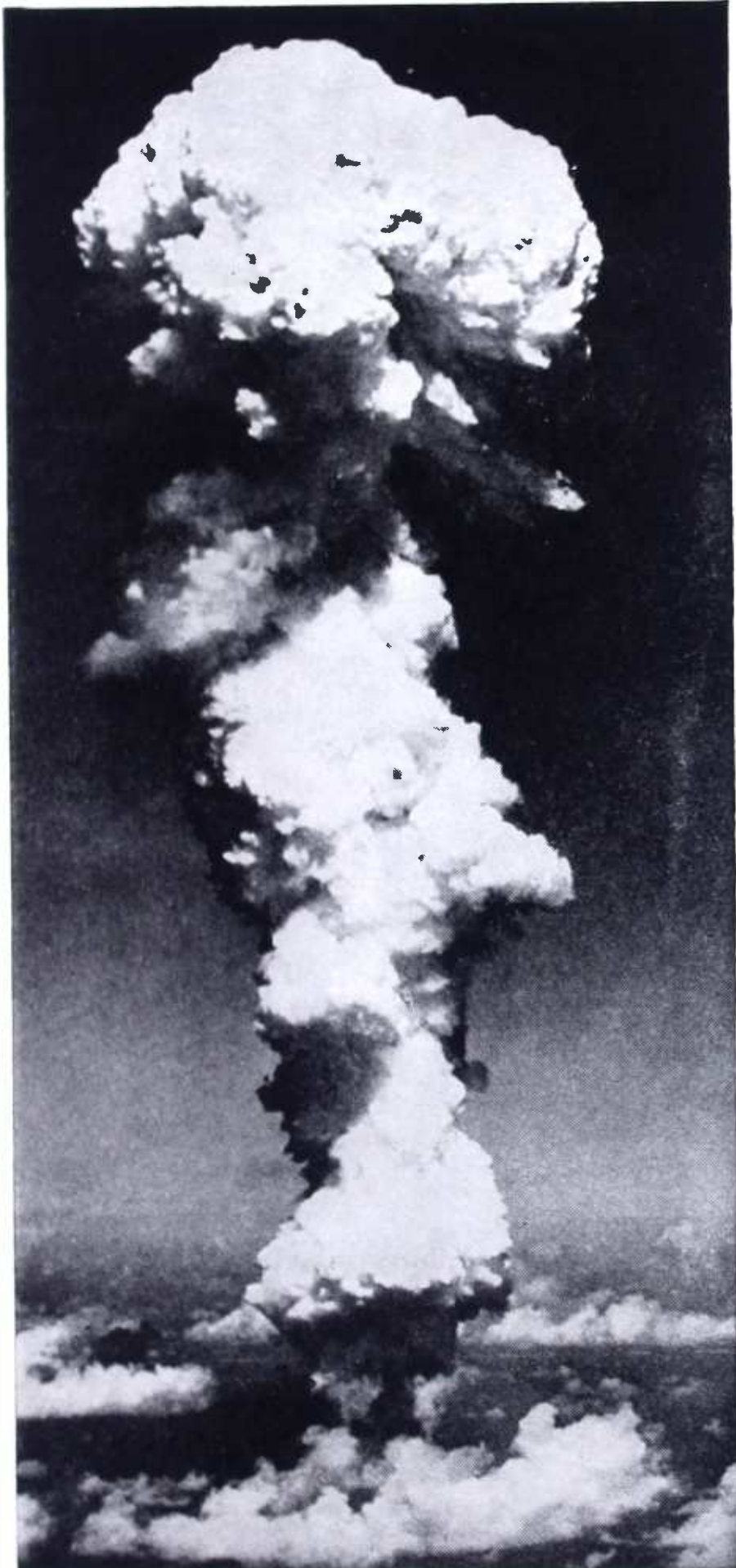
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# PRESTO made the on-the-spot recordings at Bikini



ACME PHOTO

August 1946 — formerly FM, and FM RADIO-ELECTRONICS

WHEN THE special events men of KSFO and the Universal Broadcasting Co. of San Francisco went to Bikini to record an on-the-spot word picture of the preparation for the atom bomb test, they selected PRESTO recording equipment to do the job.

This PRESTO equipment recorded the interviews with the natives of Bikini in their new home on the island of Rongerik. It recorded the on-the-spot report of an air trip over Bikini in an Army plane open to the winds and weather at 10,000 feet altitude.

This PRESTO equipment traveled to Kwajalein where the B-29 that dropped the bomb was being readied for the flight...it went from target ship to target ship in Bikini Lagoon...and it made a practice run in a pilotless plane at Eniwetok.

In hot, damp, salt air that rusted metal parts overnight if they were not protected, through surf so rough only rubber lifeboats could live in it, and in the scorching heat of these South Sea atolls, PRESTO equipment of standard design recorded this once-in-a-lifetime story for listeners of a hundred American radio stations to hear.

Thus, the atom bomb test was also a rigorous test of PRESTO equipment. And PRESTO passed that test with flying colors!



RECORDING CORPORATION  
242 West 55th Street, New York 19, N. Y.  
WALTER P. DOWNS, LTD., in Canada

WORLD'S LARGEST MANUFACTURER OF INSTANTANEOUS  
SOUND RECORDING EQUIPMENT



# ANDREW *Semi-Flexible* COAXIAL CABLE

BETTER ON 3 COUNTS

✓ **LOWER** loss than plastic 30% to 50% less loss than in plastic cables of same diameter.

✓ **GREATER** power capacity Insulation does not melt or soften . . . develops less heat than plastic cables.

✓ **LONGER** lasting Andrew cables are made entirely of copper and steel, two materials which have unlimited life and which impart the greatest resistance to crushing, corrosion and weathering.

**ANDREW "FIRSTS"** Here's proof of Andrew Leadership in the development of semi-flexible coaxial cables: 1) First to produce  $\frac{3}{8}$  and  $\frac{7}{8}$  inch soft temper cables in 100 foot lengths . . . 2) First to offer continuous coils of unlimited length with factory splicing . . . 3) First to offer lines shipped under pressure with all fittings attached.

Such continued leadership enables Andrew to offer *better* semi-flexible coaxial cables; cables that are better than those made from any other materials.

A complete line of coaxial cables, accessories, and other antenna equipment is produced by Andrew.

**ANDREW CO.**

363 E. 75th ST. • CHICAGO 19, ILL.

*Pioneer Specialists in the Manufacture of a Complete Line of Antenna Equipment*

These are the famous Andrew semi-flexible coaxial cables in  $\frac{3}{8}$  and  $\frac{7}{8}$  inch diameters (shown in actual size). Because of their better construction and design they are used throughout the world by thousands of broadcast, police, government, and military radio stations as the most efficient device for connecting antenna to transmitter or receiver.



## ENGINEERING SALES

**Finch:** Has appointed Augustus J. Eaves as director of sales on Finch facsimile equipment. Eaves was formerly general communications sales manager of Graybar in New York City.

**RCA:** New president of RCA Victor Distributing Corporation is Frank M. Folsom. He will continue as director of the recently organized distribution department of RCA Victor. Prior to joining RCA, Frank Folsom was associated with Montgomery Ward for 18 years.

**Altec-Lansing:** Has appointed Hugo A. Bondy as eastern sales engineer, with headquarters at 250 W. 57th Street, New York 19. He was formerly assistant chief engineer at WNEW.

**Eimac:** Winfield Wagener, formerly chief engineer for Heintz & Kaufman and head of Litton tube division, has joined the sales engineering staff at Eitel-McCullough, Inc., San Bruno, Calif.

**Chicago:** E. G. Brown, for the past 3 years advertising manager for Hallicrafters, has joined the staff of Burton Brown Advertising, 619 N. Michigan Avenue, Chicago, Ill.

**Centralab:** F. R. Ellinger has succeeded T. B. Hunter as Centralab representative in the Chicago area, calling on jobbers and manufacturers. Roland Moeller, who covered the Wisconsin-Illinois-Iowa-Nebraska territory, has resigned because of failing health.

**Hallicrafters:** Has set up six centers for repairing and servicing their radio equipment. Complete stocks of factory replacement items will be carried. These centers are in New York City, Los Angeles, Seattle, Pittsburgh, Chicago, and Butler, Mo.

**Finch:** Has appointed Graybar Electric as distributor for its facsimile scanners, recorders, and associated equipment.

**Sylvania:** New general sales manager of the electronics division is George C. Connor, previously in charge of the Company's West Coast sales office. Products handled in the electronics division include special tubes, measurements controls, stroboscopes, photo tubes, and custom-built equipment made at Boston and Williamsport, Pa.



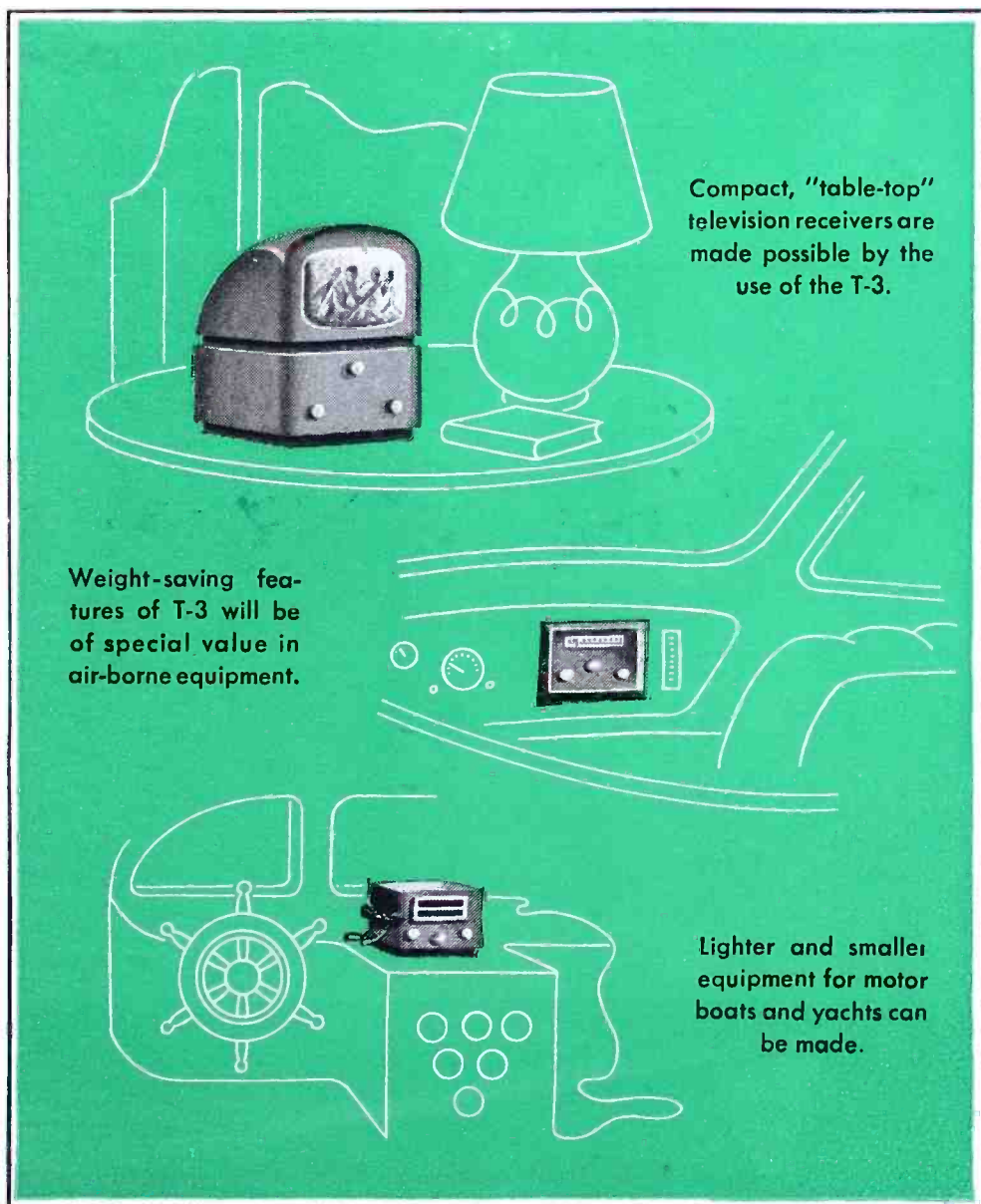
# SYLVANIA NEWS

CIRCUIT ENGINEERING EDITION

AUG. Prepared by SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1946

## MODERN SET DESIGN SEEN GREATLY INFLUENCED BY NEW SYLVANIA ELECTRIC T-3 TUBE

*Commercial Version of Proximity Fuze Tube  
Is Tiny, Rugged, Has Long Life*

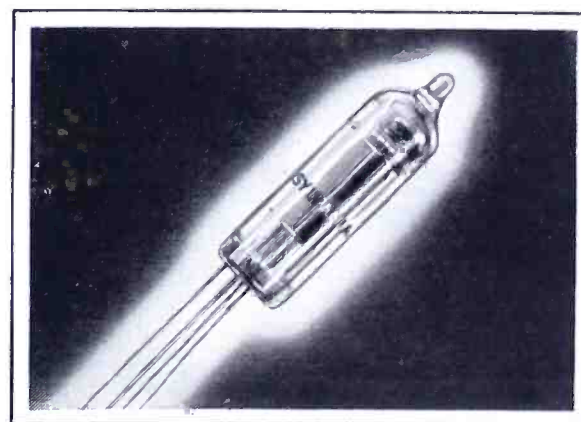


Radio equipment manufacturers are viewing with marked interest the radical reductions in size and weight now made possible in many types of electronic equipment through the use of the sensationally small Sylvania vacuum tube, T-3.

The commercial version of the former proximity fuze transceiver tube is noted for exceptional ruggedness... long life... ideal suitability for high frequency operation.

Some of the design possibilities opened by the T-3 are shown here. Of course, its potentialities are not limited to these fields.

Write Sylvania Electric Products Inc., Emporium, Pa.



The T-3 tube is shown here in its actual size.

# SYLVANIA ELECTRIC

Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS

August 1946—formerly FM, and FM RADIO ELECTRONICS

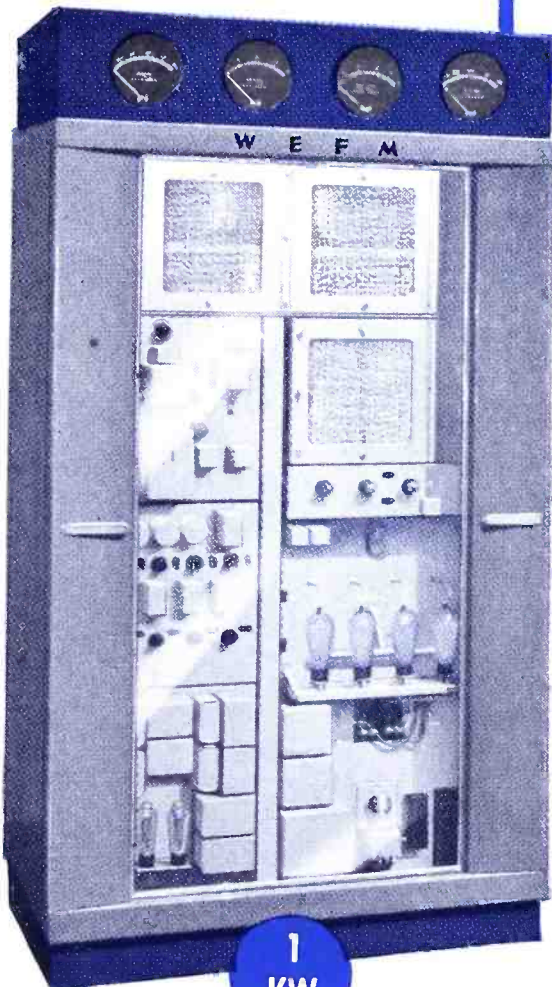


# NEW

## FM TRANSMITTERS

### *Unexcelled Performance of Western Electric FM Transmitters*

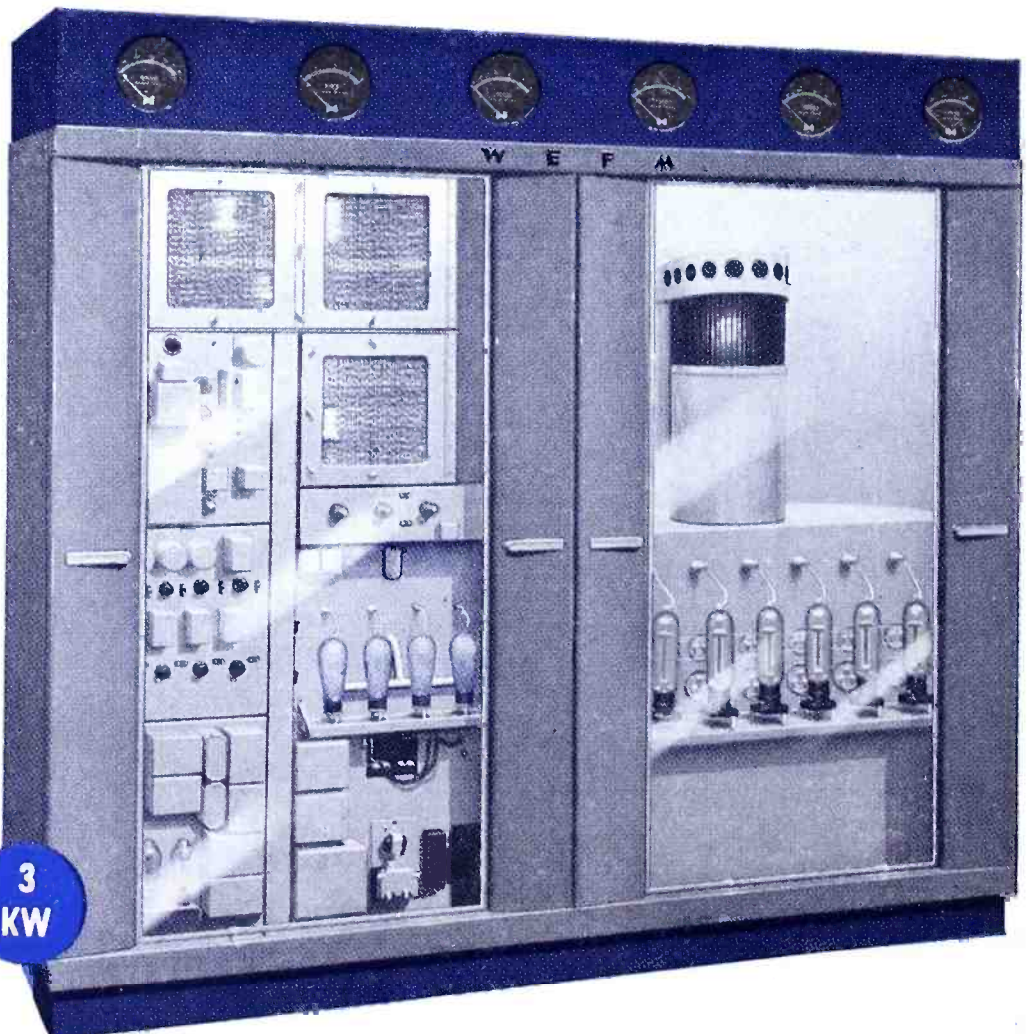
Audio Frequency Response . . . . .	$\pm 0.25$ DB from 30 to 15,000 cycles.
Harmonic distortion—for $\pm 75$ KC swing . . . . .	Less than 0.5% from 30 to 15,000 cycles.
—for $\pm 100$ KC swing . . . . .	Less than 0.75% from 30 to 15,000 cycles.
Intermodulation—for $\pm 75$ KC swing . . . . .	Less than 0.5% for 80% 50 cycles and 20% 1000 cycles; less than 1.0% for 80% 50 cycles and 20% 7000 cycles.
FM noise level . . . . .	65 DB below $\pm 75$ KC swing.
AM noise level . . . . .	50 DB below 100% amplitude modulation.
Carrier frequency stability . . . . .	Less than 2000 cycles deviation (no crystal heater).



**1  
KW**

Not only a transmitter in itself, this unit serves as the basic driver for all higher powered transmitters.

Has its own rectifier and power components, with completely shielded air-cooled triode in broad-band circuit.



**3  
KW**



# BY *Western Electric*

## *NEW Line is Keynoted by 1, 3 and 10 KW Units*

*New* in appearance, *new* in performance, these FM transmitters, specially designed for operation on the higher frequencies, incorporate Synchronized Frequency Control, developed by Bell Telephone Laboratories and Western Electric.

Outstanding new cabinet designs keep pace with circuit improvements. For the first time in FM broadcasting, all tubes are visible to the operator at a glance.

For your convenience, all units are standard width, make use of identical door assemblies and

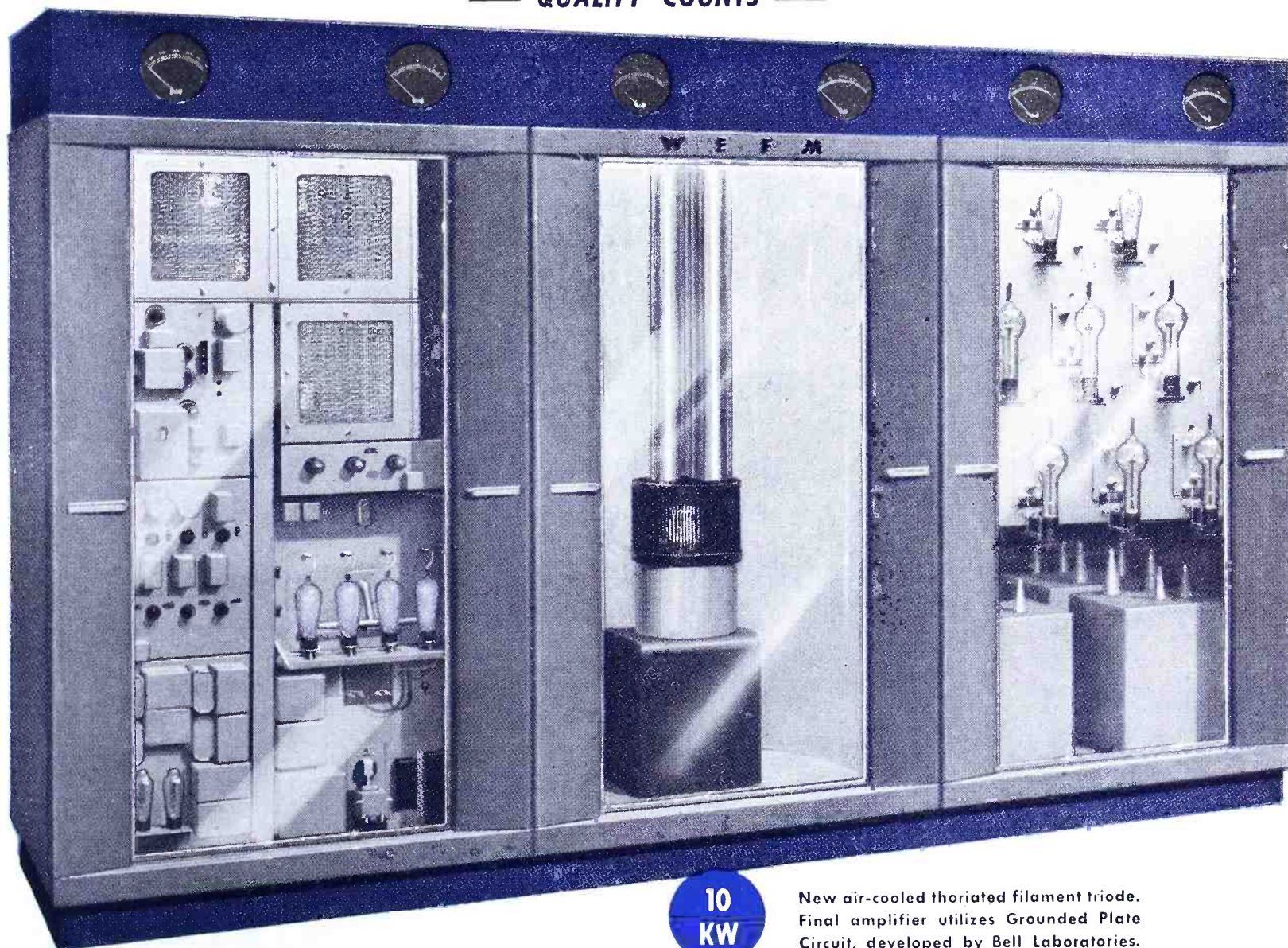
use the same top and side panels. Where more than one unit is used, a common base and meter panel provide single unit appearance.

In addition to the 1, 3 and 10 KW transmitters, Western Electric's full line will include 250 watt, 25 KW and 50 KW units.

For complete information, see your nearest Graybar Broadcast Equipment Representative, or write Graybar Electric Co., 420 Lexington Avenue, New York 17, N. Y.



### — QUALITY COUNTS —



10  
KW

New air-cooled thoriated filament triode. Final amplifier utilizes Grounded Plate Circuit, developed by Bell Laboratories.



# A MULTI-PURPOSE AMPLIFIER *of Broadcast Quality*

Worthy of an  
Engineer's Careful  
Consideration



Langevin 114-A Amplifier in 204-A Cabinet

**T**HE Langevin 114-A Amplifier is primarily a monitor amplifier. It is used in offices, audition and control rooms of radio stations and recording studios, and also fits the needs of wired music installations and other industrial uses wherever an amplifier for a single or dual speaker installation is required.

This amplifier operates on 110-120 volts AC or DC. It can be rack mounted or used in its own metal cabinet, Type 204-A; it has a frequency response of 30 to 15,000 cycles and delivers 3 watts of audio power at less than 2% RSS total harmonic distortion at 400 cycle single frequency. At 4 watts output the distortion is less than 5%.

## ELECTRICAL CHARACTERISTICS

**GAIN**—Approximately 61 db high gain and 43 db when bridging a 600 ohm source. **OPERATES FROM**—0-1000 ohms using nominal 600 ohm input, 0-25,000 ohms using nominal 25,000 ohm input, with maximum gain depending upon impedance of bridged source. **OPERATES INTO**—Nominal load impedance of 4 ohms. Working range 2 to 8 ohms. **OUTPUT POWER**—Approximately 4 watts with less than 5%, and 3 watts with less than 2%, RSS total harmonic distortion at 400 cycles single frequency into nominal 4 ohm load. **OUTPUT NOISE** 42 db below +35 VU (7 db below .001 watt) or better. **FREQUENCY CHARACTERISTIC**—Production run  $\pm 1.5$  db over the range of 30-15,000 cycles. **POWER REQUIREMENT**—110-120 volts, 25-1000 cycles AC, or 110-120 volts DC. Amplifier draws 70 watts at 120 volts. **SIZE**—Maximum length 10 $\frac{1}{4}$ " , depth 6 $\frac{1}{2}$ " , height 6 $\frac{3}{4}$ " .

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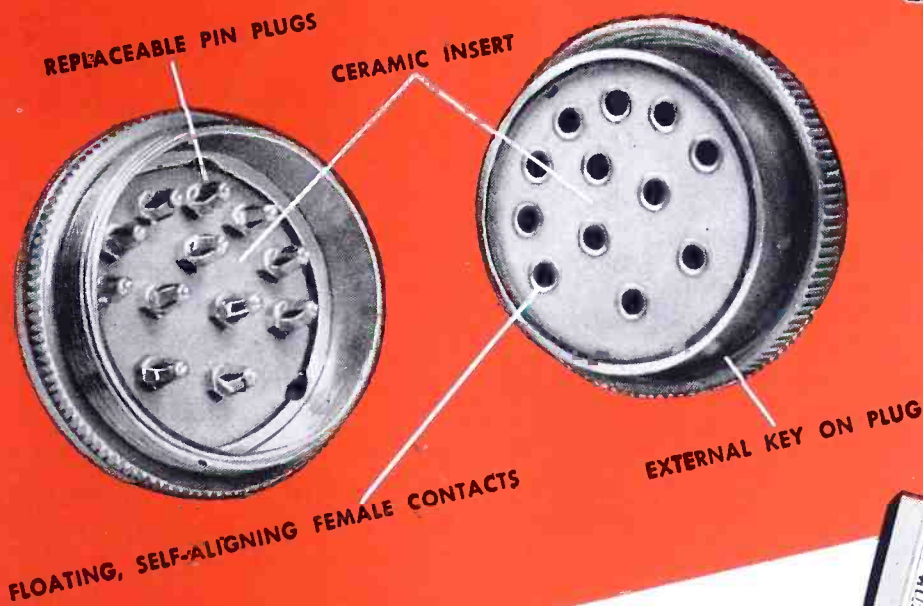
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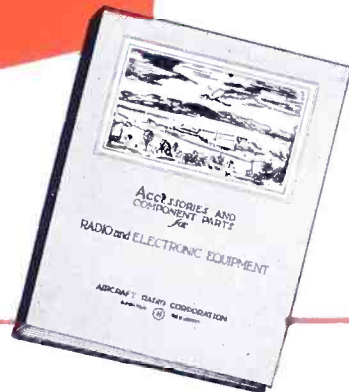
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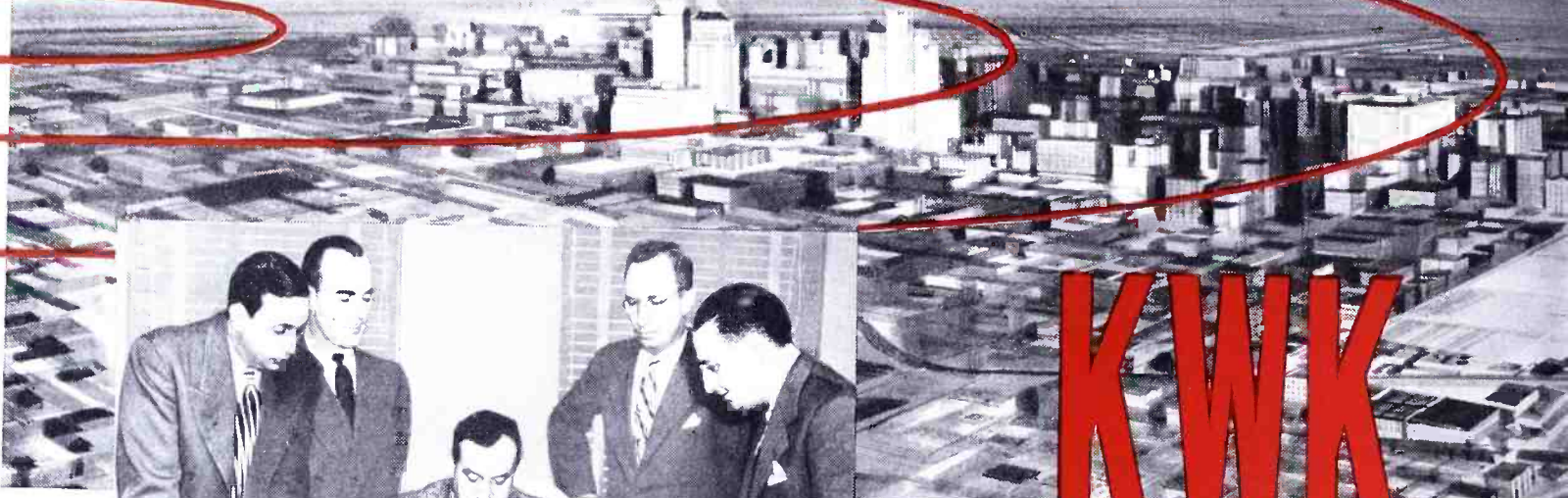
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# FIRST TWO FM STATIONS



Robert T. Convey, President of Station KWK, signing the contract for the 50-kw FM transmitter. L. to R.: Ray E. Dady, Station Director; V. E. Carmichael, Commercial Manager; Mr. Convey; Nick. J. Zehr, Chief Engineer; William Albright, Federal Representative.

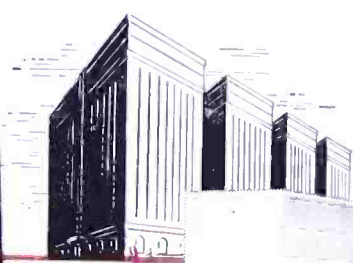
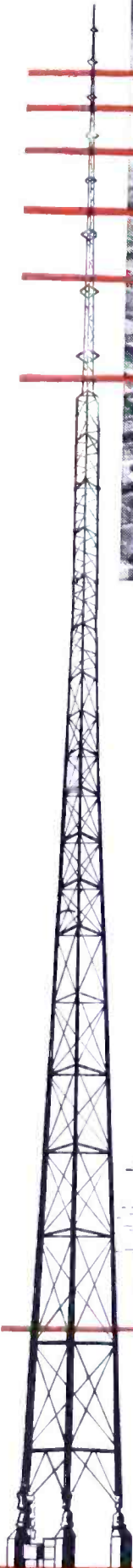
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go on  
with **FM** by

RADIO LISTENERS in the St. Louis area will get a new thrill from finer, high-fidelity, interference-free broadcasting when Station KWK goes on the air this summer with FM—powered by Federal's new 50-kilowatt transmitter. To assure maximum output, KWK will use a Federal 8-Element, Square-

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Both transmitters incorporate Federal's exclusive "Frequematic"\* modulator, assuring outstanding fidelity and mean-carrier stability. As with all of its

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# IN THE ST. LOUIS AREA!

# WEW

10 KW

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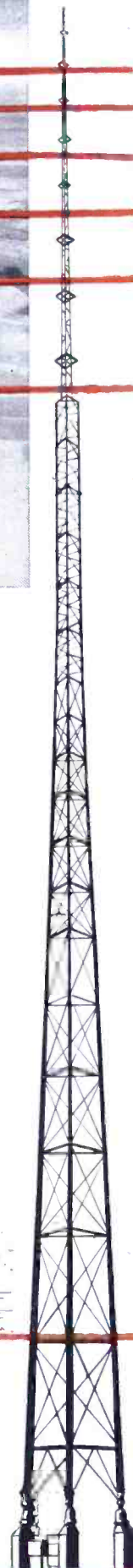
Nicholas Pagliara, General Manager of Station WEW, signs for Federal's complete 10-kw FM station. Left—W. E. Albright, Federal Representative. Right—N. E. Wunderlich, Executive Sales Director, Federal Telephone and Radio Corporation.

STATION WEW of the University of St. Louis—second oldest radio broadcasting station in the United States—has contracted with Federal for a 10-kilowatt FM transmitting station, completely Federal engineered and equipped from microphone to antenna. With the new 8-Element, Square-Loop antenna, WEW will actually

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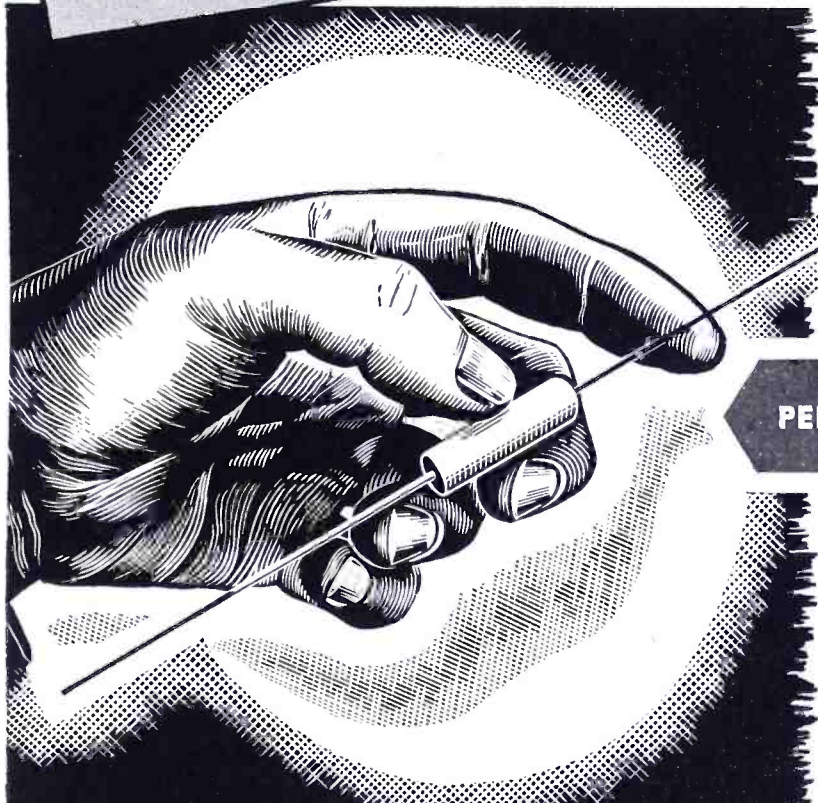
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# HOW MUCH SHOULD FM SETS COST?

Since Price Is Related to Performance, Dollar Volume, and Net Profit, This Is a Question of Utmost Importance to Broadcasters as well as to Manufacturers, Dealers, and Servicemen

BY MILTON B. SLEEPER

SO as to avoid any misunderstandings in this discussion, let us define an FM receiver as one which is equipped with circuits for the reception of FM broadcasting, and with additional circuits for AM broadcast reception.

**Tackling the Price Problem** ★ As a preliminary to arriving at a basis for discussing FM set prices, let us make a series of notes about the thoughts of the various groups involved in the matter:

1. **BROADCASTERS:** The broadcasters have a ready answer. It is some variation of: "Make FM sets so cheap that every single person within range of my station will be able to own a set and hear my programs."

2. **MANUFACTURERS:** Most set manufacturers will say: "My prices for FM models must be low on a competitive basis. If I try to make them high, my competitors will make their prices lower, and take away my market." Others: "I want a higher unit of sale. I shall make table model FM sets, but my main effort will be on consoles which include record players." A third group will maintain: "I want a very high unit of sale. Therefore, to keep out of competition with the cheaper lines, I'm going to make only phono combinations, and put my sales emphasis on record-playing."

3. **DEALERS:** The dealers will follow the general pattern of the manufacturers' thinking. The little fellows who work on a shoestring, the hardware, automotive, and small appliance dealers, and department stores with six feet of radio counter space will say: "You'll have to give me small, cheap FM sets because I only want to do a cash-and-carry business." Then come the "legitimate" radio dealers and radio departments of larger stores which are organized to do effective merchandising: "Prices should be kept low, but they must be high enough that we can give real service to our customers, and net us a worth-while profit." Last, but not to be forgotten, are the phonograph record shops and the piano and musical instrument dealers, who insist: "I can only make money on expensive models in a line which I can handle on an exclusive basis, with protection against price-cutting."

4. **SERVICEMEN:** The servicemen's answer is simple and to the point: "Make FM receivers big enough so that I can get into them to shoot trouble, and make 'em cost enough so the customer won't offer to

give me the set when I charge him a decent amount for time and materials."

5. **LISTENERS:** Somehow, the ultimate consumers are usually at the tail end of any list of people to be considered. In this case, their opinions are least helpful. They are liable to say, "Let me hear an FM set. Then I'll tell you what I'll pay for it," but even that means little, because sales promotion has such a tremendous influence in creating markets.

The foregoing paragraphs represent points of view so unrelated that they add up to nothing more intelligent than the catch-as-catch-can opportunism that has characterized AM radio merchandising for 25 years! Manufacturers who managed to catch a lot have been considered smart operators, and those who didn't catch enough went out of business.

**Broadcasters Are Smarter** ★ Over the years, radio manufacturers have made more money for the AM broadcast station operators than for themselves. In fact, as the average unit of sale for AM sets dropped from its all-time high of \$175 in 1929, the industry's biggest year, it seems as if the manufacturers have been working for the broadcasters. Certainly by making more and more sets at lower and lower prices, the manufacturers have sacrificed their own profits to create larger audiences and increasing profit for broadcasters!

As a result, AM station owners could sell out today and buy up the entire set manufacturing business with a small fraction of the proceeds.

**Car Manufacturers Are Also Smart** ★ Automobile manufacturers don't work for the tire or oil companies. That could very easily happen, though, if the motor car companies abandoned their highly organized merchandising and promotion efforts for the radio industry's out-and-out price competition. That might have started in the early days of automobiles if Ford had not set the pace by supporting quantity production methods with the policy of seeking to assure his dealers of higher profits than they could make on other cars.

There is no question but cars can be made cheaper than any now on the market. If automobile manufacturers only sold transportation, we might be a nation of motorcycle riders, and the average unit of sale might be no more than \$150.

Instead, as you will see from any auto-

mobile advertisement, that industry has consistently sold beauty, comfort, safety, power, yearly models, and enjoyment for the whole family — at an average delivered price of about \$1,000.

Automobile manufacturers have done more than that. They have done two things that the radio industry has failed to do. First, while maintaining a high average unit of sale, they have put more and more value of beauty, comfort, safety, power, and enjoyment into cars from year to year. Second, by maintaining a high unit of sale, they have created a market for second-hand cars which takes care of those who cannot afford to buy new ones. And this, in turn, maintains the yearly model market. Combined, the new-car and the second-hand markets give the dealers a chance to make two or three profits on each car manufactured!

**25 Years of Listening** ★ In the radio industry, so much happens so fast that little time is given to looking backwards. However, a review of listeners' habits and the manner in which they have changed over the past 25 years discloses some interesting information as to what can happen in the future.

In the beginning, the fascination of hearing something — anything intelligible — was both the reason and justification for the millions of home-made radio sets that were assembled by men and boys, rich and poor. Then, radio was strictly a man's hobby, pretty much of a nuisance around the house, and was generally frowned upon by women.

So matters stood, as far as the family was concerned, until the advent of the loudspeaker, when neutrodyne sets, and later the superheterodynes, made it possible to hear stations without the awful squeals and shrieks emitted by the regenerative receivers.

In those days, station call letters were announced every two or three minutes. That was because the location of the station, or its distance from the listener, was more important than the program content.

But by the time batteries were eliminated and the inside works of radio sets were concealed in cabinets, so that radio could take its place in the living room, listeners began to take an interest in the programs. Right then, the fascination of trying to get more stations and more distant stations began to fade. Radio developed into a source of family entertain-



ment, and dad and the boys stopped twisting the dials so that mother and the girls could listen to the programs that offered the best music.

In those days, remember, programs were almost entirely musical, and all live talent. Some efforts had been made to introduce recorded programs, but the networks refused to lower their program standards by using them. Records were held in low repute by the general public, for the mechanical phonograph was a thing of the past, and its electrical successor was still in the development stage.

In 1929, when the set manufacturers set an all-time record for dollar volume, the number of units was small compared to subsequent years. Therefore, most sets were well built, were equipped with a stage of tuned RF amplification, and were operated with outside antennas. Supplying a high ratio of signal to noise, they provided excellent musical entertainment from the fine programs then on the air.

More people wanted to hear those programs, but in the depression years fewer had \$175 to pay for sets. Thus the sale of "mantel" radios began to grow. At \$67.50 to \$74.50, they represented a considerable sacrifice of reproduction quality, but a large saving in cost.

Broadcasting and set manufacturing coasted along until 1932, when the late President Roosevelt conceived the idea of using the radio to talk to the Nation. With political events breaking in rapid succession thereafter, news reports and the interpretation of the news became increasingly important to listeners. Thus, more and more speech was substituted for music. Another thing had happened to further this change. Amos 'n' Andy, as a day-to-day feature, had become established as an outstanding radio program and, following in the wake of their success, came other programs which grew into what we now call soapbox operas. Then, following the President's example, other political speakers sought time on the air.

Notice how these changes gradually reduced the use of music on the radio, and increased the amount of speech on broadcast time. When World War 2 broke out, there was a sudden further increase of speech, for the whole Nation came to depend upon the radio for war bulletins.

Everyone, rich and poor alike, wanted a radio set to follow the news. Those who could afford them bought two or three or half a dozen, so that news could be tuned in all over their homes. The children, more interested in Superman's battles than those fought in Europe, got sets of their own.

Thus the listening hours devoted to speech programs increased to the point where the main requirement of receiver performance was intelligibility. A "good set" was not one that brought in DX, or good musical reproduction, but one that "let you hear the words." Note that the

reduction in fine musical programs coincided with the increasing sales promotion on cheap AM table models.

What about the great number of people who still wanted good music, and would not listen to harangues about Burpee's Bile Tablets, singing commercials with phony talking noises, or the screaming meemies on participating programs?

Well, as sales records show, they switched their listening to phonograph records. Broadcasters were indifferent to this change in taste, believing that they were a small, high-hat group of no importance to sponsors. What they didn't realize was that this group gave a tremendous new life to the record business, and built it up to the point where more and more people of all income brackets turned from radio to records. Today, this reduction of radio listening hours is assuming proportions of a serious loss to broadcasters.

**What Will Come Next?** ★ Unless there is a radical change in radio set performance and in broadcast programs — in short, a radical improvement in service to radio listeners — radio will deteriorate to the point of becoming merely a wireless version of the telephone. Regardless of the capabilities of AM broadcast stations, average radio sets in American homes are virtually limited to speech frequencies.

The next step is for broadcast stations to drop music entirely. With facsimile coming up, it would not even be necessary to keep the news announcers and commentators. Their scripts could be fed into the facsimile scanner, to be read at leisure, like the newspaper, by families who have been timing their activities to radio newscasts. Even the soap operas could be replaced with cartoon strips by facsimile. Finally, the Telephone Company, whose ordinary lines can handle facsimile signals, could take over, and we wouldn't need radio broadcasting or receivers at all. We'd just get a small monthly charge on our telephone bills.

Does this sound screwy? Well, it isn't. It's just an extension of what has been going on over a period of years. First, the manufacturers headed into their own doom by producing cheaper models of more limited audio capabilities. Then, because the broadcasters forgot that more sets meant anything other than more listeners, the blight of poor reception quality began to destroy the foundations of the broadcasting business.

The industry doesn't seem to realize that broadcast transmitters and home radio sets are as much a part of the same circuit as the telephone receiver and microphone. The only difference is that the latter are used by the same people.

Today, both the radio and the telephone are taken for granted by the American public to the point where there's nothing fascinating about hearing things by radio. People turn on their sets and, if they don't like what they hear, they switch

them off. And perhaps turn on the phonograph.

Meanwhile, Telephone Company revenues are going up, largely through the increased use of long-distance service, while broadcasting revenue is going down because AM service is steadily deteriorating. Judging from the rate that stations are changing hands, perhaps the smart people are getting out from under right now.

**Radical Change Is Required** ★ There is only one way to offset this deterioration, now so well-established that no mere shift of policy or promotion can do it. A radical change is required, radical enough to obsolete all existing AM broadcast stations and AM home receivers, in order to give complete effectiveness to a genuine renaissance of home radio entertainment.

The shift to FM is the radical change that is required to raise the quality of broadcasting as a means of mass entertainment that will not be limited to voice frequencies.

If this is done — if broadcasters and set manufacturers work together to this end — then FM receivers will do full justice to the programs transmitted, and FM broadcasting can provide a range of entertainment that will bring the public back to the loudspeakers. That's why a shift from AM to FM will serve the best interests of the broadcasters, manufacturers, and listeners alike.

**The Price of FM Sets** ★ This brings us to the question of prices for FM receivers that will assure listeners of the full enjoyment of FM programs. While the first postwar models of Sears Roebuck FM sets were still in the preproduction stage, Parker Wiggin, Sears' radio buyer, told the writer: "We shall have FM sets in three ranges of performance. The high-quality set is designed already. It was easy to design the most expensive model. The problem is to know how much we should degrade the performance of the medium- and low-priced sets."

Best opinion, giving consideration to postwar costs, is that an FM-AM phonograph combination, capable of doing complete justice to live-talent FM broadcasting, can be made to retail at about \$400. The FM performance of such sets is so startlingly different from average AM reception as to make it a completely new and delightful listening experience.

This assumes, of course, the broadcasting of live talent or the new, high-fidelity transcriptions which are now becoming available. It does not refer to AM network programs or low-fidelity records.

The price of \$400 includes a well-made cabinet of simple design, and a conventional record-changer. Some economies can be made to get below \$400, but any substantial reduction cuts into performance.

In another year or two, FM broadcast  
(CONTINUED ON PAGE 61)



# PROGRESS IN POSTWAR FACSIMILE EQUIPMENT

Accelerated Activity in Facsimile Equipment Production Advances Use for Broadcasting and Communications

BY FRANK R. BRICK\*

**R**ECENT demonstrations of facsimile, particularly at the American Newspapers Publishers Convention held in New York, April 22-26, 1946, have served to focus the attention of broadcasters, publishers and communications officials on the importance and number of applications for this medium. The new facsimile equipment incorporates many refinements resulting from wartime development and field experience. As a result, the postwar status of facsimile indicates that it is now ready for adoption by many commercial services, and that an early resumption of experimental broadcasting is at hand. The latter will serve to pave the way for necessary engineering standards and operating regulations essential to a universal, nation-wide system of facsimile broadcasting.

Until very recently, the lion's share of publicity has been concentrated on Frequency Modulation and television. However, it still remains for facsimile to provide a system whereby a permanent record of any transmitted material can be received in its exact original form and retained for post-transmission purposes. To the broadcast station operator and advertiser, it is both a new public service and a new advertising medium, and it has the advantage of lower programming cost than sound or television broadcasting. For mobile communications and point-to-point services, it is a medium whereby information of any nature can be transmitted instantaneously for later analysis when convenient or desired, with a minimum of possible transmission errors.

Prewar experimental facsimile broadcasting over AM facilities, conducted after the conclusion of regular aural programs, served to provide valuable operating and engineering data. It also demonstrated the futility of attempting to build facsimile into a healthy, competitive medium with the handicap of operation limited to early morning hours. The solution to this problem has been found in Frequency Modulation, which makes possible multiplex transmission, or the simultaneous transmission of sound and facsimile copy.

**Early System** ★ Facsimile communication is also referred to as wirephoto, radiophoto, telephoto picture transmission, and record communications.

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FIG. 1. THE ORIGINAL FACSIMILE RECEPTION WAS BETTER THAN THIS REPRODUCTION

The first record was sent over a telegraph circuit in 1842 by Alexander Baine, an English physicist. Professor Arthur Korn did a great deal of work on improving the method in the early part of this century. The most recent work has been done by Jenkins, Finch, Cooley, Ranger, Hogan, Ives, Bellin, and a number of others.

The first commercial facsimile system was placed in operation by the AT & T Company over regular telephone circuits. RCA operated a radio telegraph photo service in 1924 between New York and London.

The techniques employed in the transmission of wire photographs and telephotographs are similar in general respects to those employed in the most recent facsimile systems. However, in the former, a light-sensitive film is required in the recording operation. This makes it necessary to go through the elaborate processes of film loading, developing, fixing, washing and drying to obtain the final copy. In contrast, facsimile requires no processing of the received copy, since it appears in a permanent, visible form during the recording operation. The present home-recording facsimile instrument prints the



received copy on a continuous sheet of special electro-sensitized paper. A full-size reproduction of a facsimile picture appears in Fig. 1. The reproduction does not do full credit to the original facsimile picture, for the latter is almost equal to the appearance of rotogravure.

**First Facsimile Broadcasting** ★ The first experimental facsimile broadcasting license, with the call letters W2XBF, was granted to Capt. W. G. H. Finch in September, 1937, and daily transmissions were immediately started in the New York area. Other radio stations soon expressed a deep interest in this new broadcasting medium. WHO, Des Moines, KSTP, St. Paul and WGH, Norfolk applied for experimental licenses and were in operation before the end of the year.

To obtain technical data and determine the degree of public acceptance, a number of recorders were distributed in these areas, pre-tuned to the correct station frequency. Facsimile broadcasting was then conducted between midnight and 6:00 A.M., following the regular aural programs. These home recorders were automatically turned on and off by means of special time switches.

To obtain an acceptance evaluation of wide scope, the FCC approved the transmission of advertising copy to supplement the usual news programs. Thus, these early programs permitted the radio sta-

By early 1938, some twenty major radio stations were in operation with facsimile on an experimental basis. Many of these stations were affiliated with newspapers, Magazine, newspaper, and radio station

homes of individual subscribers.

The next logical step to improve facsimile broadcasting — the multiplex or simultaneous transmission of sound and program material was undertaken by



FIG. 2. THIS MODEL IS INTENDED FOR COMMERCIAL USE, NOT HOME FAX RECEPTION

reactions were mixed. Some publishers viewed facsimile as added competition, others believed it would prove to be a valuable supplement. All agreed, however,

Captain Finch in February, 1938. It was felt that multiplex transmission would greatly increase the value of facsimile broadcasting, and in some cases would increase the usefulness of facsimile to communications services. Multiplex experiments were successfully conducted by a series of daily transmissions to the New York World's Fair in 1938-39, and later through special tests before members of the FCC in Washington.

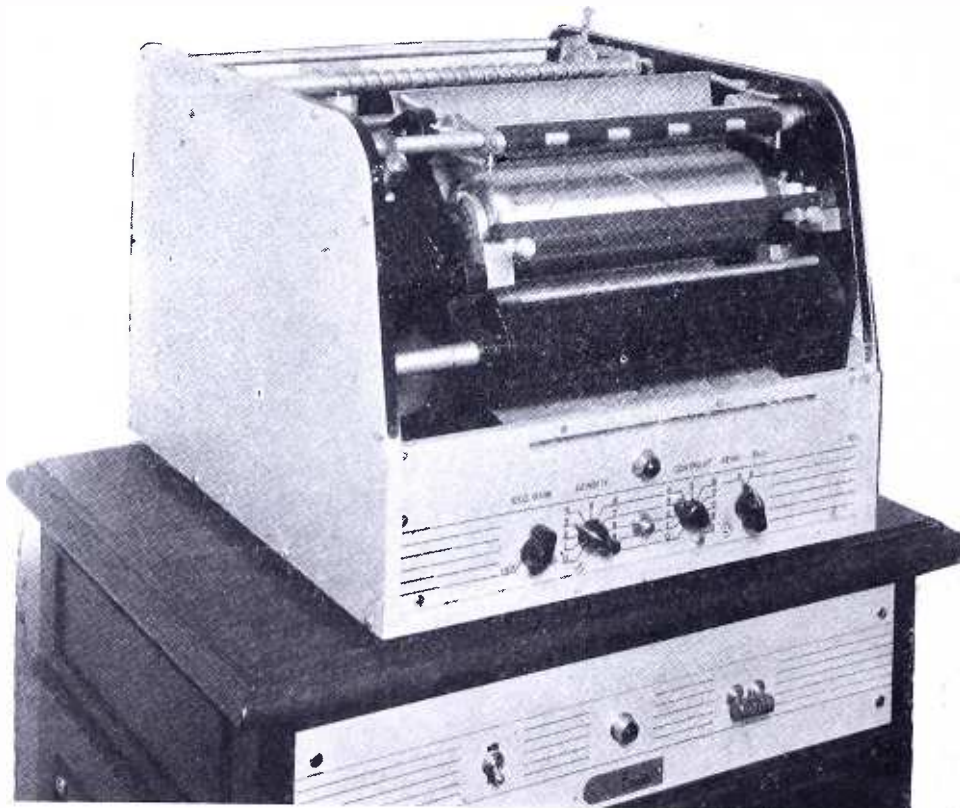


FIG. 3. INSIDE VIEW OF COMMERCIAL MODEL WHICH TRANSMITS AND RECEIVES

tions to investigate public reaction to its extended service and, at the same time, pioneer in what promised to be a fruitful source of added revenue. These first home recorders utilized a roll of specially treated paper, two newspaper columns in width. A speed of approximately five feet per hour was obtainable.

facsimile was destined to become a powerful medium for the dissemination of printed information, as it offered the added advantage of permanency to instantaneous reception, in contrast to the laborious and slow task of moving individual copies of newspapers from the printing plant to newsstands and the

**Scanning & Recording Equipment** ★ Figs. 2 and 3 show views of the dual transmit-receive facsimile unit designed for fixed station use. Fig. 4 is an interior view of a unit for mobile reception only.

Material for transmission is inserted into the TRANSMIT slot. Pressing the TRANSMIT button on the right side, Fig. 1, automatically loads and transmits the copy. After scanning, the copy is stripped from the drum and ejected by means of the EJECT button. Any black and white copy that is printed, typed, written, sketched, or photographed on ordinary paper 8½ ins. wide and not more than 11 ins. long can be used for transmission. When inserted, the copy is automatically wrapped around the surface of a metal cylinder. The cylinder rotates in front of a scanning head comprising a small electric bulb, a lens system, and a photo-electric cell. When the cylinder rotates, the scanning head is moved by means of a lead screw, parallel to the axis of the cylinder.

The electrical circuits of the scanner and recorder, Figs. 5 and 6, are relatively simple. In the scanner, light from the exciter lamp in the scanning head assembly is focused on the copy as it is moved by



the rotating cylinder. The light is reduced to a small spot 1/100 in. in diameter by means of an optical system. The light reflected from the copy is picked up by a

100 lines per inch. The output power of any unit is 0 db. (6 milliwatts) and is designed to feed into a 500 ohm circuit. The recorder unit will operate from any radio

pulses. This pulse is utilized to check the vibrations of a crystal which, in turn, controls the RPM of the recorder motor to drive and maintain the latter in correct phase relation.

If the recorder is out of frame with the scanner, the motor of the recorder is retarded by opening the circuit periodically once per revolution, causing the recording cylinder to lag. This is accomplished by having an open segment on a commutator that is attached to and drives the recorder cylinder. When both scanner and recorder cylinder are framed, the synchronizing or framing signal actuates a relay that closes the gap in the commutator locking the two cylinders in unison and maintaining them in frame as long as the signal (received by the recorder) is not interrupted.

**Present Facsimile Broadcasting** ★ Pending industry and FCC agreement on the necessary engineering standards for a common system of broadcasting, which will eventually provide for multiplex, experimental work is being resumed by a number of stations utilizing FM facilities. FM station WGHF in New York will be active in carrying out this phase of facsimile, and is now being used for specific demonstrations. Upon the availability of home recorders, a regular schedule of transmissions will be put into effect. WGHF operates on 99.7 mc.

Multiplex demonstrations to date have been conducted using a 20 kc. sub-carrier extending 10 kc. beyond the normal 150 kc. utilized for full modulation of an FM broadcast channel. A guard channel of 5 kc. is inserted between this sub-carrier

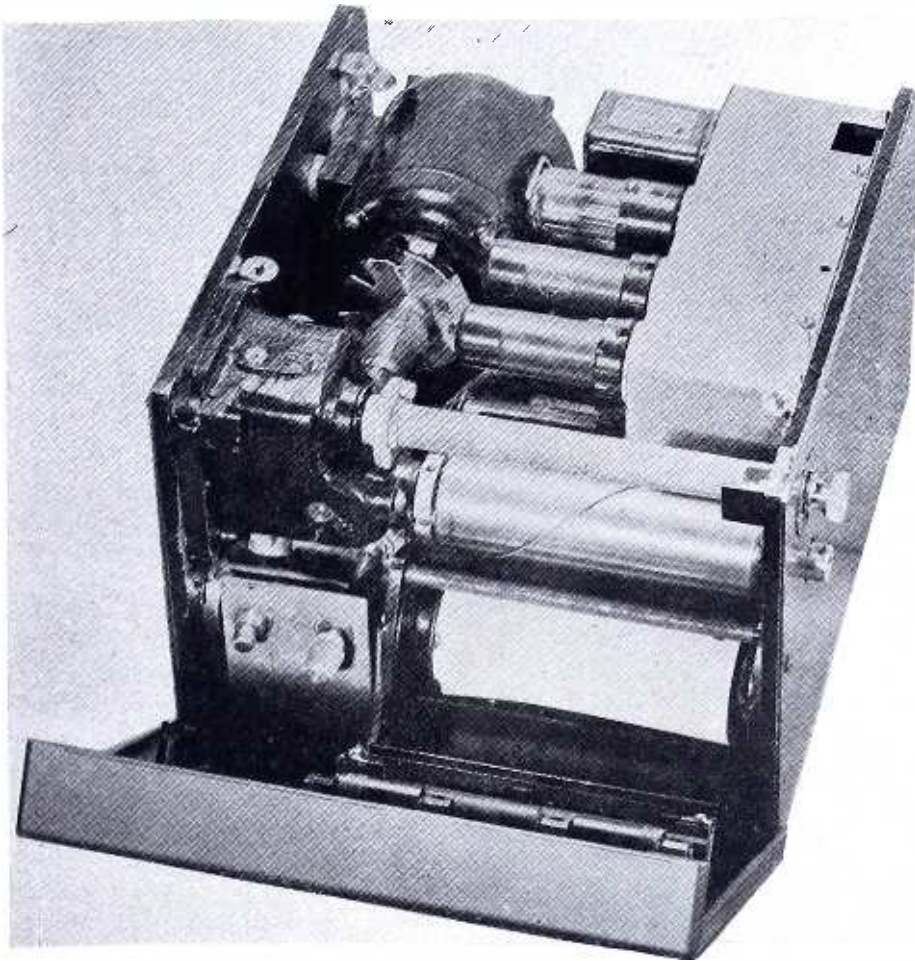


FIG. 4. COMPACT FACSIMILE RECEIVER SUITABLE FOR MOUNTING ON AUTO DASHBOARD

simple condenser lens and focused on the caesium cathode of the photoelectric cell. The amount of light reaching the cell depends upon the amount reflected from the copy. The white portions of the copy reflect the greatest amount of light and the dark portions the least. This changing amount of light controls the output of the photo-electric cell, and this output is used to modulate the radio transmitter.

At the receiving end, the facsimile signals are separated from the carrier frequency, amplified, and fed to the recorder mechanism. The program content is printed on a continuous sheet of electro-sensitive paper 8½ in. wide, fed by the receiving cylinder at identically the same rate as the transmitting cylinder. On the surface of the recorder cylinder is a spiral wire which contacts a metal blade parallel to the surface of the cylinder. In this manner, for each rotation of the cylinder the point of contact moves once along the length of the blade. The facsimile signal passes from the spiral wire to the blade, so that each line traced at the scanner is reproduced by a turn of the receiver cylinder on the sensitized paper. The paper, in turn, advances slowly between the cylinder and the blade. Fig. 6 is a simplified schematic of the recorder circuit.

The circumference of the scanning cylinder and the length of stroke of the recorder are both nine inches. Transmitted copy is scanned and recorded at a rate of

receiver of 5 watts rated output at 500 ohms, or from a wire circuit.

**Synchronizing & Framing** ★ A framing and

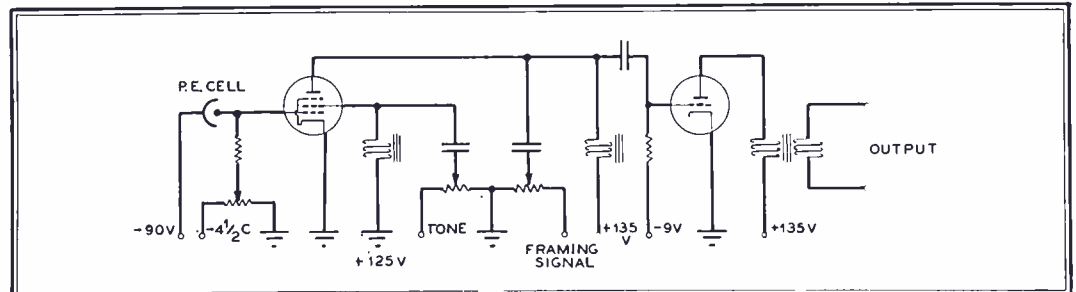


FIG. 5. ELEMENTS OF THE PHOTO-ELECTRIC CELL SCANNER AND AMPLIFIER CIRCUIT

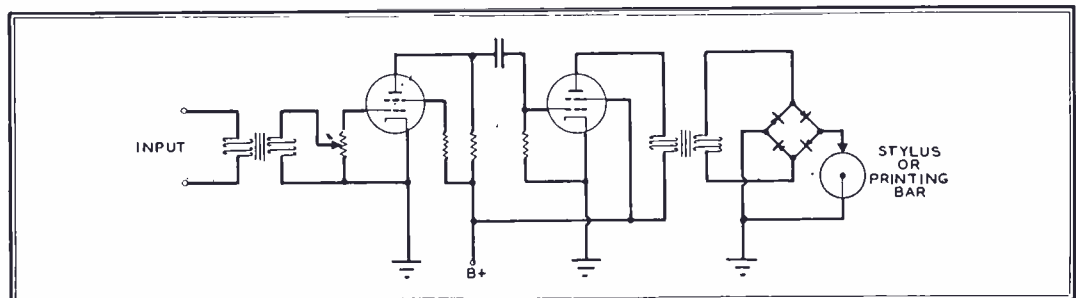


FIG. 6. AMPLIFIER AND FULL-WAVE RECTIFIER EMPLOYED FOR FACSIMILE RECORDING

synchronizing pulse is transmitted at the start of each revolution of the scanning cylinder. The frequency of this pulse may be the same frequency as the sub-carrier or one that is higher or lower. When framing signals are above or below the carrier frequency, a filter is employed to separate the picture signals from the framing

and the extreme limits of the 150 kc. channel.

**Facsimile Applications** ★ Possibly the most dramatic application of facsimile will be its eventual use in broadcasting. The delivery of photographs, sketches, cartoons,

(CONTINUED ON PAGE 60)



# SPOT NEWS NOTES

Items and comments, personal and otherwise, about manufacturing, broadcasting, communications, and television activities

**FM Handbook:** If you are one of the several thousand who have ordered the FM HANDBOOK, we can't blame you for being impatient at not having received your copy by this time. Unexpected delays concerned with printing and paper have repeatedly postponed the production of the first edition, and we hesitate to name a specific date at this time of writing. However, orders now on hand will be filled immediately after books are delivered by our printer.

May we suggest that you wait to inquire about your order until you see the announcement in *FM AND TELEVISION* that copies are available for delivery.

**FM Broadcasting:** Score at the end of July shows 57 stations on the air or conducting test transmissions, 168 construction permits and 308 conditional grants issued, with 391 applications in hearing or awaiting action. Grand total of 924 exceeds the number of AM stations at the end of the war.

Of the 476 C. P's. and conditional grants, 337 went to AM operators, while of the 391 applications pending, 216 are from AM operators.

**Wider Band:** At FM hearing on July 12, Zenith chief engineer J. E. Brown renewed his plea for more FM channels in the 50-Mc. section, and NAB general counsel Don Petty asked FCC to indicate where possible expansion will take place, so that set manufacturers can anticipate future needs. Acting Chairman Denny accepted the Brown and Petty statements for the docket although the FCC is not inviting petitions for changes. However, Chairman Denny promised that if such petitions are received, an early hearing should be held "so that manufacturers will know exactly where they stand." It is reassuring to note this consideration for the problems of the manufacturers.

**FMBI:** Whether FM Broadcasters, Inc. is to resume independent operation or become a permanent department of NAB will be settled by FMBI members at the Chicago NAB Conference, October 21 to 24. It has been suggested that FM broadcasters not already members of FMBI should pay \$50 to join now, so that they can vote in October. Correspondence should be addressed to FMBI president Walter J. Damm, station WTMJ, Milwaukee.

**WSYR-FM Syracuse:** On the air July 9th, operating 6 hours daily with 250 watts on 93.5 mc. Authorized power of 7 kw. will be used as soon as G.E. delivers additional equipment. Chief engineer is George Belle Isle.

**TBA:** New affiliate member of Television Broadcasters Association is the American Telephone & Telegraph Company.

**NEW AM Stations:** Planting 3 new AM stations in Pocatello, Idaho, (pop. 18,000) where there was one already, or increasing the number in Tucson, Arizona, (pop.

## 5TH BIRTHDAY FOR WBCA

**S**CHENECTADY'S FM station WBCA celebrated its 5th year of 16-hour-a-day broadcasting on July 17th. This record gives Battling Len Asch top honors among all FM broadcasters for service to FM listeners.

As the first independent commercial FM station, WBCA has furnished ample proof that active promotion of listener interests can build time sales to a profitable volume. Since that was done under wartime conditions which set a limit to the number of receivers in use, it is clear that new FM stations, under equally aggressive management, should achieve a level of self-supporting operation in a relatively short time.

Among the letters of congratulation received by WBCA was one from Acting FCC Chairman Denny, who wrote: "Please accept my best wishes upon this occasion. The Frequency Modulation stations offer the finest aural broadcasting which is obtainable in the present state of the radio art, and your successful operation during the past five years is further evidence that this new high fidelity and static free broadcast service is destined to have the widest public acceptance. I wish you success in your efforts to provide the best possible public service in your community."

36,800) from 2 to 5 seems to conform with the democratic plan of free competition. However, we can't help wondering how the station payrolls will be paid, or if the newcomers were required to show the FCC how they can afford to give listeners anything better than music from worn-out juke box records.

**Facsimile Equipment:** An initial order for facsimile scanners and recorders has been placed with G.E. by Radio Inventions, Inc., on behalf of members of Broadcasters Facsimile Analysis. G.E. production will be limited in 1946, however, to this single order.

**FCC Investigation:** Plans for full-scale FCC investigation have been launched by Senator Charles W. Tobey (R-N.H.) with respect to Commission's Blue Book censorship and control over programs; administration of frequency allocations, shift of FM band, and 20-kw. restriction on FM power; and FCC's general administration of the Communications Act.

Immediate FCC answer is that an investigation will cause delay in clearing up backlog of docket cases and station applications, for all departments are overloaded. However, the Commission deliberately assumed the enormous extracurricular job of undertaking to tell broadcasters how to run their stations. As OPA

experience has shown, public opinion exercises a more effective control, while Blue Book regulation accomplishes little more than adding industry confusion and increasing FCC payrolls. Fact is that Commission is persuaded to pick political and sociological daises, instead of doing its knitting.

**William H. Myers:** Appointed chief engineer of the receiver division of Farnsworth Television & Radio Corporation, Fort Wayne, Ind. He succeeds J. H. Pressley, who has been retained by the Corporation as a consultant. Prior to joining Farnsworth in 1940, Mr. Myers was a member of the Crosley engineering staff.

**Allentown, Pa.:** Penn-Allen Broadcasting Company, independent FM applicant, is doing some very clever advanced promotion with a series of mailing pieces designed to present facts about FM, to interest listeners in the superior performance of FM sets, and to pave the way for building an audience rapidly when the station goes on the air. It may be possible to get copies of these mailing pieces by addressing the Company at 1308 Chew Street.

**Plenty of Nothing:** Joseph H. Ream, CBS vice president, has proposed to FCC that television channels 5 and 6 (76 to 88 mc.) be added to FM band. CBS uses neither of the channels, and neither old or new FM sets cover them. It's amazing to see how

(CONCLUDED ON PAGE 48)

## NEWS PICTURE ▶

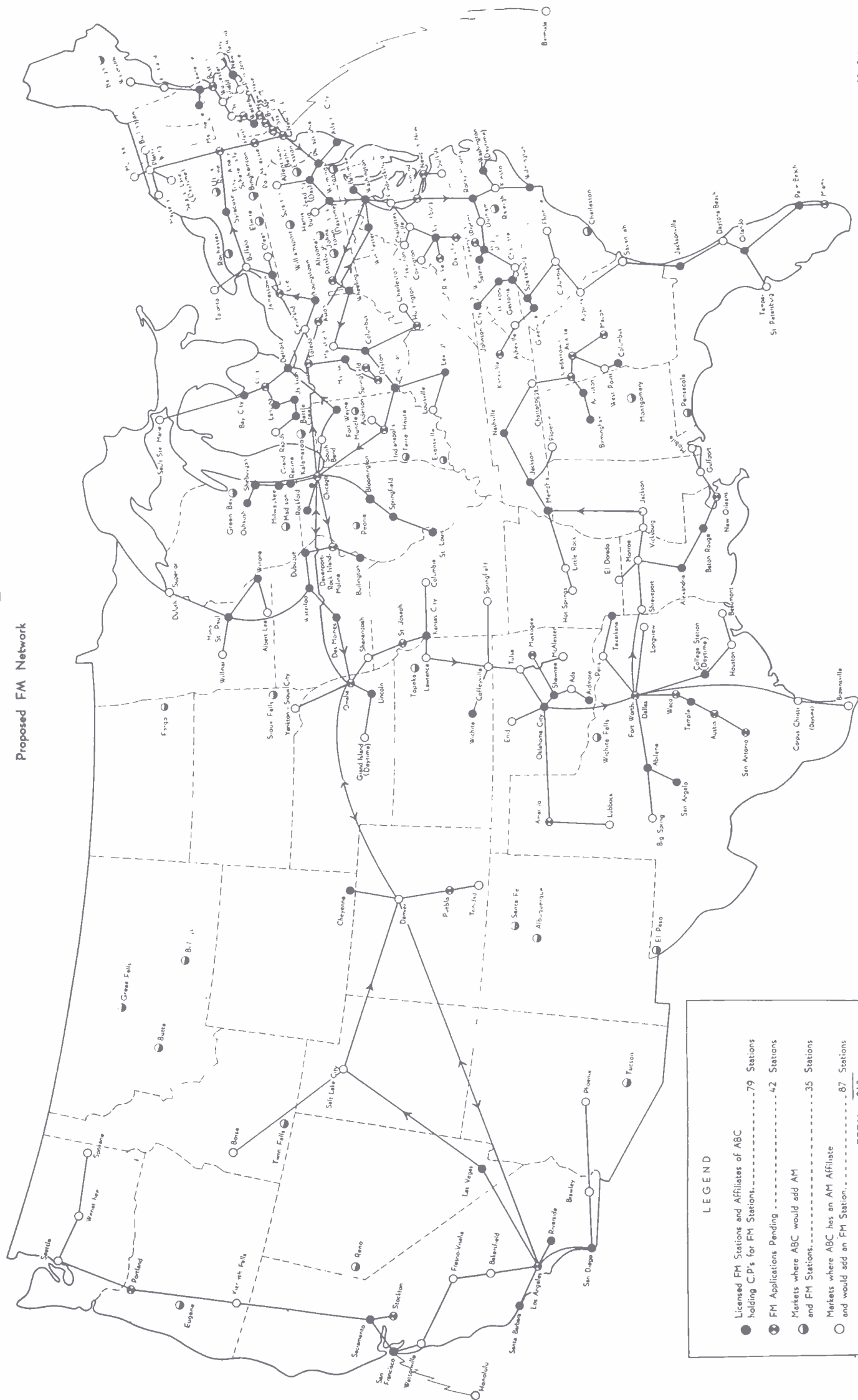
**P**LANS for an FM network to be operated by American Broadcasting Company are disclosed by the map on the page opposite. This map was introduced at the FCC hearing on FM applications in New York City. At the hearing, in reply to the question, "Will you explain what you meant, or in what respect a new horizon for the listeners was opened by the development of Frequency Modulation?" Charles C. Barry, ABC's national program manager, testified on July 12th: "I am not an engineer, but in writing that line I mean to convey this thought: that the Frequency Modulation form of transmission is cleaner, purer, and more faithful to the original sound produced in the studio, and as such any owner of an FM set or purchaser of an FM set had, in effect, a new listening pleasure or thrill awaiting him; and we, as broadcasters, would participate in that new listening horizon by originating and transmitting over FM programs which would give greater enjoyment to the listener."

FM AND TELEVISION



# American Broadcasting Company

Proposed FM Network



**LEGEND**

- Licensed FM Stations and Affiliates of ABC holding C.P.'s for FM Stations.....79 Stations
- ◐ FM Applications Pending.....42 Stations
- ◑ Markets where ABC would add AM and FM Stations.....35 Stations
- Markets where ABC has an AM Affiliate and would add an FM Station.....87 Stations

**TOTAL 243**

May 20, 1946  
ABC Network Network Data



# SHOULD THERE BE AN IFMB ASSOCIATION?

## Comments on the Proposed Association of Independent FM Broadcasters, to Which Stations with AM Affiliates Would Be Admitted as Non-Voting Members

IN the *What's New This Month* column of our June issue, on page 44, we discussed the rise and fall of the original FMBI, organized before the war to advance the progress of FM broadcasting, but now shrunk to the status of an atrophied appendage of the National Association of Broadcasters.

Why did this come about? In 1940, the active and able efforts of FMBI won a substantial place in the radio spectrum for FM broadcasting. As a result of carefully-planned testimony before the FCC, the Commission assigned the new art a band from 42 to 50 mc. After experiencing a setback at the beginning of the war, FMBI membership began to grow again, useful activities were resumed, and in 1944 an engineering conference was held in New York City which, by the very large attendance, showed far more widespread interest in FM broadcasting than had been expected.

And that was the end of any significant activity on the part of FMBI. A second annual engineering conference, originally scheduled early in 1945, was called off, although Television Broadcasters Association held their meeting, which included demonstrations of television reception.

Then, in Milwaukee, on VJ-Day, FMBI decided that this organization should become a department of NAB, under a tentative, one-year arrangement. Whether the arrangement will become permanent, or if FMBI should function independently again will not be known until the NAB conference at Chicago next October.

In considering any plans for a new association of FM broadcasters, two points should be borne in mind:

1. Although no official statement was ever issued by the officers of FMBI, it is generally understood that word went out to AM broadcasters who had or were planning to erect FM stations that AM interests would not be served by efforts to accelerate the advancement of FM. Since all the officers and board members of FMBI were AM operators with FM affiliates, and with AM still footing the broadcasters' bills, it is easy to see that any such pressure, however indirect, would have been highly effective in drying up the support of FMBI, and would explain why everything stopped after the very successful 1944 conference.

For that reason, it appears advisable, as proposed in our June issue, page 44, that any new association, if one is to be organized, should be limited in voting membership to independent FM stations,

while those with AM affiliates, together with the manufacturers, should be admitted but restricted to non-voting status.

Only in this way can the new association put its full support behind the advancement of FM broadcasting in 1) matters relating to the FCC, labor, engineering, and equipment, 2) educational activities such as seminars and demonstrations for the information of agency executives, program directors, engineers, and the radio trade, 3) formulating plans for high-fidelity wire or radio networks, 4) setting up standards of receiver performance which will assure the availability of adequate receiving sets, honestly rated as to their operating characteristics, and 5) to explore the possibilities of simultaneous sound and facsimile transmission.

2. The second point which must be borne in mind is that, as FM broadcasting spreads throughout the Nation, the FM association will gradually become directly competitive with NAB, and there will eventually be a question of the survival of one organization or the other. This situation might put new life into NAB which, as far as can be seen from the outside, now functions in such a desultory manner that it has not yet even come to grips with the AFM.

It is even possible that NAB might organize an FM department, composed of members who have filed FM applications, to fight a new association of independent broadcasters. Since NAB is dominated by AM network members, there might be reprisals against independents, by threatening to deny them participation in future facilities set up to deliver high-fidelity programs.

This might draw the fire of the FCC, but the independent FM broadcasters would have to be ready to take action in self-protection, should AM network stations attack them in that way. In any case, the lines would be drawn sharply in a fight for the survival of the inferior service that the public is getting from AM, and the vastly improved service which the public can have if FM broadcasters unite in a determined and well-directed effort to raise the service standards of broadcasting in the interests of listeners and sponsors as well.

The real fight will come when the FM audiences in the larger centers have grown to the point of supporting a new network, using high-fidelity lines capable of giving better service than the present nets with their limited audio capabilities.

To encourage this discussion of an asso-

ciation of independent FM broadcasters, we asked several men whose opinions are of particular interest to comment on the proposal made in our June issue. Their replies are presented here.

### FCC Chairman Charles R. Denny

FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, D. C.

Thank you for your letter of July 12, 1946, inquiring whether I have any views which I would care to express for publication in your August issue on the question of the most effective form of trade association for FM broadcasters. I feel that this is peculiarly an industry problem and an issue on which the Commission should maintain a position of strict neutrality.

However, as you know the Commission is anxious that everything possible be done to bring about the speedy establishment of a nationwide FM service and the Commission would welcome the opportunity to work with any organization of FM broadcasters which has that as its objective.

### Walter J. Damm, Pres. FMBI

STATIONS WTMJ AND WTMJ-FM  
MILWAUKEE, WIS.

I both agree and disagree with your suggestions relative to the need for an FM broadcasters association. There is no question in my mind that FM promotion and the steering of FM into the right paths of the future of broadcasting needs to be supervised by a group that has a real interest in FM. Unfortunately, this takes considerable money and effort, and in my humble opinion there are not enough people willing to put up sufficiently large sums as dues to make this possible. True, as far as numbers are concerned, there are many, but as is so often the case, the many will probably want the few to support the effort.

I cannot agree with you that FM needs a separate association to consider matters relating to labor unions, to hold conferences on program, operation, engineering, and policy problems. These are overall industry problems which should and can only be solved by a general broadcasting industry association.

You will recall that when the FMBI Board discussed the amalgamation with NAB last August it was with the thought in mind that the allocations and general engineering problems of FM had been settled and that there were not a sufficient number of them members of FMBI who



would be willing to pay \$300 a year dues if FMBI were to continue exclusively as a promotional group. Unfortunately, the allocations and engineering problems of FM were not completely settled and there was, and probably still is, much work to be done before these problems are settled.

Insofar as your suggestion that any future FM association be limited to exclusive FM operators is concerned, it is my opinion that this will not work because there will not be enough money forthcoming to do a real job. While I'll admit that the majority of AM-FM operators will not join a second association, I am somewhat of the opinion that there are a number who would be willing to pay considerable dues per year into a promotion FM association, if there is any indication that the exclusive FM operator will join and will not expect to be carried on the backs of a few. It must be remembered that the man starting in FM has plenty of expenses facing him for some time to come, without any revenue in prospect, and to most of these substantial dues in a trade association (at least from my experience) are looked upon as an unnecessary burden.

For any association of FM broadcasters to do a consistent and worthwhile job would take an annual budget of at least \$100,000. Will exclusive FM broadcasters support this? Or, going even farther, can that much money be raised annually even if AM-FM broadcasters who are really sincere about FM are approached? I am not so sure that it can be done without going still farther and taking in the manufacturers. And if you take in the manufacturers and the AM-FM broadcasters, no matter how sincere they are, isn't the exclusive FM broadcasters, whose proportion of the dues from a dollar standpoint will be very small, going to cry "AM and manufacturer domination"?

#### **I. A. Hirschmann**

FM STATION WABF  
NEW YORK CITY

I was glad to have your letter of July 15th. It came just at the time when I was planning to set up a separate FM organization to fight for the rights of the people and the FM owners.

The record of the defunct FM Broadcasters, Inc. and the NAB will disclose that I vigorously opposed this merger at the time, stating that it was the end of an effective FM instrument. That is exactly what has happened.

The people of this country certainly deserve quality broadcasting. They will get it. We at WABF have been fighting for this almost since Major Armstrong developed FM.

I will be glad to meet with any group that want to throw their weight behind FM and to work with or head up such an organization. Perhaps you will have some suggestions.

I am enclosing a copy of my letter of October 2nd, 1945 to Mr. Walter Damm, in which I opposed the merger. (The letter follows):

Our attention has been called to the fact that a Committee is now studying the question of amalgamating in some form; and that the Board has authorized a Committee to consider the "fostering of FMBI's policy through a single trade association."

I wish to register in the name of our FM Station WABF a vigorous protest against any design which will aim at the coalescence of the FMBI with the National Association of Broadcasters. This is not said in any way in derogation of the NAB. We are not in a position to pass judgment on an organization which functions exclusively in the field of amplitude modulation broadcasting.

The interest in the expeditious development of frequency modulation calls for a separate organization which represents the FM operators and which will employ an aggressive program to concentrate on the development of the field of FM.

The NAB to date has functioned as the mouthpiece for amplitude modulation broadcasters. To the best of our abilities we have not been able to discern even any efforts on the part of the NAB or AM broadcasters as a group to expedite the development of the improved form of broadcasting, namely FM. The assumption that the NAB would reconvert itself overnight and become a powerful factor in the furtherance of FM as an acknowledged improvement over the AM field is one that may not hold water. In fact, it may be that NAB's effort may in some way dilute the program of the FM broadcasters.

FM as an improved service cannot at this time afford to throw its lot with any other broadcasting association. It will make progress in direct ratio to its ability to fight its way through to a full recognition by the public of its acknowledged superior service. Any confusion of this issue among the broadcasters or the public will be a disservice to the art of broadcasting in the long run.

#### **Dr. George A. Mayoral**

FM STATION WRCM  
NEW ORLEANS, LA.

With reference to your letter of July 15th, I wish to thank you for giving me an opportunity to express my views regarding the usefulness of a new FM broadcasters association.

It has always been my opinion, since the adoption of FM as a broadcasting medium for the public's service, that FM is destined to take its place as the leading system of broadcasting. It is only as to the time element, in the development of this system, that there is any longer any difference of opinion among the recognized leaders of the radio industry. FM has reached a state of technical develop-

ment far in advance of any other broadcasting system. Only a few unsolved problems remain, especially in the receiver field, and these problems can best be met by the continuous use of the system.

A new association of FM broadcasters can serve as a stimulus for the expansion of the system and undoubtedly FM broadcasters who have no AM affiliations should be the ones to form the nucleus of such an association. I do not believe that those who have AM connections should be excluded from the voting membership of such an association, but I do believe that voting rights should be granted only to those who demonstrate their willingness to work for the advancement of FM and who show their foresight by means of action rather than words, irrespective of affiliation.

There are quite a number of AM broadcasters who certainly are progressive and aggressive and who certainly are 100% behind FM. These men, most of whom now employ regional and local AM channels, can certainly not afford to deny themselves the advantages of FM; it is not good business.

A new FM broadcasters association, therefore, as a successor to the original FMBI, is definitely a step in the right direction to reach the ultimate goal which we all seek: several thousand FM stations throughout the land, with additional network facilities, more open competition, and a greater opportunity for good programming.

A successor to FMBI should be formed with paid working personnel and a central coordinating office, with honorary officers selected from the membership on the basis of ability and willingness to work. We, at WRCM, would certainly enjoy cooperating with such an association and would be willing to contribute our share of work in establishing and organizing such a group for the common crusade—to sell the public the better radio that is FM.

I hope that my ideas on the matter may be shared by others in the industry.

#### **Capt. W. G. H. Finch**

FM-FACSIMILE STATION WGHF  
NEW YORK CITY

I have just had the opportunity of reading your signed column *What's New This Month* in the June issue of *FM AND TELEVISION*, page 44, and particularly paragraph 2 in which you stress the need for a separate FM Broadcasters' organization independent of the NAB.

It is my considered opinion, as a pioneer FM Broadcaster and owner of the new FM-Facsimile broadcasting station WGHF in New York City, that the need for such an organization is extremely urgent. As pointed out in your column, the NAB has its hands full of AM matters. So, naturally, we need an organization devoted exclusively to promoting the

(CONCLUDED ON PAGE 37)



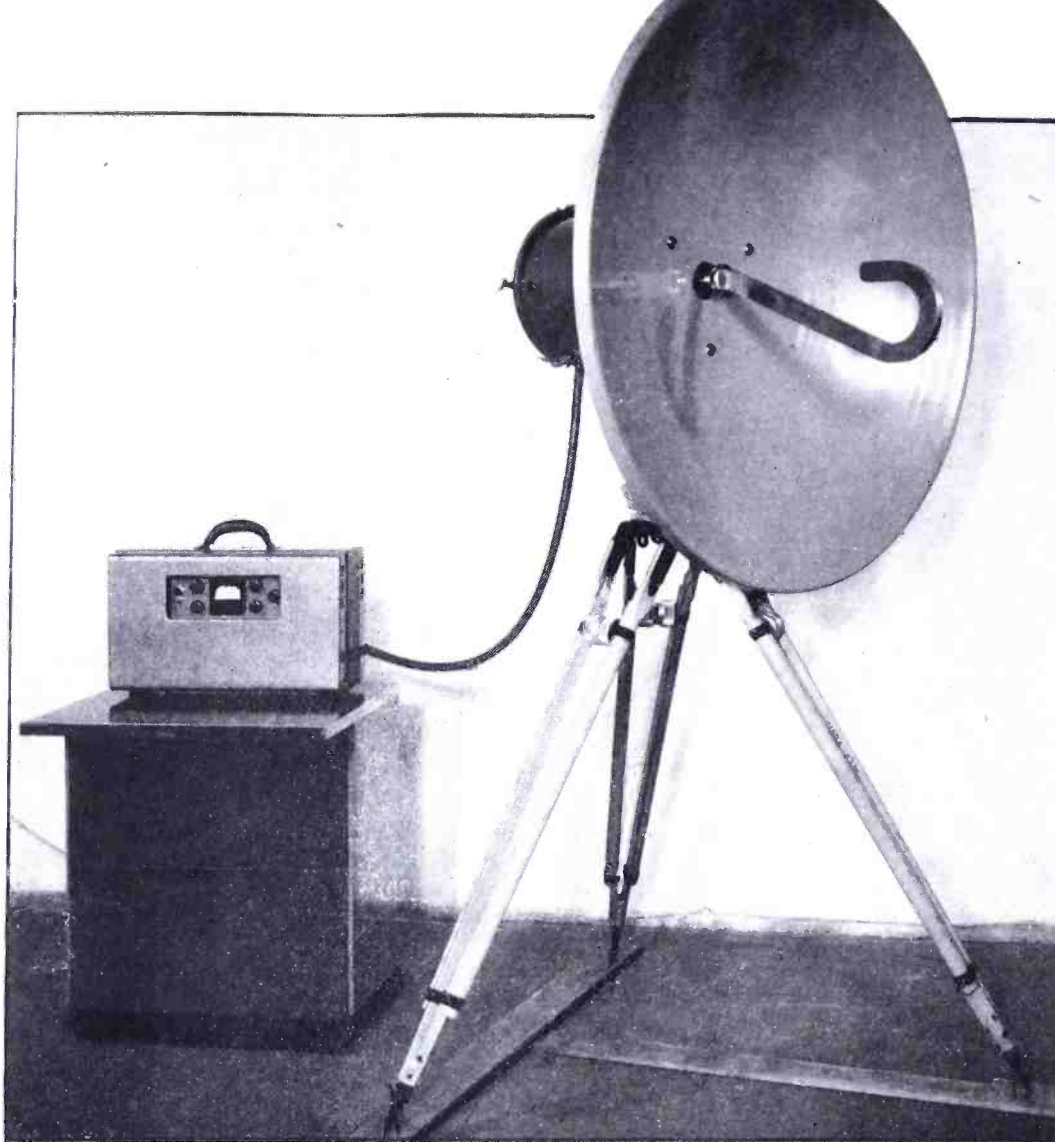


FIG. 2. TELEVISION RELAY TRANSMITTER USING REFLEX KLYSTRON CIRCUIT

recent years, there have been a number of one-of-a-kind installations which have been in more or less regular use for television relaying. However, the equipment shown on these pages differs from all such previous equipments in three important respects, which are:

(1) It uses war-developed reflex Klystron circuits in both transmitter and receiver. This makes possible an equipment which is small in size and relatively light, so that it is suitable for mobile as well as fixed use.

(2) It operates on much higher frequencies (6,800 to 7,050 mc.) than have been used previously for this service, thereby making possible high-gain antennas which provide much better signal-to-noise ratios.

(3) It is not experimental, one-of-a-kind equipment made for the manufacturer's own use, but rather a production design of which the units shown here are the first from a factory assembly line, set up to turn out identical units in quantity.

**Need for Radio Links** ★ Because of the 4.5-mc. bandwidth required for transmitting video signals, the telephone lines presently used for aural broadcasting purposes are not satisfactory for television service. Coaxial lines and specially-equalized wire pairs can be used in some instances, but the cost of installing and maintaining such circuits is likely to be high. For this reason, radio links are expected to find much use. Applications will include 1) inter-city network links, 2) studio-to-transmitter links, and 3) field pickup links. Indications are that the first of these, that is, the network connections, will be supplied by common carriers. The second and third, however, will be provided by the stations themselves in many instances. The equipment described here is designed primarily, therefore, for studio-to-transmitter and field pickup links, with special emphasis on portable use. A typical example was the relay transmission of the Louis-Conn fight telecast from the Yankee Stadium, at New York. Fig. 1 shows the camera set

# MICRO-WAVE TELEVISION RELAY

## Describing Standard Units for FM Television Relays, Operating on 6,800 to 7,050 Mc.

BY W. J. POCH AND JOHN P. TAYLOR \*

THE fact that television relay equipment, designed for operation in the micro-wave bands, is now in quantity production indicates that another mile-stone of video progress has been reached. This equipment is being produced at RCA's Camden plant, and includes transmitters, transmitter control units, antennas, receivers, and receiver control units — all of the units required for a complete point-to-point installation. The first set of this equipment has been delivered to NBC at New York City, and is now in operation. Additional equipments are nearing completion, and it is expected that by late fall production will be sufficient to meet the requirements of the television stations under construction or in operation at that time.

Radio link circuits for television are, of course, not new in themselves. They have been the subject of speculation and ex-

perimentation since RCA first demonstrated this application in a circuit from Long Island to New York in 1936. In

FIG. 1. THE RELAY EQUIPMENT SHOWN HERE WAS USED AT THE LOUIS-CONN FIGHT



\* Engineering Products Dept., Radio Corporation of America, Camden, N. J.



up on this occasion.

**Advantages of Microwaves** ★ Most of the radio link circuits in use at present for television service operate at frequencies of 170 to 350 mc. Although these have been fairly satisfactory for some purposes, they are frequently disturbed by interference due to harmonics of broadcast stations, amateur transmitters, diathermy equipments, and ignition noise. Directional antennas were employed but the gain was relatively low, the transmitted beam rather broad, and reflections from buildings and airplanes flying overhead occasionally caused ghosts. Moreover, when the range is more than a few miles, substantial power is needed so that the equipment required is too heavy and bulky for field pickups.

The new RCA television relay equipment is designed to operate in the band from 6,800 to 7,050 mc. At these frequencies the wavelength is less than 5 centimeters, permitting the use of antennas which have very high gain, but are relatively small in mechanical dimensions. For example, the parabolic reflector for the new relay transmitter shown in Fig. 2 is 4 ft. in diameter, and has a gain of 5,000. For fixed installations, larger parabolas of even higher gain are practical.

This high gain affords two big advantages. First, it provides relatively high equivalent power from a very low transmitter power. For example: using the 4-ft. parabola shown in Fig. 2, and a transmitter power of only 100 milliwatts, an equivalent power of 500 watts is obtained. This makes possible very simple, small-size, light-weight transmitter units. A second and equally important advantage is that transmitted power is concentrated in a very narrow beam. The receiver, Fig. 3, using a similar antenna, has a very narrow angle of pickup. When the two antennas are lined up on each other, an exceedingly selective path is provided. This has the effect of eliminating all extraneous reflections, whether from fixed or moving objects. The narrow reception angle, together with the negligible interference at these extremely high frequen-

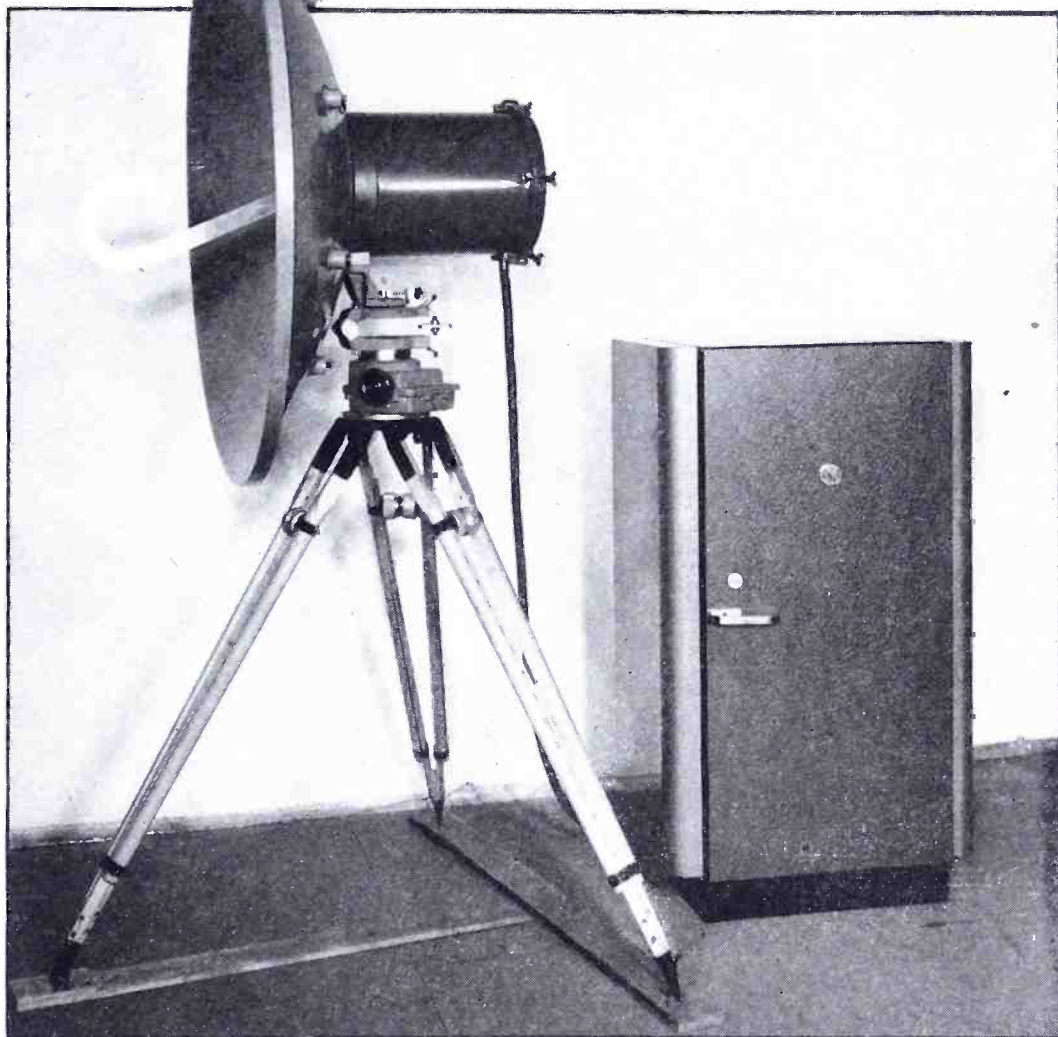


FIG. 3. RELAY RECEIVER PROVIDES NOISE-FREE RECEPTION AT 15 MILES OR MORE

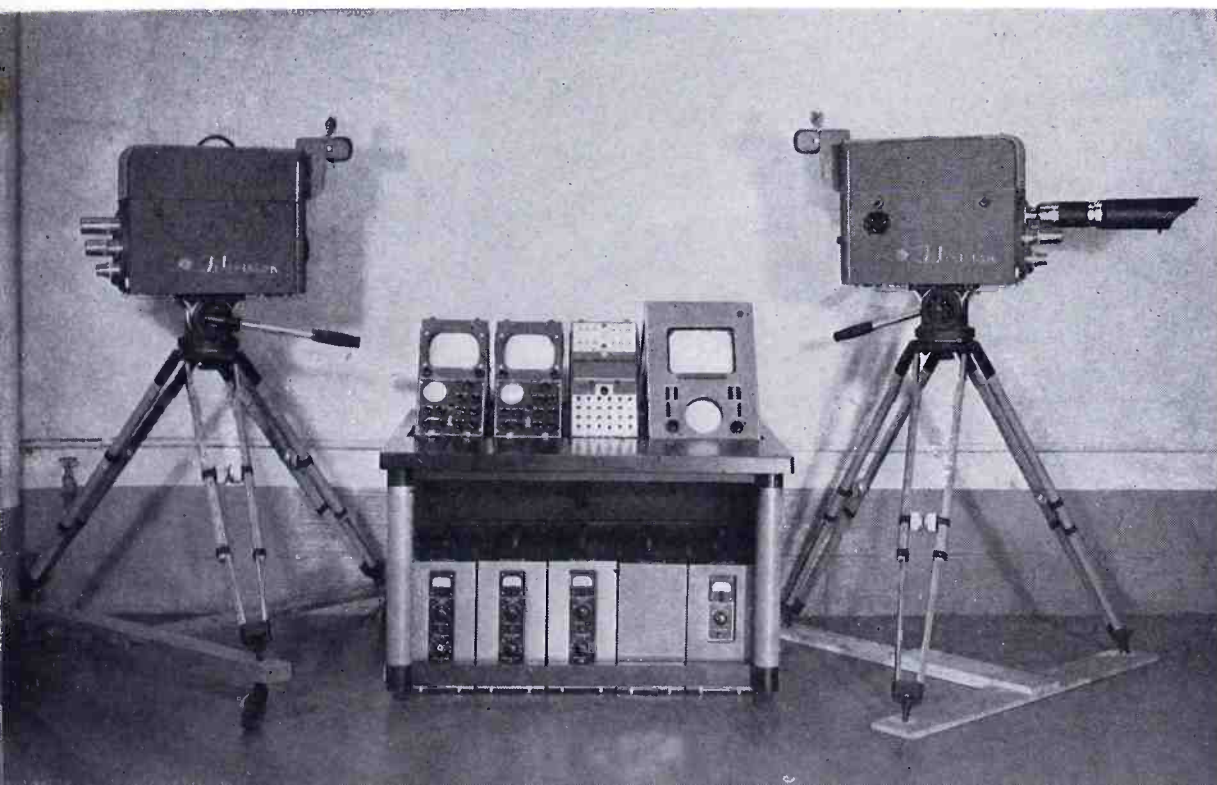
cies, provides almost noise-free transmission over line-of-sight paths up to 15 miles or more. There are other advantages to the use of microwaves, such as the availability of many channels, the ease with which wide-band modulation may be obtained, and the fact that numerous links can be operated in the same area without interference.

**Tests of the System** ★ Although the advantages of a microwave system seemed obvious, RCA engineers, nevertheless, did not go ahead with design of a commercial product until after exhaustive tests had been made. Starting about two years ago, several experimental models were built

and field-tested. One of these was permanently installed as a link connecting a studio in the RCA plant in Camden with the transmitter control room of W3XEP, RCA's experimental television station, which is 1½ miles away. In the 15 months this circuit has been operating, it has carried nearly 100 scheduled transmission tests. At no time has any trouble whatsoever been encountered from noise or interference, even though the main antenna of W3XEP is within 200 ft. of the relay receiver.

A second set of equipment, very similar to the final design, has been in use for various purposes during the last nine months. It has been operated on a number of occasions as a portable equipment to pick up programs for W3XEP at remote points in Camden. In such cases, the video signal is sent back to the studio and from there to the transmitter by the studio-transmitter link mentioned above. This use of two of these equipments in series, so to speak, did not result in any degradation of the picture, showing that such multiple use is entirely practical. The equipment was also used during the demonstrations of RCA color television at Princeton last December and January, to transmit the video signal from the RCA Laboratories to the Princeton Inn. It was used with great success by NBC to transmit the proceedings of the UNO at Hunter College back to Radio City, a distance of 9 miles. It has been tested over a 23-mile path from Freeport, Long

FIG. 4. TWO OF THE NEW RCA CAMERAS WITH THE ASSOCIATED CONTROL EQUIPMENT





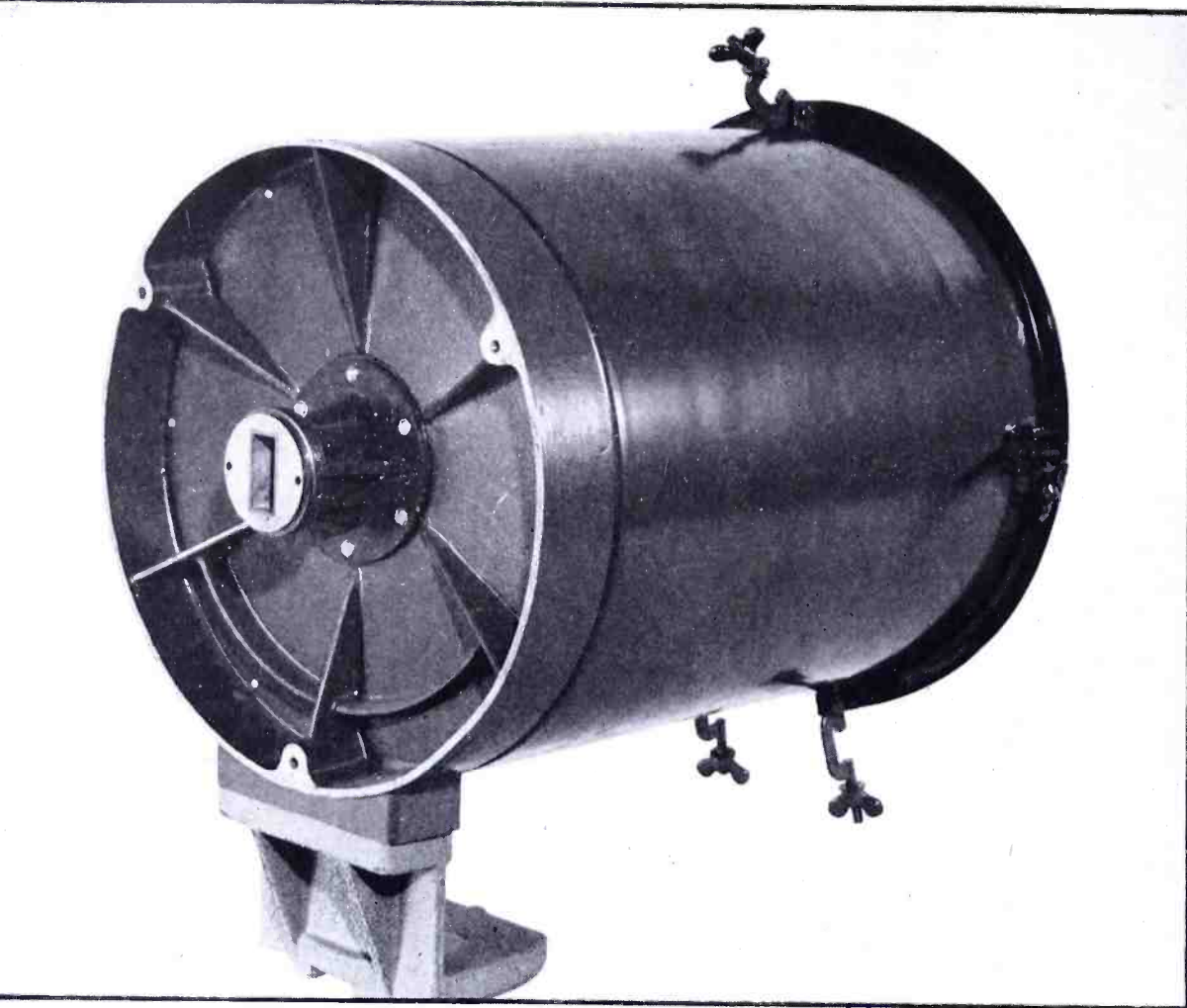


FIG. 5. TRANSMITTER UNIT WITH WAVE GUIDE WHICH CONNECTS TO REFLECTOR UNIT

Island to Radio City. At this distance, some noise was introduced by the relay link, but it was considered to be less than that contributed by the cameras themselves. On the basis of these tests, it appears that this equipment will be very satisfactory for line-of-sight distances up to 15 or 20 miles.

**Arrangement of Equipment Units** ★ This equipment, as previously noted, was designed with an eye to the requirements of portable use. For this reason the several units of which it is composed have been made as light and as portable in form as possible. The general arrangement of the transmitter components is shown in Fig. 2. The

antenna consists of a metal parabola which focuses into a narrow beam the power fed to its focal point by a hook-shaped wave guide. Parabolas 4 ft. and 6 ft. in diameter are available. The wave guide is a hollow metal pipe. The cross-section of this pipe,  $1\frac{1}{2} \times \frac{3}{4}$  ins., is such as to provide optimum performance over the band of 6,800 to 7,050 mc.

The transmitter proper is enclosed in a cylindrical weather-proof housing, rigidly attached to the back of the parabola. This arrangement makes possible a very short wave guide transmission line between transmitter and antenna, and eliminates all the matching and loss problems encountered when the transmitter and antenna are located at different points.

The combined transmitter-antenna assembly is provided with either of two types of mountings. One of these, shown in Fig. 2, is a rotatable type which allows the parabola to be moved through a wide angle in either the horizontal or vertical planes. Calibrated scales are provided so that the approximate direction can be set by compass. When the equipment is used in portable form for field pickups, the assembly can be mounted on a heavy tripod as shown here. For fixed use, a more permanent mounting is desirable, and a second type of mounting, which provides for only small adjustments of horizontal and vertical directions, is available for this purpose.

The power supply for the transmitter and the operating controls are contained in a small suitcase type unit, Fig. 2, which can be located as much as 400 ft. from the transmitter-antenna unit. Connections are made by a single cable of the same type used between cameras and

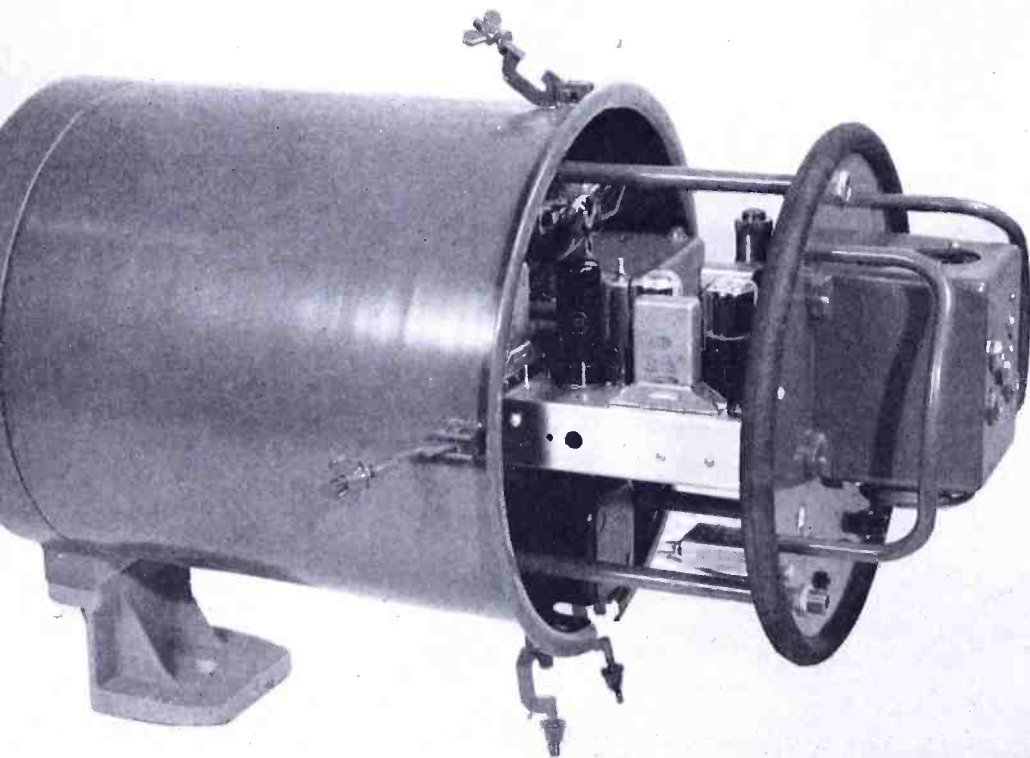


FIG. 7. CHASSIS SLIDED OUT FROM THE TRANSMITTER HOUSING. WEATHER-PROOF SEAL IS USED TO PROTECT THE CHASSIS

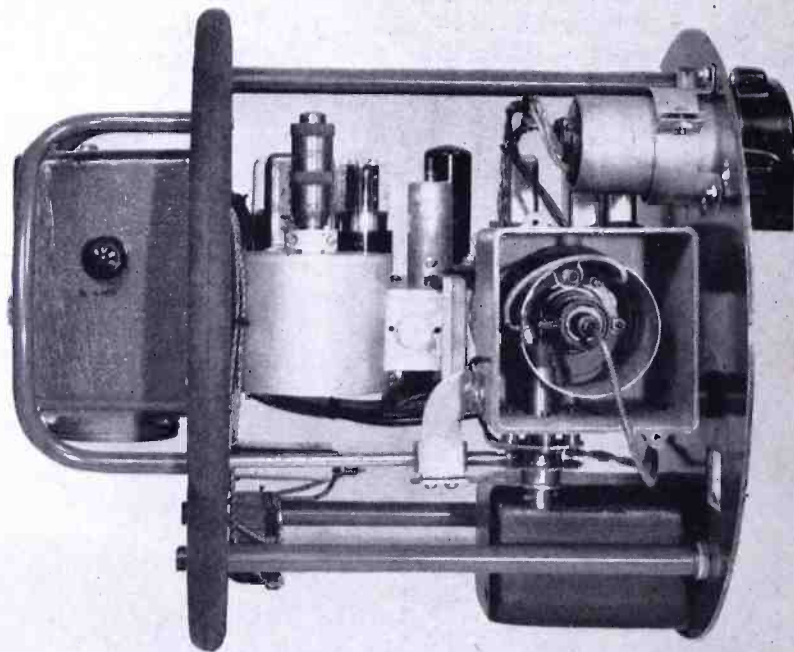


FIG. 8. VIEW OF THE TRANSMITTER CHASSIS. THE COVER OF THE KLYSTRON COMPARTMENT IS OFF SHOWING THE TUBE



camera control units. Thus, for field use, the transmitter-antenna assembly can be placed on some high point, such as the top of a stadium, while the control unit is located at some more convenient point as, for instance, with the camera control and switching units. For fixed use, the transmitter-antenna can be mounted on the top of the building or a tall tower, with the control unit mounted on a rack in the studio control room.

A view of a 2-camera set up, with the associated camera controls and switching units, is given in Fig. 4, with a close-up of the control desk in Fig. 13.

On the top of the control desk, from left to right, are the individual camera controls, a master switching unit, and a master monitoring unit. Below, left to right, are two individual camera power supplies, master power supply, pulse-shaping unit, and a pulse-forming unit. These controls can be installed as much as 500 ft. from the cameras.

The camera control contains, in addition to the control circuits for the camera, a 7-in. high-quality viewing monitor and a 3-in. oscilloscope. Camera driving pulses are generated in the camera control unit and transmitted to the camera through the connecting cable. A video amplifier incorporated in the control unit feeds the camera signal by coaxial cable directly to the micro-wave relay transmitter or, where more than one camera is used, to a master monitor.

The regulated power supply unit takes 110-volt, 60-cycle power from almost any standard outlet. The total current drain for a camera and camera control unit is only 8.5 amperes.

The pulse generator, providing the

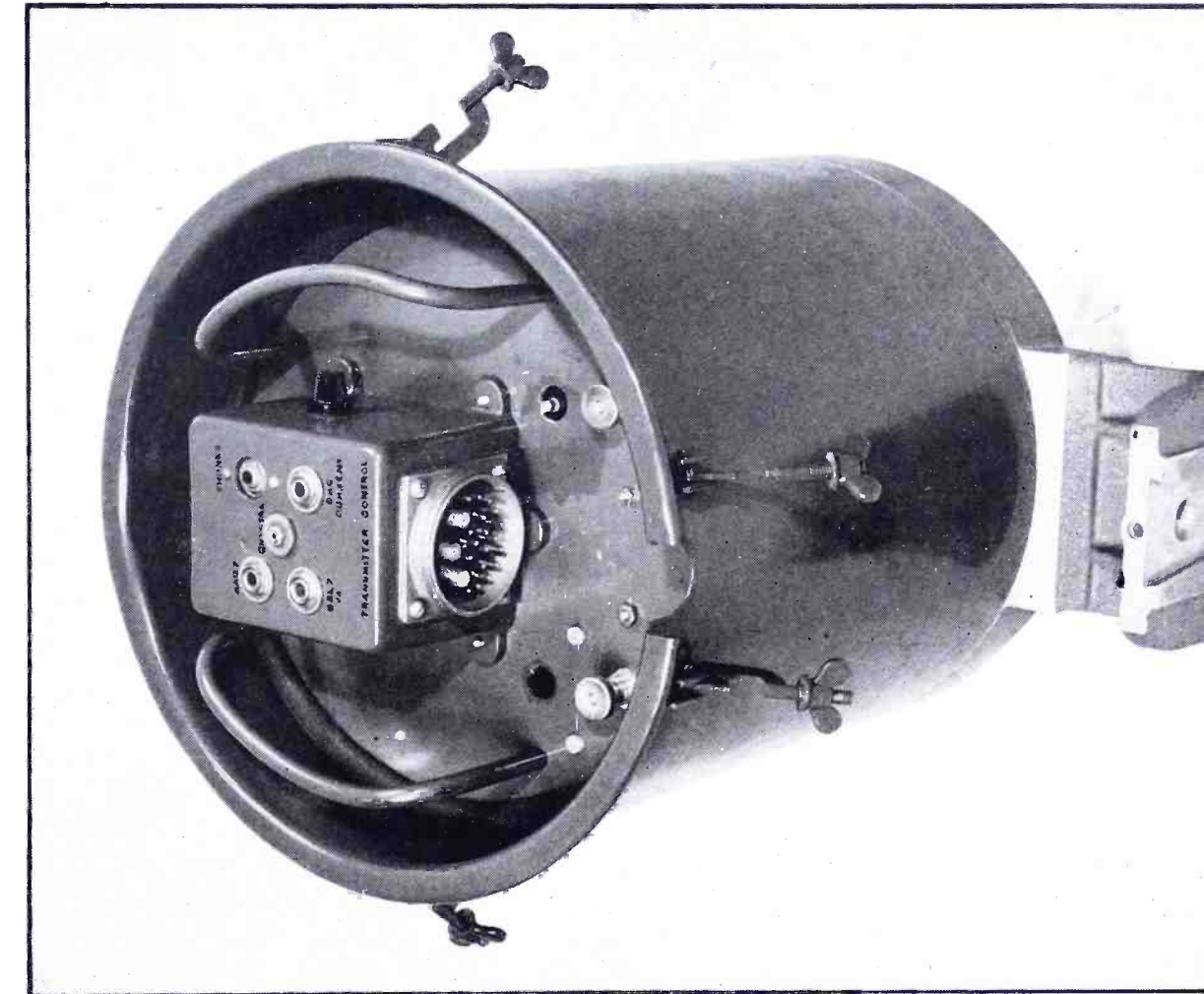


FIG. 6. LID REMOVED TO SHOW CABLE CONNECTOR, JACKS, AND 110-V. OUTLET

standard sweep frequencies for the camera, has a self-contained power supply for its operation and for the pulse-shaping unit. The latter includes circuits for generating the blanking and synchronization voltages from the master pulses. These two units can be used with one or more cameras.

The master control unit provides for adjustment of deflection and blanking. A 10-in. high-quality picture tube is employed for monitoring the picture transmission, and a 5-in. oscilloscope allows for adjusting the signal level and synchronization. From this point, the video signals are carried by coaxial cable to the micro-

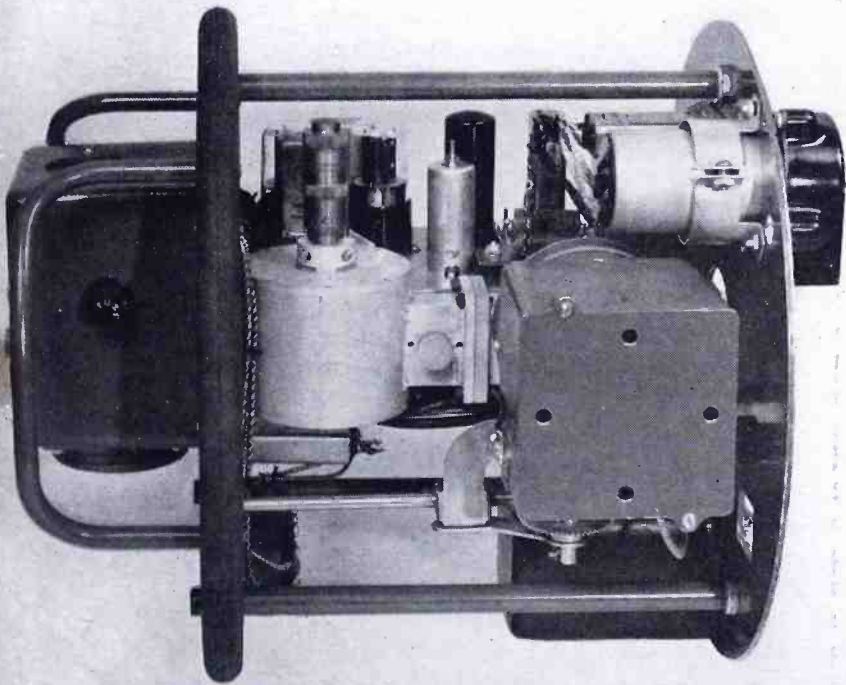


FIG. 9. IN THIS VIEW, THE UNIT IS READY FOR USE, AND THE COVER OF THE KLYSTRON COMPARTMENT IS IN PLACE

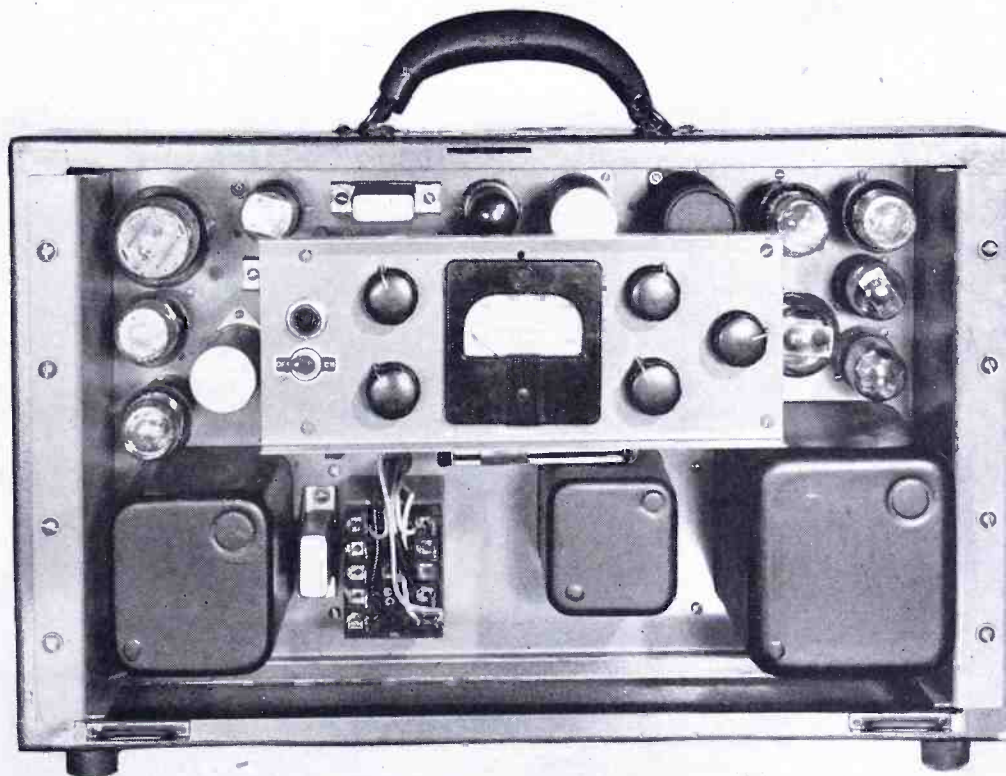


FIG. 10. THE TRANSMITTER CONTROL IS MOUNTED ON A STANDARD CHASSIS, AND FITS EITHER A RACK OR A CARRYING CASE



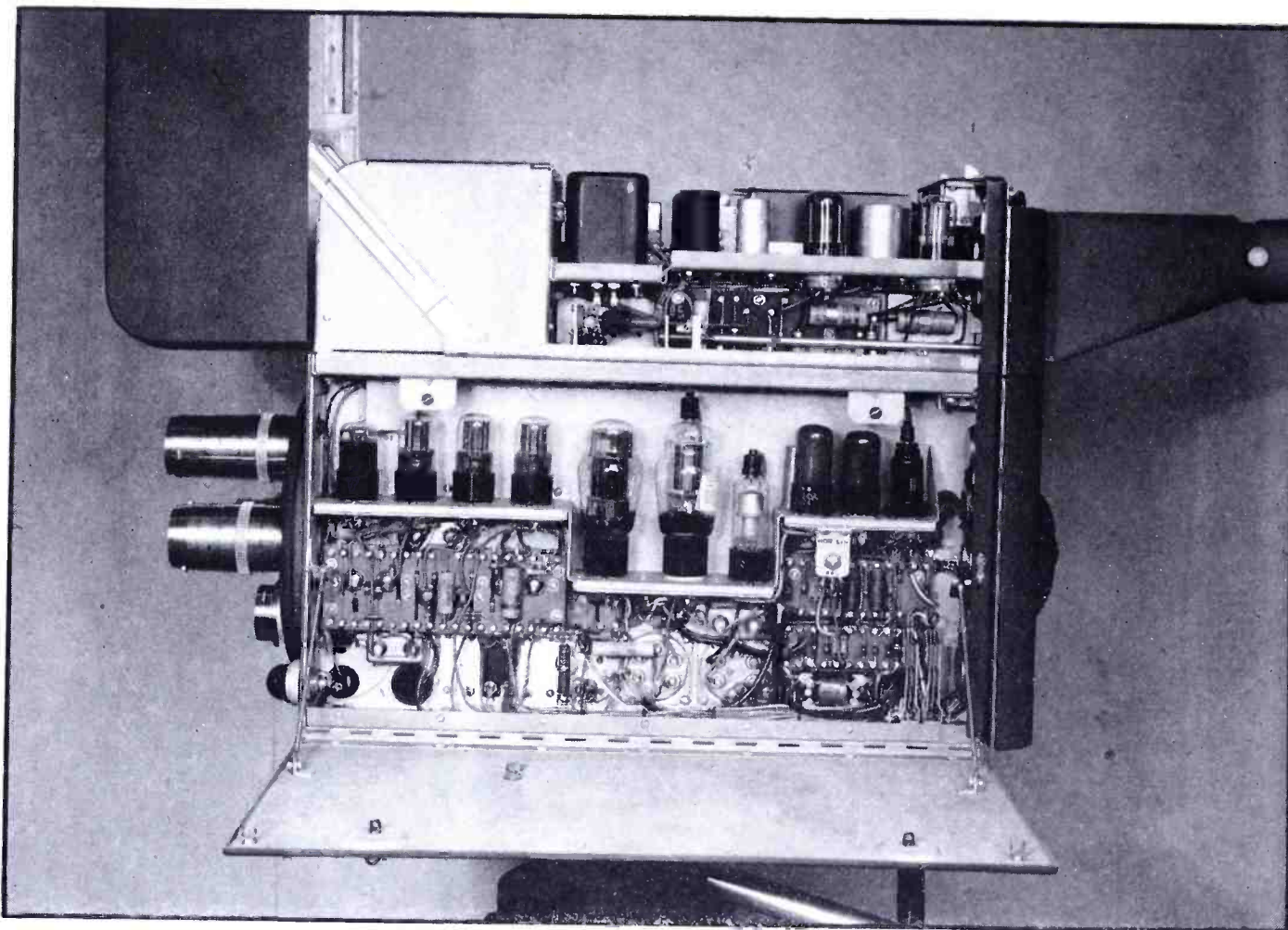


FIG. 11. IMAGE ORTHICON CAMERA WITH THE TOP RAISED AND THE SIDE LOWERED, GIVING ACCESS TO THE TUBES

wave transmitter and beamed to the television station.

The switching unit provides for changing from one camera to another with as many as 4 cameras in use, or from remote pickup to film or studio. It also serves as the center of an intercommunication system which enables the program director to supervise all actions of cameramen, announcers, and other personnel, in some cases located as far as 500 ft. away.

The entire equipment can be transported to a field pickup location in a station wagon or a light truck. If a truck is used, the monitoring equipment, power units, and synchronization generators can be mounted on built-in tables and racks and operated from the truck. With a larger type of truck, it is possible to transport a gasoline engine power supply for pickups where no utility power line is available. It is sometimes found advantageous to mount the microwave transmitter on the roof of the same truck for transmission to the studio.

Figs. 11 and 14 show the latest RCA Image Orthicon camera with turret lens mounting.

The interior view of the Image Orthicon camera, Fig. 11, was taken with the hinged side panel and cover open, disclosing the pre-amplifier in the lower section and the electronic view finder above. The camera tube is housed in a center compartment.

The arrangement of the receiver components, Fig. 3, is similar to that of the transmitter. The antenna is identical except, of course, that in this case the parabolic reflector picks up the signal and the

wave guide feeds it to the receiver unit mounted in the can attached to the rear of the parabola. This receiver unit includes only the heterodyne oscillator, first detector, and five IF stages. Signals at IF frequency are fed from this pre-amplifier to the remaining stages of the receiver which, along with the receiver operating controls, are located in a re-



FIG. 12. TRANSMITTER CONTROL UNIT IN PORTABLE CARRYING CASE

ceiver control unit, also shown in Fig. 3. Like the transmitter control unit, it can be located as much as 200 ft. away. This receiver control unit requires a separate power supply unit of similar size. Each unit is mounted on a chassis of standard bathtub design. Thus they can be put in carrying cases of the type shown in Fig. 2, on standard equipment racks, or in small cabinet racks as in Fig. 3.

Since the receiver is ordinarily used at a fixed point, the usual arrangement will be to locate the receiver-antenna on a tower or other high-point, with the control and

power units mounted on racks in the studio or transmitter control room. However, it may be necessary in some cases, in order to get a line-of-sight path, to use some intermediate receiving or relaying point, in which case the portable arrangement would be used.

**Details of Transmitter** ★ The transmitter chassis, mounted in the cylindrical case, Fig. 5, is attached to the parabola. It contains the oscillator and modulator circuits, a monitor and a wave meter. When the lid of the weather-proof case is opened, Fig. 6, the chassis connections are made accessible. These connections include the large cable from the transmitter control unit, a jack for interphone communicating with the control point during setup, a jack for monitoring and another for metering. The latter are used only during test adjustments. There is also a convenient 110-volt outlet.

To provide for easy maintenance and replacement in case of emergency, the transmitter chassis is made demountable. When three thumb-nuts are removed, the whole chassis can be slid out of the case, as shown in Fig. 7. The chassis itself is shown in Figs. 8 and 9. At the center of the chassis assembly is the wave guide which extends the length of the unit. The oscillator, a type 2K26 Klystron, is mounted in the shielded compartment at the right in Fig. 8, in such position that its base extends into the wave guide. The oscillator compartment is temperature-controlled to improve the frequency stability. Tests indicate that after a warm-up



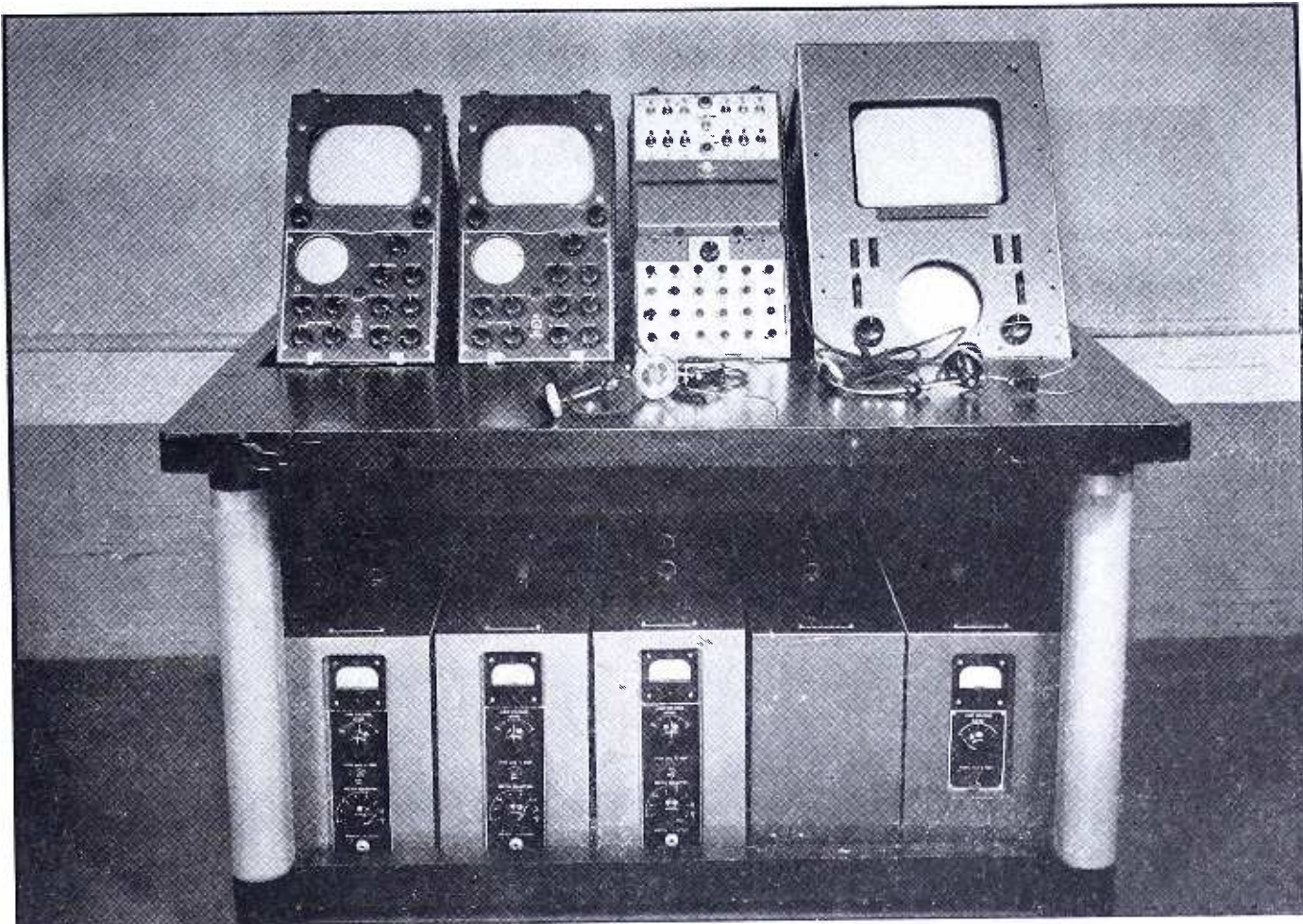


FIG. 13. CLOSE-UP VIEW OF THE CONTROL DESK, EQUIPPED FOR 2 TO 4 CAMERAS, USED WITH THE RELAY UNIT

period for 15 minutes, this oscillator will hold its center frequency within  $\pm 2$  mc. for periods of an hour or more. Power output of the oscillator is approximately 100 milliwatts.

The oscillator is frequency-modulated by varying the reflector voltage at video frequency. Normal deviation is approximately 8 mc. with polarity such that the video signal in the white direction causes an increase in transmitter frequency. The 6AG7 modulator tube receives its input voltage from one of the coaxial lines in the connecting cable. A peak-to-peak input signal of .65 volt from the transmitter control unit is sufficient for normal modulation of the transmitter. The frequency characteristic of the overall system is flat from 60 cycles to 6 mc. The phase shift at low frequencies is low enough that a 60-cycle square wave at the input will appear in the output with less than 5% tilt.

A wavemeter, at the left center in Figs. 8 and 9, coupled into the wave guide, provides a reference for transmitter frequency calibration. This wavemeter is made of invar to minimize temperature effects, and is sealed to eliminate humidity effects. A crystal detector is also coupled into the wave guide. The DC output of the crystal, which is a measure of the transmitter output, can be read either at the transmitter or at the transmitter control location. The AC output of the crystal, which gives an indication of the type of modulation and hence can be used to monitor modulation, is amplified by a buffer amplifier and sent over one of the

coaxial lines to the transmitter control.

**Transmitter Control Unit** ★ The transmitter control component and the regulated power supply are assembled on a rack-width, bath-tub type chassis, Fig. 10, which can be mounted on a standard relay rack or in a carrying case, Fig. 12.

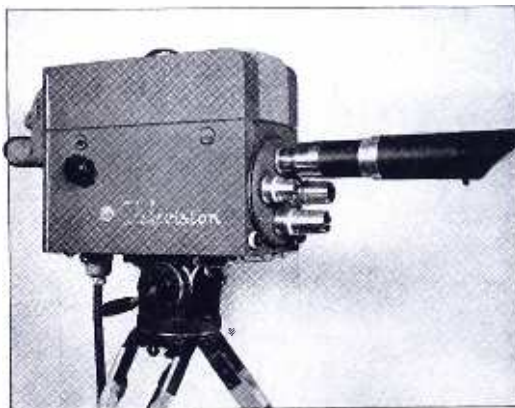


FIG. 14. IMAGE ORTHICON CAMERA WITH THE NEW LENS TURRET

The controls incorporated in this unit are mounted on a small sub-panel behind an opening in the carrying case. One of these controls provides a means of adjusting the transmitter modulation. Another switches the output from the normal video voltage to either of two 60-cycle test voltages, of fixed amplitude, which are used to check deviation and output of the transmitter.

The regulated power supply provides 300 volts for the oscillator and modulator tubes, and a regulated negative supply for the oscillator reflector voltage. This can

be adjusted from -250 to -100 volts with a normal output of 5 milliamperes. Both supplies maintain a substantially constant output voltage for an input variation of 100 to 130 volts. Total power required from the AC line is 150 watts.

**Description of Receiver** ★ The receiver chassis, mounted in the cylindrical case on the back of the receiver parabola, contains the heterodyne oscillator, the first detector, and four IF stages of the receiver. This chassis, Figs. 15 to 18, is mechanically similar to the transmitter chassis, and can be removed in the same way. It is connected with the receiver control unit, which can be as much as 200 ft. away, by a single connecting cable of the same type as the transmitter cable.

The heterodyne oscillator is a type 2K26 Klystron, designed for operation in the band 6,800 to 7,050 mc. This oscillator beats with the incoming frequency to provide, in the crystal 1st detector, a difference frequency in the IF bands of 110 to 130 mc. Five stages of IF amplification follow the detector. The output of the 5th IF stage is fed to the receiver control unit over one of the coaxial lines in the connecting cable.

Jacks are mounted on the receiver chassis so that crystal detector current and the grid current of the IF limiter stage in the receiver control unit can be measured readily. When the IF gain is reduced until the grid current in the limiter stage is reduced to half normal value, by turning a knob on the receiver control, the setting of the gain control will indicate relative



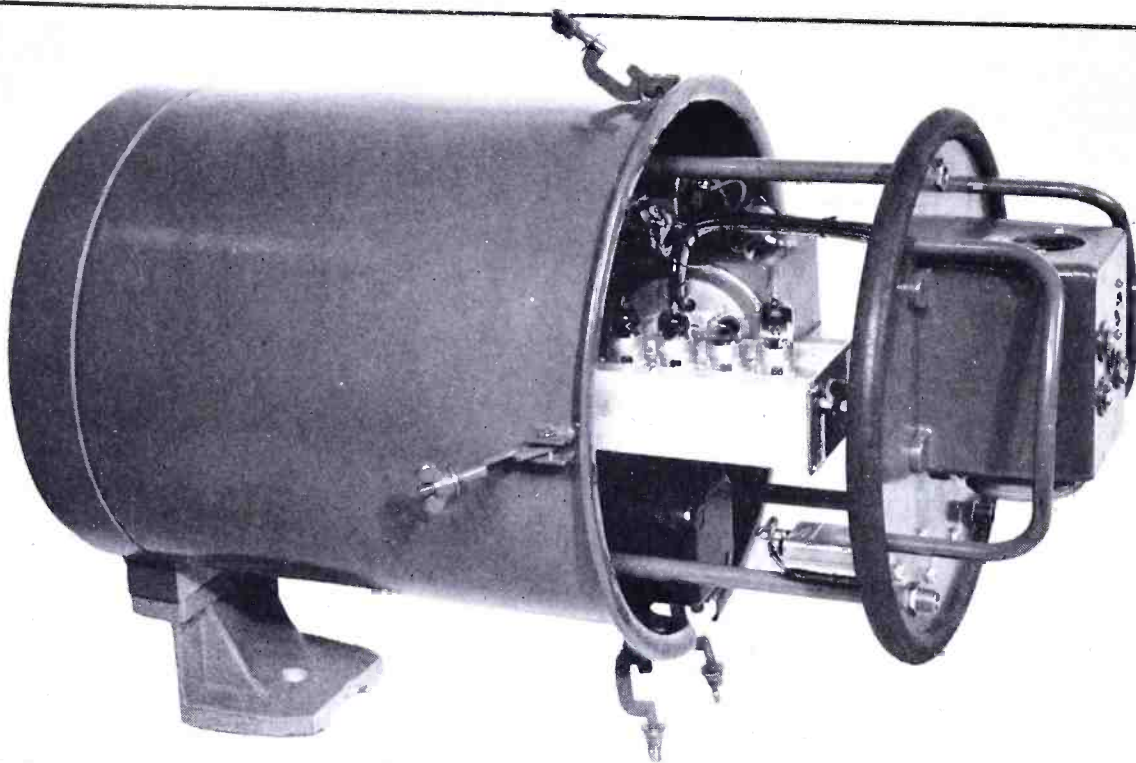


FIG. 15. RECEIVER MOUNTING IS SIMILAR TO TRANSMITTER UNIT

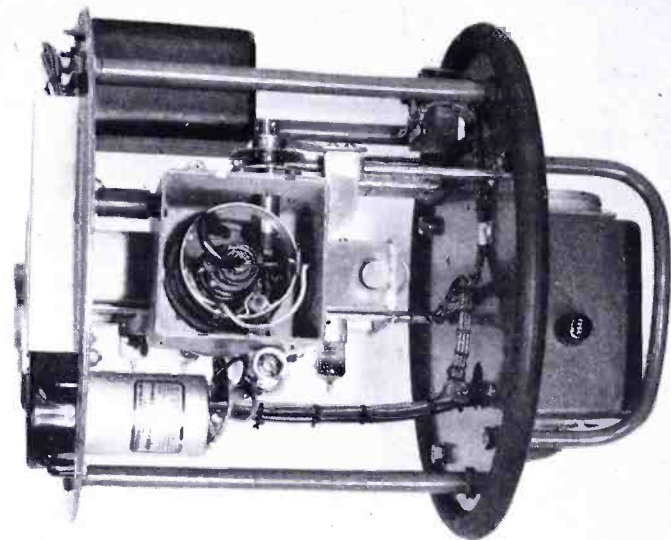


FIG. 16. A TYPE 2K26 IS USED FOR THE OSCILLATOR

input signal. Thus, by using a meter to observe this current, it is possible to adjust the orientation of the reflector in order to obtain maximum output signal.

**Receiver Control Unit** ★ Signals at IF frequency are fed from the receiver proper into the receiver control unit, where they are amplified sufficiently to operate the limiter and discriminator circuits. Two separate discriminator channels are provided.

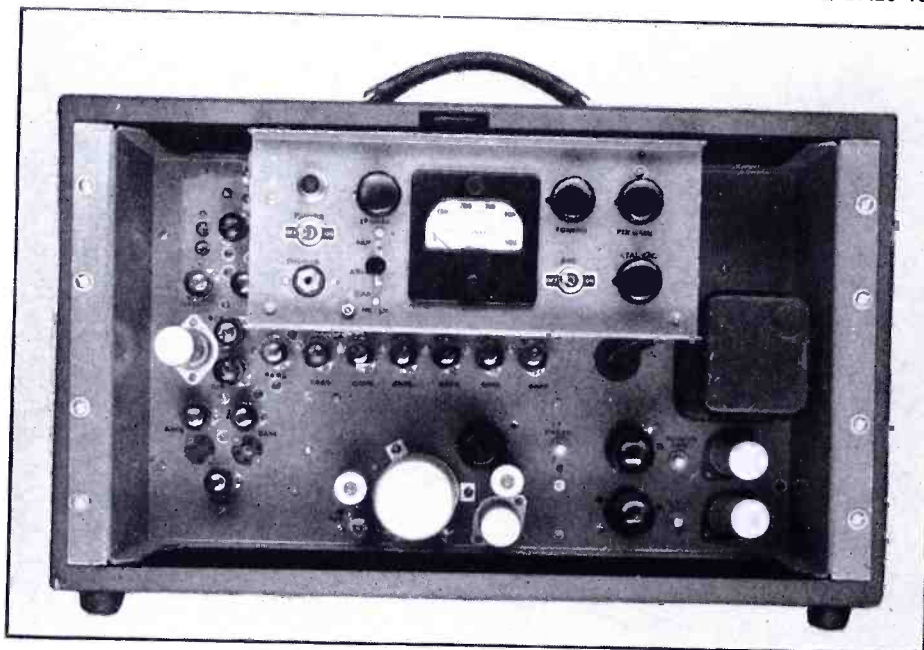


FIG. 19. RECEIVER CONTROL FOR PORTABLE OR RACK MOUNTING

Each channel contains a limiter circuit, a balancing circuit, and the discriminator circuit proper. The first channel supplies video signals to the video amplifier which, in turn, feeds two outputs. One of these is the regular output line to studio control room or to the main transmitter, if the receiver is located at the station. The other supplies signals to the monitor control circuits. The second discriminator channel generates a control voltage

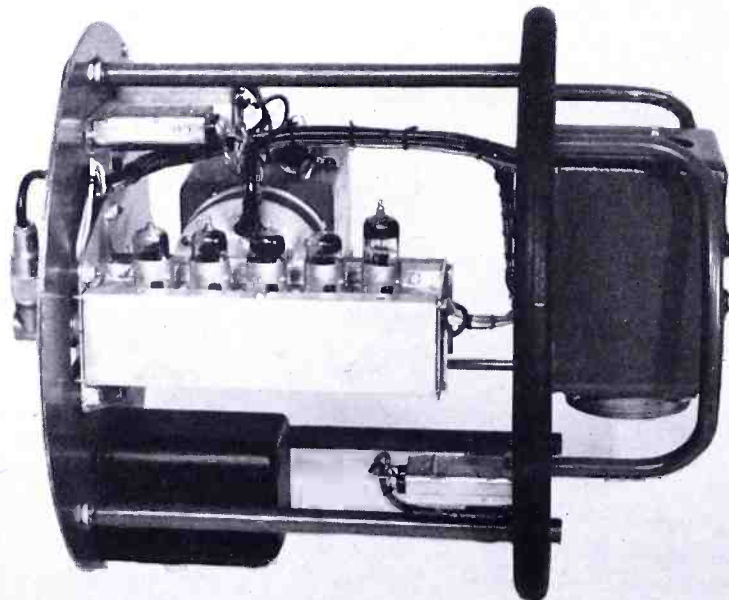
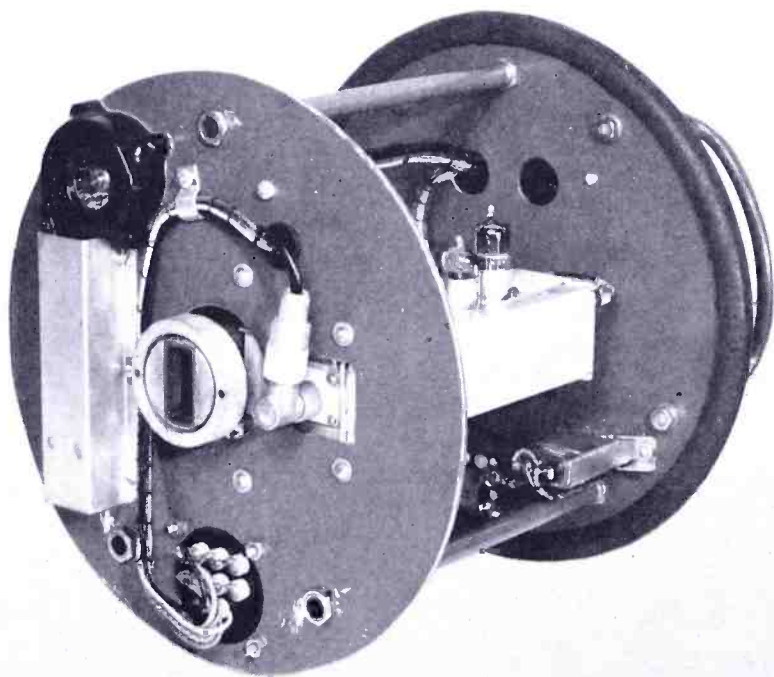


FIG. 17. NOTE THE MINIATURE BLOWER ON THE FRONT OF THIS UNIT FIG. 18. USING SMALL TUBES, CHASSIS HAS 5-STAGE IF AMPLIFIER



for the AFC amplifier. The output of this amplifier is used to control the frequency of the heterodyne oscillator. It operates in such a way that the peaks of the synchronizing signal appear at the same point of the discriminator characteristic within  $\pm 1$  mc., regardless of the picture content. The AFC amplifier is a special type of DC amplifier which receives a DC signal varying at a relatively slow rate, and amplifies this to supply a control voltage to the heterodyne oscillator. This control system keeps the receiver in proper adjustment for a change in transmitter frequency of  $\pm 20$  mc. The control of the voltage output of the

AFC amplifier is the main adjustment on the heterodyne oscillator frequency and,



FIG. 20. PORTABLE RECEIVER CONTROL

therefore, the timing of the receivers. A plug at the rear of the receiver control unit permits the location of a vernier control of frequency and an on-off switch on the AFC amplifier at some distance from the receiver. This allows routine tuning of the receiver at a console location where a monitoring kinescope and oscilloscope are located.

Power supply for the receiver and receiver control unit is obtained from a separate unit. This is a standard RCA type 580-C power supply, similar in construction and size to the receiver control unit, and like it, can be mounted on a standard rack or in a carrying case.

## AN IFMB ASSOCIATION

(CONTINUED FROM PAGE 29)

interests of all those who eat, sleep and dream FM broadcasting. Then and only then can a successful, 100% job be done for FM. Certainly the interests of facsimile, since they are wedded to FM, should be part of the FM program.

Commissioner Durr has outlined a splendid eight-point program. I might add to this that any new plans of such an independent organization of FM Broadcasters should include consideration of facsimile because the FCC has fully authorized experimental facsimile signals to be transmitted by FM Broadcasters.

I believe that the consideration of the points as outlined and the fact that very little is being done to promote the understanding of the common interests and needs of all FM Broadcasters, listeners and sponsors, is the best proof for the need of an independent FM Broadcasters Association.

**Arthur Freed**

FREED RADIO CORPORATION  
200 HUDSON ST., NEW YORK

I have your letter of July 12th, and read with interest the story on page 44 of your June issue, particularly item No. 2, regarding the proposed formation of an association of independent FM broadcasters.

It is my opinion that there is a great need for the creation of a new group or association whose exclusive purpose would be the active support of all needed regulations and publicity which would accelerate the widespread broadcasting of FM programs.

Its membership should not be restricted to FM broadcasters having no AM affiliates. It should be open to everyone who is genuinely interested in immediate FM activity, whether it be in the manufacture of radio transmitters, FM broadcasters, manufacturers of FM receivers, FM radio-phonographs, FM converters, or FM trade publications.

I have been travelling around the country and I know from personal experience that there is a tremendous amount of edu-

ational work to be done among the radio trade and radio public about all phases of Frequency Modulation.

We shall be glad to publish other letters in our September issue if they are received before September 5th. Letters received after that date will appear in our October number.

## WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 4)

a widened tuning band. But, the FCC, under the chairmanship of Paul Porter, threw all that preparation into the discard by the simple process of shifting FM to an entirely new band that imposed radically different conditions. Then, apparently presuming to accomplish engineering miracles by pointing his finger, he announced on August 17, 1945 that 10-kw. new-band FM transmitters would be "immediately available"!

That was a bitter blow to the FM equipment manufacturers who had built their reconversion plans around FM broadcast transmitters or home receivers. Indeed, if this change and delay had been forced upon them prior to Pearl Harbor, it would have meant FM's death sentence. Fortunately, the industry had been strengthened greatly by war experience. With better-equipped laboratories and factories, and better-organized engineering and production departments, the manufacturers discarded all they had already accomplished and were able to make an entirely new start.

In the short time since civilian production started, they have made more progress than would have been possible over a 3-year period before the war. An FM impasse? Why, new band FM transmitters are being installed and FM receivers are being delivered at a more rapid rate now than in 1941! What makes progress seem so slow now is that today the demand is nation-wide.

In our issue of February, 1942, we listed a total of 115 FM applicants and stations on the air. On the first of July, 1946, stations regularly on the air and those that

have started test transmissions totalled 57, construction permits have been issued to 168, conditional grants to 308, and 391 applications are awaiting action. The grand total is 924 FM stations under way in 315 cities spread out over the entire nation.

As for receiving sets — they are being simply swallowed up in areas where there is FM reception. Like new automobiles, they seem to be non-existent only because they are sold before the dealers get them.

In Zenith Radio's report to stockholders at the annual meeting on July 23rd, Commander McDonald told of a test sale run in Streator, Ill., a town of about 15,000 population. He said: "Our three dealers there were told that they could make immediate delivery on all models, but they could not advertise, use newspaper publicity, or make out of town sales. In 4 1/2 days they sold \$46,000 worth of Zeniths. — Sales on the last day were larger than on any other, and our highest-priced model, with 2-band FM and the Cobra tone arm, was the best seller."

Impasse? Webster's Dictionary defines the word as meaning "an impossible road or way, a blind alley; hence, a position or predicament affording no escape." Well, perhaps Tom Kennedy has been around asking dealers if they had any FM sets in stock. And if they answered him the way soda clerks tell customers there's no Coca Cola to lay, he probably wanted to go back to *The Times* and write a piece headed "The FM Situation Stinks."

But FM is not bottled up in a blind alley, from which there is no escape. The present state of FM progress is comparable to that of our military effort just before U. S. troops landed in Africa. Whatever the outward manifestations, it's no military secret among manufacturers of FM transmitters and receivers that Frequency Modulation will make a full-dress "landing" before the end of 1946, and that the dollar volume of FM-AM receivers in 1947 will be three and possibly four times that of straight AM models. Also, there is a growing conviction that AM construction permits will be abandoned by newcomers who do not get delivery

(CONTINUED ON PAGE 58)



# CONDENSER MICROPHONE DESIGN

## Tiny Condenser Microphone Is Combined with Bullet-Shaped Amplifier

BY ARNOLD C. NYGREN

THE introduction of a new Western Electric condenser microphone and bullet-shaped amplifier marks another step in the preparations for enabling radio listeners to get the utmost realism from FM music and voice transmission. While the 640-AA microphone and RA-1095 amplifier are already being used for AM, they show up to best advantage on FM on high-fidelity, vertical-cut transcriptions.

Fig. 1 shows the microphone itself, while in Fig. 2 it is mounted in place on the amplifier shell. Only 1 in. in diameter and 1 in. long, it utilizes the 2-plate capacity principle, with a stainless steel diaphragm, less than 1 in. in diameter, acting as the variable element.

Fig. 3 shows the circuit. Since the elements are connected in series with a resistor and its DC voltage source, any movement of the diaphragm alters the capacity of the condenser and causes a small charging current to flow through the circuit. The resulting audio voltage, which appears across the resistor and is a true replica of the movements of the diaphragm in amplitude and frequency, is fed through a condenser coupling to the grid of the associated single-stage amplifier.

A special feature of the mechanical design of the microphone which contributes to its high-fidelity characteristics is the diaphragm mounting. Since it is

flush with the front of the case, cavity resonance is eliminated. That is a common fault of designs in which the diaphragm is set back in the mounting.

Another feature is the small size of the microphone, since it makes possible a stream-lined casing for the pre-amplifier unit.

**Frequency Response** ★ The free-field response characteristics of the microphone, mounted on the amplifier, are shown in

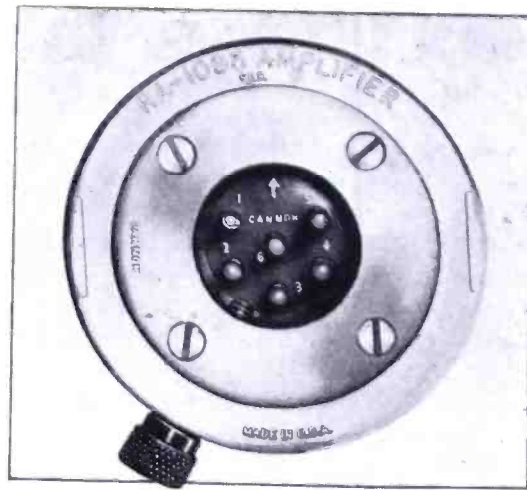


FIG. 7. TERMINAL END OF AMPLIFIER

perpendicular to the plane of the diaphragm, indicated by the detail in Fig. 4 as 0°, the response is approximately constant at frequencies from 50 to 1,000 cycles.

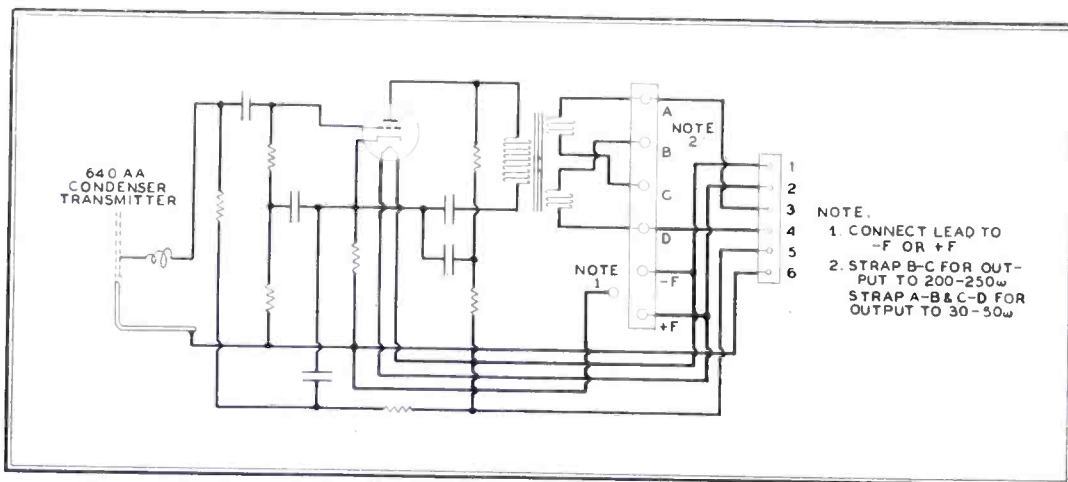


FIG. 3. CIRCUIT OF THE CONDENSER MICROPHONE AND ASSOCIATED PRE-AMPLIFIER

flush with the front of the case, cavity resonance is eliminated. That is a common fault of designs in which the diaphragm is set back in the mounting.

With the normal line of sound approach,

Above 1,000 cycles, the response rises gradually to a maximum of about 8 db at 8,000 cycles, and then drops off uniformly to a level which, at 15,000 cycles, is roughly equal to the gain at 1,000 cycles.

As indicated in Fig. 4, the response at the higher frequencies varies slightly with the angle at which sound waves strike the diaphragm. At an angle of 30°, the 8,000-cycle maximum is reduced about 1 db. The response at 60° is down 3.5 db, and at 90°, when sounds approach the microphone in a direction parallel to the diaphragm, the drop is about 7 db. Also, the steepness of the response curves for frequencies above 8,000 cycles increases slightly with the increasing angle of approach.

This is not particularly important, however, for studio practice is to locate the microphone farther from the sound source than is customary with other types of microphones.

The pressure response, Fig. 5, applicable to measurements in small chambers, is approximately constant to 6,000 cycles. It then falls off at a uniform rate to the

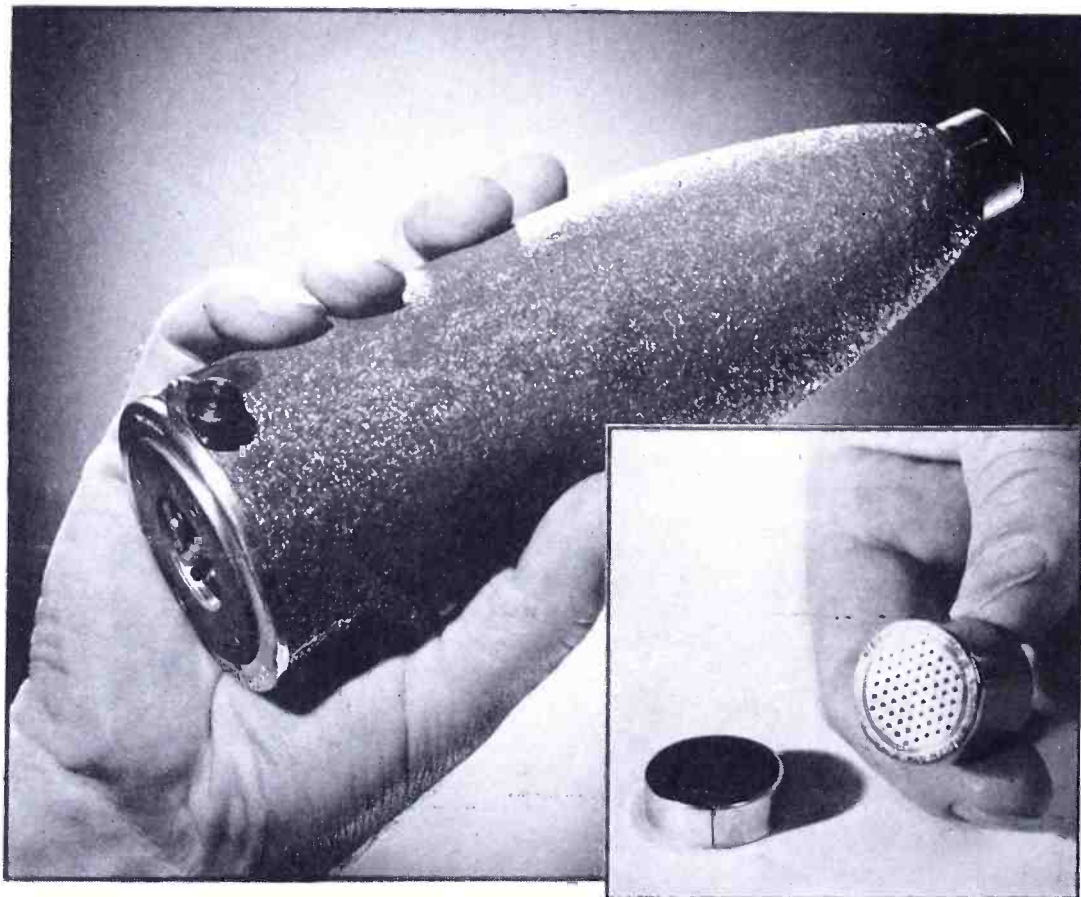


FIG. 1, INSERT. CONDENSER MICROPHONE REMOVED FROM AMPLIFIER. FIG. 2, LEFT. PRE-AMPLIFIER WITH THE CONDENSER MICROPHONE IN PLACE



extent of about 8 db at 15,000 cycles. The pressure response level in the 50- to 6,000-cycle range, with 200 volts polarizing potential, is approximately 49 db below 1 volt (open circuit) per dyne/cm<sup>2</sup>.

Pressure and free-field levels at 50 to 500 cycles, the range in which most of the energy in sound is concentrated, are identical.

**Amplifier** ★ The amplifier unit, shown with the casing removed in Fig. 6, is a compact

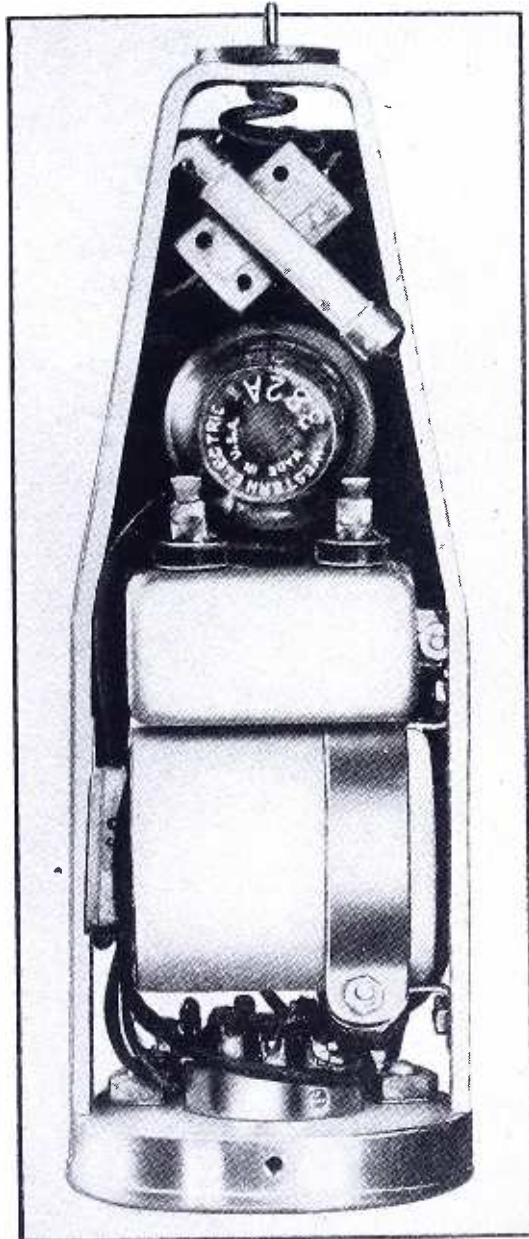


FIG. 6. INTERIOR OF THE AMPLIFIER, WITH THE METAL CASING REMOVED

single-stage arrangement developed specifically for the condenser microphone. It is quite small, measuring only 2½ ins. in diameter by 7¾ ins. long, and weighs 1¾ lbs. The case, which holds all the components, is finished in non-reflecting gray wrinkle lacquer.

As can be seen in Fig. 6, the microphone screws onto a threaded boss, so that the smooth exterior presents an unbroken outer surface offering the least possible disturbance to the surrounding sound field.

The screw mounting of the microphone and the metal amplifier case form the grounded side of the circuit. The high-potential side is complete to the micro-

phone through a spring-mounted plunger at the nose of the amplifier.

The output level of the amplifier is about 26 db higher than conventional high-quality studio microphones. Hence, it delivers a high initial signal-to-noise ratio.

A type 382A door-knob tube is employed in the amplifier. This is the design which has no base. Instead, the pins are anchored in the glass envelope. Therefore, the tube is supported in a hole in the main chassis frame, with its leads soldered

A thumb screw is provided in the base so that pressure can be applied to the socket, holding the connections firmly, and permitting the suspension of the amplifier by the connecting cord.

**Terminals** ★ A row of terminals is provided on a strip mounted inside the case of the amplifier. Arranged as indicated in Fig. 3, they permit the use of straps in accordance with external impedance conditions. These are readily accessible when the casing is slipped off.

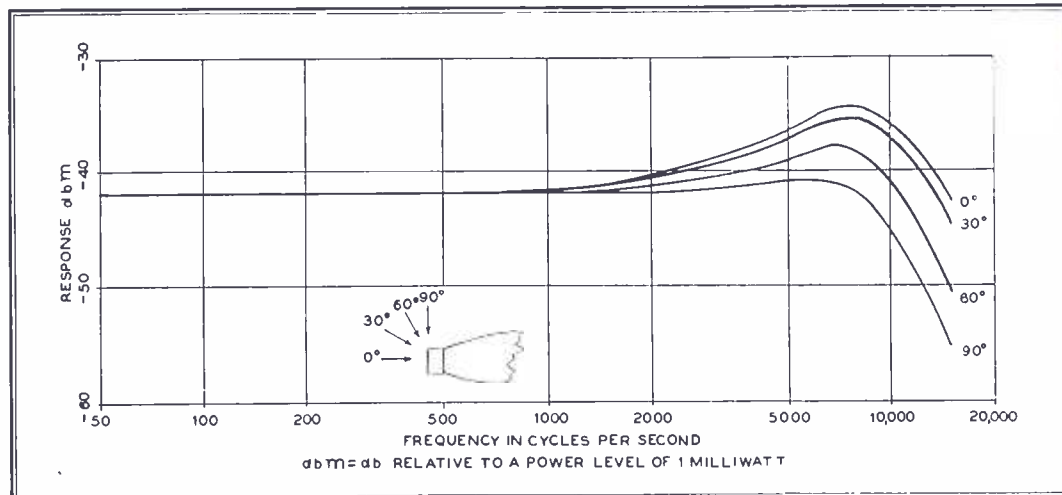


FIG. 4. RESPONSE OF THE MICROPHONE TO SOUNDS FROM DIFFERENT ANGLES

in such a way that the glass shoulders rest firmly against the mounting.

**Power Supply** ★ To operate the amplifier,

As Fig. 3 shows, provisions are made for operation into a circuit of 30 to 50 ohms, or 200 to 250 ohms. The lead marked NOTE 1 in the diagram, carrying

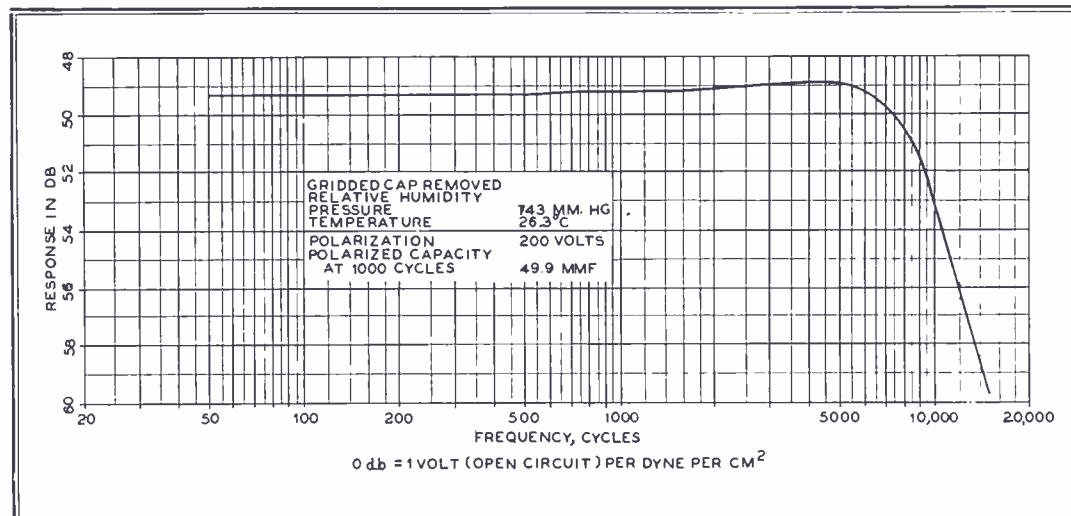


FIG. 5. PRESSURE RESPONSE APPLICABLE TO MEASUREMENTS IN SMALL CHAMBERS

150 milliamperes at 6.3 volts DC are required for the heater circuit, and 3 milliamperes at 180 volts DC for the plate supply and microphone bias. Both sources should be extremely quiet in order to obtain noise-free operation.

Voltages in excess of 200 should not be applied to the amplifier plate circuit when the microphone is attached, as it may be damaged. If power is to be applied from an unregulated source, precautions should be taken against excessive potentials.

Connections for plate and filament supplies and for the program circuit are made through a standard 6-prong male socket, recessed into the base of the amplifier case, as illustrated in Fig. 7.

the cathode return and ground connection to the filament supply circuit, should be connected to either the -F or +F terminal — whichever is found to give the lower noise level when the amplifier is connected to the succeeding circuits.

**Laboratory Use** ★ This microphone is available with a calibration made in accordance with procedures established by the U. S. Bureau of Standards, Cruft Laboratories, and Bell Telephone Laboratories. The stability of the microphone is such that it holds its calibration over a long period of time when treated with a reasonable degree of care.



# Part 2: EMERGENCY COMMUNICATIONS STATIONS

State & Zone Police, Fire, Forestry, and Special Emergency Transmitters Licensed Jan. 1, 1946

## STATE POLICE

### ALABAMA

DEPT. OF PUBLIC SAFETY, Montgomery			
Fixed Stations			
WKVG	Anniston	Mtr	37500 FM
WLBA	Birmingham	Mtr	37500 FM
WHTX	Box Springs	Mtr	37500 FM
WKSD	Decatur	Mtr	37500 FM
WKSR	Demopolis	Mtr	37500 FM
WXXR	Dothan	Mtr	37500 FM
WQXE	Evergreen	Mtr	37500 FM
WKSQ	Gadsden	Mtr	37500 FM
WKSQ	Huntsville	Mtr	37500 FM
WKSQ	Mobile	Mtr	37500 FM
WQXG	Opelika	Mtr	37500 FM
WKSJ	Selma	Mtr	37500 FM
WRBU	Snowdown	Mtr	37500 FM
WQXF	Tuscumbia	Mtr	37500 FM

### ARIZONA

HIGHWAY DEPARTMENT, Phoenix			
Fixed Stations			
6XCF	Crown King	Comp	116550 AM
KNGG	Phoenix	Comp	1698 AM

### ARKANSAS

STATE POLICE, Little Rock			
Fixed Stations			
KFDL	Clarksville	RCA	1722 AM
KQSR	El Dorado	RCA	1722 AM
KFDK	Forrest City	RCA	1722 AM
KEZX	Hope	RCA	1722 AM
KASP	Little Rock	RCA	1722 AM
KBSL	Newport	Comp	1722 AM
KFDO	Warren	RCA	1722 AM

### CALIFORNIA

HIGHWAY PATROL, Sacramento			
Fixed Stations			
KADC	Bakersfield	Thdn	1682 AM
6XJC	Bloomer Mtn.	Mtr	118150 FM
6XHB	Blue Canyon	Mtr	118550 FM
KSCC	Chino	Mtr	39900 FM
KAWF	Culver City	Mtr	1682 AM
KADJ	Davis	Comp	1682 AM
6XIE	Grapevine Smt.	Mtr	118550 FM
KAPI	Grass Valley	Comp	1682 AM
6XHL	Lyons Peak	Mtr	118550 FM
6XAR	Modjeska Peak	Mtr	118550 FM
6XHH	Mt Diablo	Mtr	118550 FM
6XFY	Mt Hamilton	Mtr	118550 FM
KQUL	Newhall	Comp	1682 AM
KFPE	Oak Glen	Thdn Mtr	1682 AM
KRBU	Oakland	Mtr	1682 AM
KSCC	Oroville	Comp	1682 AM
KQUG	Pomona	Comp	1682 AM
KSPR	Redding	Comp	1682 AM
KSRF	Represa	Mtr	39900 FM
KFPH	Ridge Rte. Sta.	Mtr Thdn	1682 AM
KAA8	Sacramento	Comp	1682 AM
6X1K	Sacred Oak Pk.	Mtr	118550 FM
KALF	Sallinas	Comp	1682 AM
KQDO	San Luis Obispo	Comp	1682 AM
6X1C	" " " (Co)	Mtr	118550 FM
6XHM	San Marcos Pass	Mtr	118550 FM
KSQP	San Quentin	Mtr	39900 FM
6XHI	S. Mountain	Mtr	118550 FM
KSPN	Stockton	Comp	1682 AM
6XHK	Strawberry Pk	Mtr	118550 FM
KIUF	Ventura	Comp	1682 AM
6XJB	Weott	Mtr	118550 FM
KASG	Willows	Comp	1682 AM
KSCY	Yreka	Comp	1682 AM

### COLORADO

HIGHWAY COURTESY PATROL, Denver			
No fixed stations			

### CONNECTICUT

DEPT. OF STATE POLICE, Hartford			
Fixed Stations			
WJTH	Avon	Link	39500 FM
WJTI	Bethany	Link	39500 FM
WJFA	Brookfield	Link	39500 FM
WJTD	Brooklyn	Link	39500 FM
WJFK	Colchester	Link	39500 FM
WJTF	Killingworth	Link	39500 FM
WJTE	Ledyard	Link	39500 FM
WJTI	Litchfield	Link	39500 FM
WJTB	Norfolk	Link	39500 FM
WJTC	Stafford	Link	39500 FM
WJTG	Wilton	Link	39500 FM

### DELAWARE

STATE HIGHWAY DEPT., Wilmington			
Fixed Stations			
WAFB	Bellefonte	Link	39500 FM
WAYZ	Bridgetown	Link	39500 FM
WJRF	Dover	Link	39500 FM
WAYY	Georgetown	Link	39500 FM
WDSP	State Road	Link	39500 FM

### FLORIDA

HIGHWAY PATROL, Bartow			
Fixed Stations			
WLIU	Chipley	Mtr	31100 FM
WJXX	DeLand	Mtr	31100 FM
WSPP	Ft Myers	Mtr	31100 FM
WKSO	Highland City	Mtr	31100 FM
WKDR	Lake City	Mtr	31100 FM
WSYP	Miami	Mtr	31100 FM
WJXI	Ocala	Mtr	31100 FM
WKVM	Okechobee City	Mtr	31100 FM
WRSF	Palm Beach	Mtr	31100 FM
WJXJ	Penny Farms	RCA	31100 FM
WSWR	Pensacola	Mtr	31100 FM
WKTF	Tallahassee	Mtr	31100 FM
WKGZ	Tampa	Mtr	31100 FM

## SPECIAL INFORMATION

1. Attention is called to an important change in this 6th edition. In the past, FCC records showed the names of the companies whose equipment is used at each station. Now, however, entirely new records have been set up, and that particular information is not available to us. Therefore, where changes or additions to the previous Directory have been made, the manufacturers' names do not appear.

2. Listings are for fixed, portable, and portable-mobile transmitters, but portable and portable-mobile stations are not identified separately for, except in rare cases, they use the same call as the associated fixed station.

### GEORGIA

DEPT. OF PUBLIC SAFETY, Atlanta			
Fixed Stations			
WSIK	Albany	WE	1666 AM
WGSP	Atlanta	WE	1666 AM
WGRN	Gainesville	Comp	1666 AM
WSIN	Griffin	Comp	1666 AM
WSIJ	Reidsville	WE	1666 AM
WSIO	Washington	Comp	1666 AM

### IDAHO

No fixed stations

### ILLINOIS

DIVISION OF HIGHWAYS, Springfield			
Fixed Stations			
WQPB	Blue Island	Mtr	39500 FM
WQPC	Chicago	WE	1610 AM
WQPD	DuQuoin	WE	1610 AM
WQPF	Effingham	WE	1610 AM
WQPE	Elgin	Mtr	39500 FM
WQPJ	French Village	Comp	1610 AM
WQPO	Joliet	Mtr	39500 FM
WQPM	Macomb	WE	1610 AM
WQPL	Peoria	Comp	1610 AM
WQPP	Pontiac	WE	1610 AM
WQPR	Rock Island	Mtr	39500 FM
WQPS	Springfield	WE	1610 AM
WQPG	Sterling	WE	1610 AM
WQPH	Urbana	Mtr	39500 FM

### INDIANA

DEPT. OF PUBLIC SAFETY, Indianapolis			
Fixed Stations			
WBMO	Charleston	Comp	1634 AM
WPHS	Chesterton	Comp	1634 AM
WQFW	Columbia City	WE	1634 AM
9XGC	" " " "	Mtr	116550 FM
WB11	Connorsville	Comp	1634 AM
WPHE	Indianapolis	Comp	1634 AM
WPHU	Jasper	Comp	1634 AM
WQFW	Ligonier	SP	1634 AM
WRNR	Pendleton	Comp	1634 AM
WQGB	Putnamville	Comp	1634 AM
9XGC	Rochester	Mtr	116550 FM
WQFE	Seymour	Comp	1634 AM
WROR	W. Lafayette	Comp	1634 AM

### IOWA

DEPT. OF PUBLIC SAFETY, Des Moines			
Fixed Stations			
KACD	Atlantic	Coll	1682 AM
KNFN	Cedar Falls	WE	1682 AM
KGHO	Des Moines	Coll	1682 AM
KACC	Fairfield	Coll	1682 AM
KNFO	Storm Lake	WE	1682 AM

### KANSAS

HIGHWAY COMMISSION, Topeka			
Fixed Stations			
KAQB	Chanute	Mtr	39900 FM
9XIB	Council Grove	Mtr	118550 FM
9XIE	Frankfort	Mtr	118550 FM
9XID	Horton	Mtr	118550 FM
KBMO	Norton	Comp	1698 AM
9XIC	Olathe	Mtr	118550 FM
KAZZ	Topeka	Comp	1698 AM

### KENTUCKY

HIGHWAY PATROL, Frankfort			
Fixed Station			
WQWY	Frankfort	Mtr	39900 FM

### LOUISIANA

STATE POLICE, Lake Charles			
Fixed Stations			
KRAD	Alexandria	RCA	1682 AM
WLSP	Baton Rouge	RCA	1682 AM
KSPB	E. Lake Charles	RCA	1682 AM
KSPF	Franklin	RCA	1682 AM
KHQS	Lafayette	Comp	1682 AM
KSPL	Leesville	RCA	1682 AM
KSPC	Monroe	RCA	1682 AM
WNHI	New Orleans	Mtr	39500 FM
KSPS	Shreveport	RCA	1682 AM

### MAINE

STATE POLICE, Augusta			
Fixed Stations			
WBNV	Augusta	HW	39900 AM
		HW	1642 AM
WKQP	Bangor	Comp	1642 AM
WSYX	Boothbay Harbor	HW	1642 AM
WLDQ	Houlton	Comp	1642 AM
WSTR	Thomaston	HW	1642 AM
		HW	39900 AM
WSWD	Wells	HW	1642 AM
		HW	39900 AM
WBVW	W. Scarborough	HW	1642 AM
WSYD		HW	1642 AM

### MARYLAND

STATE POLICE, Baltimore			
Fixed Stations			
WEVN	Belair	Comp	1698 AM
		Link	39100 FM
WMSH	Conowingo	Comp	1698 AM
		Link	39100 FM
WMSC	Cumberland	Comp	1698 AM
WMEV	Dan's Rock	Link	39100 FM
WMSE	Easton	Comp	1698 AM
		Link	39100 FM
WMSF	Frederick	Comp	1698 AM
		Link	39100 FM
WMQU	Hagerstown	Link	39100 FM
WMSR	Randallstown	Comp	1698 AM
		Link	39100 FM
WWSG	Sallsbury	Comp	1698 AM
		Link	39100 FM
WMSW	Waldorf	Comp	1698 AM
		Link	39100 FM
WHWN	Waterloo	Comp	1698 AM
		Link	39100 FM

### MASSACHUSETTS

DIVISION OF STATE POLICE, Boston			
Fixed Stations			
WKFI	Adams	Link	35900 FM
WKFA	Andover	Link	35900 FM
WBKU	Bridgewater	Hftr	1666 AM
WPEL	" " " "	DeF	1666 AM
WBVP	Brookline	Comp	1666 AM
WPEW	Hadley	Link	35900 FM
WKGC	Fall River	Link	35900 FM
WBQN	Frammingham	Comp	1666 AM
WMPF	Milton	Comp	35900 FM
WSPN	Nantucket	Link	35900 FM
WPYM	Northampton	Comp	1666 AM
WSPQ	Oak Bluffs	Link	35900 FM
WPEL	Plymouth	Link	35900 FM
WSQL	Princeton	Link	35900 FM

### MICHIGAN

STATE POLICE, Lansing			
Fixed Stations			
WBQI	Alpena	Mtr	37500 FM
WBRD	Atlanta	Mtr	37500 FM
WBQT	Bad Axe	Mtr	37500 FM
WDAL	Baldwin	Mtr	37500 FM
WIWG	Battle Creek	Mtr	37500 FM
WITR	Bay City	Mtr	37500 FM
WJBS	Billssfield	Mtr	37500 FM
WDAQ	Boyer City	Mtr	37500 FM
WAOB	Brighton	Mtr	37500 FM
WBQS	Cadillac	Mtr	37500 FM
WBTO	Center Line	Mtr	37500 FM
WKJU	Cheboygan	Mtr	37500 FM
WJBR	Clinton	Mtr	37500 FM
WSWK	Crystal Falls	Mtr	37500 FM
WAPU	Detroit	Mtr	37500 FM
EXAV	" " " "	Mtr	117750 FM
WRDS	E. Lansing	RCA WE	1642 AM
WBQL	E. Tawas	Mtr	37500 FM
WJBP	Erie	Mtr	37500 FM
WBRC	Escanaba City	Mtr	37500 FM
WDSO	Ewen	Mtr	37500 FM
WAPW	Flatrock	Mtr	37500 FM
WITQ	Flint	Mtr	37500 FM
WBUN	Fort Brady	Mtr	37500 FM
WEJR	Gaylord	Mtr	37500 FM
WBQU	Gladstone	Mtr	37500 FM
WBXA	Gladwin	Mtr	37500 FM
WRLS	Grand Haven	Mtr	37500 FM
EXBH	Houghton Lake	Mtr	116550 FM
WRDH	Houghton Lake	RCA	1642 AM
WRDH	" " " "	Mtr	37500 FM
WBBI	Iron Mountain	Mtr	37500 FM
EXBG	Jackson	Mtr	118550 FM
WBNI	Jonesville	Mtr	37500 FM
WITN	Jackson	Mtr	37500 FM
		Mtr	33100 FM
WITP	Keego Harbor	Mtr	37500 FM
WBQR	Lansie	Mtr	37500 FM
WBQK	Manistee	Mtr	37500 FM
WBTP	Manistique	Mtr	37500 FM
WBKZ	Mio	Mtr	37500 FM
WKJM	Mt Pleasant	Mtr	37500 FM
WBKJ	Muskegon	Mtr	37500 FM
WBQP	Newberry	Mtr	37500 FM
WBQJ	New Buffalo	Mtr	37500 FM
WSWF	Niles	Mtr	37500 FM
EXAU	Okemos	Mtr	116550 FM
WRDS	" " " "	Mtr	37500 FM
		Mtr	33100 FM
WBFR	Palmer	Mtr	37500 FM
WRDP	Paw Paw	RCA	1642 AM
		Mtr	33100 FM
		Mtr	37500 FM
WRLE	Reed City	Mtr	37500 FM
WMSP	Rockford	Mtr	33100 FM
		Mtr	37500 FM
WJBL	Romeo	Mtr	37500 FM
WBTS	Romulus	Mtr	37500 FM
WIVA	Roscommon	Mtr	37500 FM
WJBI	St Clair	Mtr	37500 FM
WQSY	St Ignace	Mtr	37500 FM
WJAT	Sandusky	Mtr	37500 FM
WJAT	St. Ste. Marie	Mtr	37500 FM
WJBT	South Haven	Mtr	37500 FM
WKJK	Traverse City	Mtr	37500 FM
WBQV	Wakefield	Mtr	37500 FM



# Highlights in THE 1946

## Jensen LINE

★ *Hypex*  
PROJECTORS

★ **COAXIAL**  
SPEAKERS

★ *Speech Master*  
REPRODUCERS

★ *Bass Reflex*  
REPRODUCERS



★ **HYPEX Projectors** better than ever—more efficient. They have the famous Hypex "flare formula"—not exponential—developed by Jensen acoustical research. Driver units employ the Jensen "Annular" diaphragm, clamped at periphery and center—another exclusive feature!

★ **COAXIAL Speakers.** Now four improved 15" and 12" designs for high-fidelity, extended-range reproduction. High-frequency Control provides instant fidelity adjustment to suit program quality and listener preference. Available in complete Reproducers.

★ **SPEECH MASTER Reproducers.** Designed especially for crisp highly-effective speech reproduction. Desk-, panel-, wall-mounting types in power ratings for low-level and high-level applications.

★ **BASS REFLEX\* Reproducers.** A complete line of reproducers with speaker installed, or enclosures only, in fine furniture or utility styles—all with the smoothly extended low-frequency range for which Jensen Bass Reflex is justly famous.

\*Trade Mark Registered

*These are only a few of the many distinguished products in the complete Jensen line. Write for catalogs and data sheets for further information.*

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 **Jensen**  
SPEAKERS  
WITH **ALNICO 5**

*Specialists in Design and Manufacture of Acoustic Equipment*



**STATE POLICE, continued**

WBQQ West Branch Mtr 37500 FM  
 AJAW White Pigeon Mtr 37500 FM  
 WAOG Ypsilanti Mtr 37500 FM

**MINNESOTA**

STATE POLICE, St. Paul  
 Fixed Stations  
 KNHD Redwood Falls WE 1658 AM  
 WAMV St Paul Mtr Comp 1658 AM

**MISSISSIPPI**

DEPT OF PUBLIC SAFETY, Jackson  
 Fixed Stations  
 WJGW Brookhaven Comp 1690 AM  
 WJKZ Grenada Comp 1690 AM  
 WMHP Hattiesburg Mtr 1690 AM  
 WRJI Jackson RCA 1690 AM

**MISSOURI**

HIGHWAY PATROL, Jefferson City  
 Fixed Stations  
 9XGL Carthage Mtr 118150 FM  
 9XGD Ft Leonard Wood Mtr 118150 FM  
 9XHU Hannibal Mtr 118150 FM  
 KHHP Jefferson City Mtr 39900 FM  
 KHPC Kirkwood Coll 1674 AM  
 KHPA Lee's Summit Coll 1674 AM  
 KHPP Macon Coll 1674 AM  
 9XGF Osborn Mtr 118150 FM  
 KHPE Poplar Bluff Coll 1674 AM  
 9XGE Potosi Mtr 118150 FM  
 9XGG Shannon Co Mtr 118150 FM  
 KHPD Springfield Coll 1674 AM

**MONTANA**

HIGHWAY PATROL, Helena  
 No Fixed Stations

**NEVADA**

STATE POLICE, Reno  
 Fixed Stations  
 KODH Carson City Mtr 1634 AM  
 KRNP Reno Comp 1634 AM

**NEW HAMPSHIRE**

STATE POLICE, Concord  
 Fixed Stations  
 WMOE Bow Mtr 33500 FM  
 WRPT Concord WE 1682 AM  
 IXUD Warner Mtr 118550 FM

**NEW JERSEY**

STATE POLICE, Trenton  
 Fixed Stations  
 3XTI Absecon Link 27925 FM  
 3XTK Berlin Link 27925 FM  
 WAOM Camden RCA 35900 AM  
 3XTG Cape May Link 27925 FM  
 3XTS Cherryville Link 27925 FM  
 3XTJ Elwood Link 27925 FM  
 3XTO Flanders Link 27925 FM  
 2XZS Freehold Link 27925 FM  
 3XTH Halesville Link 27925 FM  
 3XTT Hightstown Link 27925 FM  
 2XZU Keyport Link 27925 FM  
 3XTL Malaga Link 27925 FM  
 3XWS Mantua Link 27925 FM  
 3XTQ Morristown Link 27925 FM  
 3XTX New Brunswick Link 27925 FM  
 3XTN Newton Link 27925 FM  
 WBYM Del. River Bdg RCA 35900 AM  
 2XZQ Ramsey Link 27925 FM  
 3XTW Riverton Link 27925 FM  
 2XZR Scotch Plains Link 27925 FM  
 3XTM Sharptown Link 27925 FM  
 3XTR Somerville Link 27925 FM  
 2XZT Toms River Link 27925 FM  
 2XZP Tuckerton Link 27925 FM  
 3XTP Washington Link 27925 FM  
 3STV W. Trenton Link 27925 FM  
 3XTU Wrightstown Link 27925 FM  
 Boats:  
 WSPZ Anne E RCA 1610 AM  
 WRSN Director JT 1610 AM  
 WPIF Elizabeth C RCA 1610 AM  
 WRSL Navigator JT 1610 AM  
 WRSM Polaris JT 1610 AM

**NEW YORK**

STATE POLICE, Albany  
 Fixed Stations  
 WKVA Altamont Link 1658 AM  
 WJKW Babylon Link 37500 FM  
 WBTC Batavia Link 1658 AM  
 WIZP Bayshore Link 37500 FM  
 WIZO Bethpage St Pk Link 37500 FM  
 WLSA Commack Link 37500 FM  
 WKVC Fishkill Link 1658 AM  
 WIZL Jones Beach Link 37500 FM  
 KIZG Kings Park Link 37500 FM  
 WIZC Lake Success Link 37500 FM  
 WPJK Oneida Link 1658 AM  
 WJGA Riverhead Link 37500 FM  
 WJKR Montauk Link 37500 FM  
 WAKP Sldney Link 1658 AM  
 WPGC S. Schenectady GE 1658 AM  
 WTOH Troy Link 39100 FM  
 WIZA Valley Stream Link 37500 FM

**NORTH CAROLINA**

HIGHWAY PATROL, Raleigh  
 Fixed Stations  
 4XAF Clingman's Pk Link 116950 FM  
 WANL Elizabethtown GE 1658 AM  
 4XAR Parkton Link 116950 FM  
 WANH Raleigh GE 1658 AM  
 WANK Salisbury GE 1658 AM  
 4XAU Scuppernon Link 116950 FM  
 WANJ Swannanoa GE 1658 AM  
 4XAS Troy Link 116950 FM  
 4XAQ Ward's Corner Link 116950 FM  
 4XAE Wilmar Link 116950 FM  
 4XAT Winston-Salem Link 116950 FM  
 WANL Williamston GE 1658 AM

**NORTH DAKOTA**

STATE PATROL, Bismarck  
 Fixed Station  
 KAZB Bismarck Dool 1674 AM

**OHIO**

STATE HIGHWAY PATROL, Columbus  
 Fixed Stations  
 WOZY Athens Mtr 39100 FM  
 WOHO Bellevue Mtr 39100 FM  
 WLSZ Bridgeport Mtr 39100 FM  
 WPHT Cambridge WE 1730 AM  
 WWCL Chillicothe Mtr 39100 FM  
 WPGQ Columbus WE RCA 1730 AM  
 WODH Dayton Mtr 39100 FM  
 WPGG Findlay WE 1730 AM  
 WLSW Geneva Mtr 39100 FM  
 WWCJ Kent Mtr 39100 FM  
 WWCN Lima Mtr 39100 FM  
 WVOG Lorain Mtr 39100 FM  
 WLSV Mansfield Mtr 39100 FM  
 WOGN Marion Mtr 39100 FM  
 WPHC Massillon WE 1730 AM  
 WWCJ Medina Mtr 39100 FM  
 WWOB Middletown Mtr 39100 FM  
 WWCN New Phila. Mtr 39100 FM  
 WODX Perrysburg Mtr 39100 FM  
 WHNT Portsmouth Mtr 39100 FM  
 WOEX Salem Mtr 39100 FM  
 WWCN Steubenville Mtr 39100 FM  
 WBGQ Warren Link 1730 AM  
 WPIIK Wilmington WE Mtr 39100 FM

**OKLAHOMA**

DEPT OF PUBLIC SAFETY, Oklahoma City  
 Fixed Stations  
 KOSC Ardmore Comp 1626 AM  
 KOSU Claremore RCA 1626 AM  
 KOSX Clinton RCA 1626 AM  
 KOSY Lawton RCA 1626 AM  
 KOSW McAlester RCA 1626 AM  
 KOSO Oklahoma City RCA 1626 AM  
 KOSP Perry RCA 1626 AM

**OREGON**

POLICE AND HIGHWAY DEPT, Salem  
 Fixed Stations  
 KOHA Astoria Coll 1706 AM  
 KOHB Baker Coll 1706 AM  
 KOHN Bend Coll 1706 AM  
 KOHU Burns Coll 1706 AM  
 KOHC Coquille Coll 1706 AM  
 KOHD The Dalles Coll 1706 AM  
 KOHE Eugene Coll 1706 AM  
 KOHI Gov. Camp Comp 1706 AM  
 KOHG Grants Pass Coll 1706 AM  
 KOHO John Day Coll 1706 AM  
 KOHK Klamath Falls Coll 1706 AM  
 KOHL LaGrande Coll 1706 AM  
 KOHQ Medford GE 1706 AM  
 KOHY Odell Lake Comp 1706 AM  
 KOHP Pendleton Coll 1706 AM  
 KOHM Portland Coll 1706 AM  
 KOHR Roseburg Coll 1706 AM  
 KCHS Salem Coll 1706 AM  
 KOIJ Santiam Jct. Comp 1706 AM

**PENNSYLVANIA**

STATE POLICE, Harrisburg  
 Fixed Stations  
 8XXX Allegheny Mt GE 33940 FM  
 8XXI Bedford RCA 117350 AM  
 8XXX Bedford RCA 118150 AM  
 3XXX Blue Mt. RCA 37500 AM  
 3XRD Blue Mt. GE 33940 FM  
 WBJY Blue Mt. RCA 116150 AM  
 WBJV Breezewood RCA 37500 AM  
 WBJZ Carlisle RCA 37500 AM  
 WBJO Donegal RCA 37500 AM  
 WBJS Everett Mnt Shed RCA 37500 AM  
 WBJX Ft. Littleton RCA 37500 AM  
 WPSP Harrisburg RCA 1674 AM  
 WBJM Irwin RCA 33940 FM  
 WBJR Kegg Mnt Shed RCA 37500 AM  
 8XXD Laurel Hill GE 33940 FM  
 8XXX Laurel Hill RCA 116150 AM  
 WBJN New Stanton RCA 37500 AM  
 WBJT Newville RCA 37500 AM  
 8XXJ Rays Hill RCA 116950 AM  
 8XXX Sideling Hill GE 33940 FM  
 WBJP Somerset RCA 117750 AM  
 WBJQ Somerset RCA 37500 AM  
 8XXX Tuscarora Mt. RCA 37500 AM  
 WBJL Willow Hill RCA 118550 AM  
 WPAJ Wyoming Mtr 33940 FM

**RHODE ISLAND**

STATE POLICE, Providence  
 Fixed Station  
 WRSA Scituate WE 1634 AM

**SOUTH DAKOTA**

STATE POLICE, Pierre  
 Fixed Stations  
 KSDL Custer Mtr 39100 FM  
 9XSL Custer Mtr 81240 FM  
 KSDG Deadwood Mtr 39100 FM  
 9XSJ Deadwood Mtr 81000 FM  
 KSDH Huron Mtr 39100 FM  
 KSDA Parker Mtr 39100 FM  
 KSDP Pierre Mtr 39100 FM  
 9XSI Rapid City Mtr 81000 FM  
 9XSK Rapid City Mtr 81240 FM  
 KSDW Webster Mtr 39100 FM

**TENNESSEE**

DEPARTMENT OF SAFETY, Nashville  
 Fixed Stations  
 4XTB Bells Link 116950 AM  
 WJBV Chattanooga Comp 1618 AM  
 4XTH Henry Link 116950 FM  
 WBYM Jordonia Comp 1618 AM  
 WKVT Knoxville Comp 1618 AM  
 4XTL Linden Link 116950 FM  
 WDBW Memphis Comp 1618 AM  
 4XTM Monteagle Link 116950 FM

**TEXAS**

DEPT OF PUBLIC SAFETY, Austin  
 Fixed Stations  
 KTXA Austin Wstg 1658 AM  
 KTXH Dallas Kaar 1658 AM  
 KTXF Ft Worth Comp 1658 AM  
 KTXU Houston Comp 1658 AM

**UTAH**

HIGHWAY PATROL, Salt Lake City  
 Fixed Stations  
 KUSH Ogden Comp 1674 AM  
 KPRV Provo Comp 1674 AM  
 KUHP Salt Lake City Comp 1674 AM

**VIRGINIA**

DEPT OF STATE POLICE, Richmond  
 Fixed Stations  
 WRIF Appomattox Comp 1690 AM  
 Link 35500 FM  
 WSPH Chesterfield Comp 1690 AM  
 Link 35500 FM  
 WRIG Culpeper Comp 1690 AM  
 Link 35500 FM  
 3XVY Christiansburg Link 116550 FM  
 WAEE Princess Anne Comp 1690 AM  
 3XVX Washington Link 116550 FM  
 WAEE Denbigh Link 35500 FM  
 3XVW Wise Link 116550 FM  
 WBXQ Wytheville Comp 1690 AM  
 Link 35500 FM

**WASHINGTON**

STATE PATROL, Olympia  
 Fixed Stations  
 KNFK Bellingham Nord 2490 AM  
 KQZT Bremerton R Lab 2490 AM  
 KNFS Chehalis Comp 2490 AM  
 KGHQ Chinook Pass Nord 2490 AM  
 KQCS Colfax Comp 2490 AM  
 KAXV Colville Comp 2490 AM  
 KWSF Davenport Nord 2490 AM  
 KNFX Ellensburg R Lab 2490 AM  
 KNGZ Ephrata Nord 2490 AM  
 KFDG Everett Nord 2490 AM  
 WRHX Fort Lewis Comp 2490 AM  
 KNGA Goldendale Comp 2490 AM  
 KBPW Hoquiam Nord 2490 AM  
 KNFY Ilwaco Nord 2490 AM  
 KBKK Kelso R Lab 2490 AM  
 KQGF K-M Hill Nord 2490 AM  
 KLEZ Little Mountain Mtr 37500 FM  
 KNFZ Lodge Pole Camp Nord 2490 AM  
 KQDY Mason City R Lab 2490 AM  
 KPHP Mt Vernon Nord 2490 AM  
 KACB Okanogan Nord 2490 AM  
 KPPM Olympia Mtr 37500 FM  
 KNFG Pasco Nord 2490 AM  
 KQEK Port Angeles R Lab 2490 AM  
 KRGS Raymond Nord 2490 AM  
 KWSE Seattle Nord 2490 AM  
 KGHD Shuksan Nord 2490 AM  
 KNFL Snoqualmie Pass Nord 2490 AM  
 KGHE Spokane Nord 2490 AM  
 KNGR Tacoma R Lab 2490 AM  
 KQJY Vancouver Nord 2490 AM  
 KNGC Walla Walla Nord 2490 AM  
 KNGD Wenatchee Nord 2490 AM  
 KNGQ Yakima Nord 2490 AM  
 KNGB Yakima Nord 2490 AM

**WEST VIRGINIA**

STATE POLICE, Charleston  
 Fixed Stations  
 WBSP Beckley RCA 1626 AM  
 WSPL Elkins Mtr 1626 AM  
 WMWV Moundsville RCA 1626 AM  
 WSLT Mountain View Mtr 39900 FM  
 WSJA Parkersburg Mtr 39900 FM  
 WRMP Romney RCA 1626 AM  
 WSWV Shinnston RCA 1626 AM  
 WBPW S. Charleston RCA 1626 AM  
 WSLT Stollings Mtr 39900 FM

**WISCONSIN**

CONSERVATION COMMISSION, Madison  
 Fixed Station  
 WIZR Sumpter Mtr 31500 AM

**WYOMING**

HIGHWAY PATROL, Cheyenne  
 Fixed Stations  
 KWHF Casper RCA 1642 AM  
 KWHC Cheyenne Coll 1642 AM  
 KWHG Cody Comp 1642 AM  
 KWHQ Laramie Temc 1642 AM  
 KSHD Rawlins RCA 1642 AM  
 KWHA Rock Springs RCA 1642 AM  
 KWHE Sheridan RCA 1642 AM

**ZONE POLICE STATIONS**

**ARKANSAS**

KNHA Fort Smith Comp 2804 2808 2812 A1  
 5135 5140 5195  
 KEZX Hope Comp 2804 2808 2812 A1  
 KASP Little Rock RCA 2804 2808 2812  
 5135 5140 5195  
 7480 7935 A1

**CALIFORNIA**

KGPL Los Angeles Comp 2804 2808 2812 A1  
 7480 7805 7935  
 5195 5135 5140

**GEORGIA**

WPFI Columbus Comp 2804 2808 5140 A1  
 5195

**ILLINOIS**

WQPJ E. St Louis Comp 2804 2808 2812 A1  
 5140 5195  
 WQPF Effingham Comp 2804 2808 5140 A1  
 5195 Wkg: 2812  
 WQPD Duquoin Comp 2804 2808 5140 A1  
 5159 Wkg: 2812  
 WQPM Macomb Comp 2804 2808 5140 A1  
 5195 Wkg: 2812



**Introducing A New Concept in High Speed Measurement  
for the Laboratory and Production Line . . .**

# PANALYZOR

**FEATURING  
PANORAMIC TECHNIQUE**



44 pounds • Price: Complete with tubes and accessories,  
Model 5B-3, with 3" C.R.T. • 13 1/4" x 7 1/4" x 13"  
Types T-50 to T-1000 . . . . . **\$425.00**  
Types T-3000 to T-6000 . . . . . **\$475.00**  
(F.O.B. Factory, Tax not included)



## Panoramic Reception with the PANADAPTOR

**A "Must" for Modern Radio Shacks**

Panoramic Reception enables simultaneous visual reception of many radio signals, continuously selectable from a broad band of frequencies down to a single frequency. With the PANADAPTOR connected to a receiver, having an I. F. between 450 and 470kc, you can see up to 200kc of the band at once.

### Some Typical Applications

- Select QRM-free spots for sending and listening.
- Provide automatic visual and aural monitoring.
- Locate stations whose exact frequencies are not known.
- Enable observation of other fellow's frequencies in three-way or round robin QSOs — acts as an additional tunable receiver.
- Spot replies to your CQs.
- Provide instantaneous "S" meter for CW and PHONE.
- Simplify frequency setting and station monitoring.
- Facilitate netting operations.
- Assist in making adjustments of transmitters and antennas.
- Enable identification and interpretation of transmitter signal characteristics (your own and others).  
CW . . . . key clicks, noise, frequency shift.  
PHONE . . modulation percent, distortion, carrier shift and splatter, spurious supersonic and R.F. parasites.  
FM . . . . AM on FM, modulation monitoring.

Model PCA-2. Amateur net price, complete with 10 tubes and accessories, for 115 V., 50-60 cycle operation. **\$99.75**

**ONE YEAR GUARANTEE** against defects in parts or workmanship (excluding tubes). Panoramic Handbook with full installation, operating, application and maintenance instructions furnished with each PANADAPTOR. PANADAPTOR, featuring PANORAMIC RECEPTION, is the exclusive and original design of PANORAMIC RADIO CORPORATION.

THE PANALYZOR provides an instantaneous visual presentation of static and dynamic characteristics of a band of radio signals in any part of the spectrum. Each signal produces its own characteristic deflection on the Panoramic screen, and each deflection reveals the frequency, amplitude, and stability of the corresponding signal. FM systems are "naturals" for PANORAMIC analysis.

Not only signals, but any variation of electrical or physical dimensions, convertible to a variation of frequency, can be more quickly and accurately measured by the PANORAMIC TECHNIQUE.

An outstanding feature of the PANALYZOR, in many applications, is that all necessary information is given without the necessity of the operator's balancing or adjusting the test equipment. PANORAMIC TECHNIQUE is economical in time and energy . . . but highly accurate in results.

Several models are available with different sweep-widths from 50kc to 6000kc. Speedwidths up to 20 megacycles available on special order.

### Some Applications of the PANALYZOR

#### PRODUCTION

- Match inductances, capacitors, resistors, and I. F. Transformers.
- Compare components with standards.
- Test Crystals against standards — during grinding.
- Align FM discriminators.

#### BROADCAST STATION AND LABORATORY

- Study oscillator and transmitter behavior, frequency drift, "supering", carrier shift and modulation.
- Detect residual AM in FM transmitters.
- Detect residual FM in AM transmitters.
- Measure FM deviation.

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CABLE ADDRESS: PANORAMIC, NEW YORK  
242-250 WEST 55<sup>TH</sup> ST. New York 19, N.Y.



**ZONE POLICE, continued**

WQPG	Sterling	Comp	2804	2808	5140	A1
			5195	Wkg:	2812	
WQPP	Pontiac	Comp	2804	2808	5140	A1
			5195	Wkg:	2812	
WQPC	Chicago	Comp	2804	2808	5140	A1
			5195	Wkg:	7480	7805
WASE	Peoria	Comp	2804	2808	5140	A1
			5195			
WPGD	Rockford	Comp	2804	2808	2812	A1

**INDIANA**

WBMO	Charlestown	Comp	2804	2808	2812	A1
WPHS	Chesterton	Comp	2804	2808	2812	A1
			5140	5195		
WBH	Connersville	Comp	2804	2808	2812	A1
WMDZ	Indianapolis	Comp	2804	2808	2812	A1
			5135	5140	5195	
WPHU	Jasper	Comp	2804	2808	2812	A1
			5140	5195		
WQFW	Ligonier	Comp	2804	2808	2812	A1
			5140	5195		
WRNR	Pendleton	Comp	2804	Wkg:	2808	A1
			2812			
WQGB	Putnamville	Comp	2804	2808	2812	A1
WQFE	Seymour	Comp	2804	2808	2812	A1
			5140	5195		
WROR	W. Lafayette	Comp	2804	2808	2812	A1
			5140	5195		

**KANSAS**

KGPZ	Wichita	RCA	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**LOUISIANA**

WBRP	Baton Rouge	Comp	2804	2808	2812	A1
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**MASSACHUSETTS**

WMP	Framlingham	Hftr	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**MICHIGAN**

WPSB	Grand Rapids	Comp	2804	2808	2812	A1
			5135	5140	5195	

**MINNESOTA**

KNFE	Duluth	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**MISSOURI**

KHPF	Jefferson City	Coll	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	
KHPC	Kirkwood	Coll	2804	2808	2812	A1
			5140	5195		
KHPA	Lee's Summit	Coll	2804	2808	2812	A1
			5140	5195		
KHPB	Macon	Coll	2804	2808	2812	A1
			5140	5195		
KHPE	Poplar Bluff	Coll	2804	2808	2812	A1
			5140	5195		
KHPD	Springfield	Coll	2804	2808	2812	A1
			5140	5195		

**OHIO**

WPDO	Akron	Comp	2804	2808	2812	A1
WKDU	Cincinnati	RCA	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	
WENB	Cleveland	Bnd	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	
WPGG	Findlay	Coll	2804	2808	5140	A1
			5195			
WPHC	Massillon	Coll	2804	2808	2812	A1
			5140	5195		
WRDQ	Toledo	Comp	2804	2808	5140	A1
			5195			
WPHK	Wilmington	Coll	2804	2808	2812	A1
			5140	5195		
WPDG	Youngstown	Comp	2804	2808	2812	A1

**OKLAHOMA**

KOSO	Okla. City	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	
KQEI	Tulsa	Comp	2804	2808	5140	A1
			5195	7935		

**OREGON**

KOHK	Klamath Falls	Comp	2804	2808	5140	A1
			5195			
KOHL	La Grande	Comp	2804	2808	5140	A1
			5195			
KOHS	Salem	Comp	2804	2808	5140	A1
			5195			

**PENNSYLVANIA**

WBTF	Butler	Comp	2804	2808		A1
WBTG	Greensburg	Comp	2804	2808		A1
WPSP	Harrisburg	RCA	2804	2808		A1
WBTD	W. Reading	Comp	2804	2808		A1
WBTE	Wyoming	Comp	2804	2808		A1

**TEXAS**

KTXA	Austin	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	
KGPJ	Beaumont	Comp	2804	2808	2812	A1
			5135	5140	5195	
KNHF	Denton	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**WASHINGTON**

KNFK	Bellingham	Nord	2804	2808	2812	A1
			5140	5195		
KFDG	Everett	Nord	2804	2808	2812	A1
KBPW	Hoquiam	Nord	2804	2808	5140	A1
			5195			
KFHP	Mt Vernon	Nord	2804	2808	2812	A1
KGHD	Seattle	Nord	2804	2808	5140	A1
			5195			
KGHE	Snoqualmie Pass	Nord	2804	2808	5140	A1
KNGR	Spokane	Nord	2804	2808	5140	A1

KNGC	Vancouver	Nord	2804	2808	5140	A1
KNGQ	Wenatchee	Nord	2804	2808	5140	A1
KNGB	Yakima	Nord	2804	2808	5140	A1

**WEST VIRGINIA**

WRMP	Romney	RCA	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**WISCONSIN**

WMPE	Elkhorn	Comp	2804	2808	2812	A1
WIZR	Madison	Comp	2804	2808	2812	A1
WQLJ	Racine	Comp	2804	2808		A1

**INTERZONE POLICE STATIONS**

**ARKANSAS**

KGHZ	Little Rock	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7805	7480	7935	

**CALIFORNIA**

KGHX	Santa Ana	Coll	2804	2808	2812	A1
			5135	5140	5195	

**COLORADO**

KGPX	Denver	Coll	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**FLORIDA**

WPHN	Tampa	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**GEORGIA**

WPDY	Atlanta	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**ILLINOIS**

WQPS	Springfield	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**INDIANA**

WPIE	Indianapolis	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**IOWA**

KGHO	Des Moines	Coll	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**KANSAS**

KGZC	Topeka	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7935			

**KENTUCKY**

WPDE	Louisville	Comp	2804	2808	2812	A1
			5135	5140	5195	

**LOUISIANA**

WPEK	New Orleans	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**MASSACHUSETTS**

WPEW	Northampton	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**MICHIGAN**

WCK	Detroit	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	
WRDS	E. Lansing	WE	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**MINNESOTA**

KGPB	Minneapolis	WE	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**MISSISSIPPI**

WRJI	Jackson	Comp	2804	2808	2812	A1
			5135	5140	5195	
			7480	7805	7935	

**MISSOURI**

KGPE	Kansas City	WE	2804	2
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**FORESTRY SYSTEMS, continued**

WDNN	Dennis	Mtr	31340 FM
WSVG	Duxbury	Mtr	31340 FM
WLDK	North Easton	RCA	31340 AM
WQYX	Falmouth	Mtr	31340 FM
WAAN	Middleboro	GE	31340 FM
WRGE	Plymouth	Link	31340 FM
WRKV	Wareham	GE	31340 FM

**Licensed to Commonwealth of Massachusetts**

WBMR	Andover	Hftr	31340 AM
WRML		Comp	31340 AM
WQYW	Barnstable	Comp	35940 39940 AM
WBIO	Billerica	Link	31340 FM
WRNB	Boston	Comp	31340 AM
		Link	31340 FM
WQWJ	Bourne	Comp	35940 AM
		Link	31340 FM
WRKT	Brimfield	Comp	31340 AM
WCAW	Burlington	Comp	31340 AM
WBJP	Carlisle	Comp	31340 AM
WQYR	Carver	Link	31340 FM
		Comp	35940 AM
WSVG	Duxbury	Comp	35940 AM
WRKQ	Fall River	Link	31340 AM
		Link	31340 FM
WQYV	Falmouth	Comp	35940 39940 AM
		Link	31340 FM
WQYX		Hftr	35940 39940 AM
WBQY	Foxboro	Comp	31340 AM
WQYU	Hanson	Comp	35940 AM
		Link	31340 FM
WQMG	Harvard	Comp	31340 AM
WQYA	Harwich	Comp	35940 AM
		Link	31340 FM
WBKN	Haverhill	Hftr	31340 AM
WRKP	Mendon	Comp	31340 AM
WQYQ	Middleboro	Comp	35940 AM
		Link	31340 FM
WCAS	Monument Beach	Hftr	35940 AM
WMNR	North Reading	GE	31340 AM
WRKW	Osterville	Hftr	35940 AM
WRKU	Oxford	Comp	31340 AM
WRKR	Petersham	Comp	31340 AM
WQYS	Plymouth	Comp	35940 39940 AM
		Link	31340 FM
WRGE		Comp	35940 AM
WQWH	Princeton	Comp	31340 AM
WRKO	Sharon	Comp	31340 AM
WBPP	Sterling	Comp	31340 AM
WBKW	Stoughton	Comp	31340 AM
WBGD	Stow	Comp	35940 31340 AM
WRKV	Warsham	Comp	35940 AM
WQW1	Westboro	Comp	31340 AM

**MICHIGAN**

WBRD	Atlanta	RCA	30940 45740 AM
		35940	39420 39940 AM
WDAY	Baldwin	RCA	35740 AM
WSWB	Baraga	Mtr	30940 35740 AM
		35940	39420 39940 AM
WDAQ	Boyer City	Comp	35740 AM
WSWK	Crystal Falls	Mtr	30940 35740 AM
		35940	39420 39940 AM
WRRG	Escanaba	Mtr	35740 AM
WDSO	Ewen	RCA	30940 35740 AM
		35940	39420 39940 AM
WBXA	Gladwin	RCA	30940 35740 AM
		35940	39420 39940 AM
WBHX	Marquette	Comp	30940 35740 AM
		35940	39420 39940 AM
WBKZ	Mio	RCA	30940 35740 AM
		35940	39420 39940 AM
WEDM	Newberry	RCA	35740 AM
WIVA	Roscommon	Comp	30940 35740 AM
		39420	39940 AM
WMIC	Sit. Ste. Marie	Hftr	
WDAP	Traverse City	RCA	30940 35740 AM
		35940	39420 39940 AM

**MISSISSIPPI**

WPMZ	DeKalb	Mtr	39420 FM
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**NEW HAMPSHIRE**

WKJY	Concord	Mtr	39420 AM
WSRF	Franklin	Mtr	39420 AM
WLOM	Loudon	Comp	39420 AM
WAYI	Manchester	Mtr	39420 AM
WKRH	Northwood	Comp	39420 AM
WFZW	Wolfboro	Comp	39420 AM

**NEW JERSEY**

WQVN	Bass River	Comp	39740 AM
WQVR	Batsto	Comp	39740 AM
WQVI	Beaufort	Comp	39940 AM
WQVS	Belle Plain	Comp	39420 AM
WQVC	Blue Anchor	Comp	37460 AM
WQVE	Budd Lake	Comp	39940 AM
WQVB	Butler	Comp	39940 AM
WQVG	Catfish	Comp	39940 AM
WQVP	Coyle Field	Comp	39740 AM
WQVF	Culver Lake	Comp	39940 AM
WQVM	Farmingdale	Comp	39740 AM
WQVQ	Lakehurst	Comp	39740 AM
WBPN	Lebanon St. Fst.	Comp	35740 AM
WQVU	McKeetown	Comp	39420 AM
WRHU	Martinsville	Comp	39940 AM
		39420	39740 AM
WQVL	May's Landing	Comp	39420 AM
WQVT	Millville	Comp	39420 AM
WQVJ	Milton	Comp	39940 AM
WQVW	Mizpah	Comp	39420 AM
WQVO	Retreat	Comp	39740 AM
WQVK	Toms River	Comp	39740 AM
WQVA	Trenton	Comp	39420 39940 AM
		39740	39740 AM
WQVD	Union Hill	Comp	35940 AM
WQVH	Windbeam	Comp	39940 AM

**NORTH CAROLINA**

WLSE	Hertford	USFS	2236 AM
WLSK	South Mills	USFS	2236 AM

**OREGON**

KQSD	Dallas	Comp	2236 30940 AM
		31340	31580 31940 AM
KRDP	Medford	Comp	2236 30940 AM
		31340	31580 31940 AM
KQHQ	Salem	Comp	2236 30940 AM
		31340	31580 31940 AM

**PENNSYLVANIA**

WRXV	Clearfield	RCA	35940 AM
WRXT	Emporium	RCA	30940 AM
WIRT	Harrisburg	RCA	30940 AM
WJAB		RCA	35740 AM

8XVE	Kellogg Mtn. Fire Tower	RCA	30940 31580 AM
		31940	35740 35940 AM
8XVF	Knobs Fire Tower	RCA	39420 39740 AM
		35740	35940 37460 AM
8XUT	Lee Fire Tower	RCA	39420 39740 AM
		31580	31940 35740 AM
		35940	37460 39420 AM
8XVL	Loop Fire Tower	RCA	30940 31340 AM
		31580	31940 35740 AM
		35940	37460 39420 AM
WROE	Milroy	RCA	31940 35940 AM
WRKM	Milroyburg	RCA	35940 AM
WROF	Petersburg	RCA	30940 AM
3XPT	Peters Mtn.	RCA	30940 31940 AM
		35740	35940 37460 AM
WRMQ	Renova	RCA	39940 AM
WIYA	Scranton	RCA	37460 AM
8XUN	Shaffers Path Fire Tower	RCA	30940 AM
WRIA	Stroudsburg	RCA	31580 37460 AM
WRIB	Williamsport	Comp	31940 AM
		RCA	30940 AM

**RHODE ISLAND**

WAWR	Seltuate	USFS	31340 AM
		35940	37660 AM

**SOUTH DAKOTA**

KAFQ	Hermosa	GE	35940 FM
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**TEXAS**

KBWP	Cushing	Comp	2226 AM
KBWR	Hyatt	Comp	2226 AM
KBWO	Jefferson	Comp	2226 AM
KHJF	Lufkin	Comp	2226 AM
KBWK	Newton	Comp	2226 AM

**VIRGINIA**

WETN	Deep Creek	USFS	2236 AM
WETV	Suffolk	USFS	2236 AM

**WASHINGTON**

KGMD	Olympia	Stnc	2212 2236 AM
			2244 AM

**SPECIAL EMERGENCY SYSTEMS**

NOTE: The FCC listings of stations do not identify the stations with the operating companies

**ALABAMA**

Andalusia	Ala. Electric Cooperative, Inc.
Birmingham	Birmingham Gas Co. 1918 1st Ave. N. South. Natural Gas Co. P.O. Box 2563 Dept. of Cons., Div. Forestry 5 N. Bainbridge St.
Montgomery	

**ARKANSAS**

Little Rock	City of Little Rock City Hall
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**CALIFORNIA**

Grass Valley	Nevada Irrigation Dist.
Long Beach	City of Long Beach City Hall
Los Angeles	Dept. of Water & Power Box 240, Arcade Annex Flood Control District 751 S. Figueroa St. L. A. Railway Corp. 1060 S. Broadway Pacific Lighting Corp. 810 S. Flower St. Sheriff's Dept. Rm. 220, Hall of Justice S. Calif. Edison Co., Ltd. 601 W. 5th St. S. Calif. Gas Co. 810 S. Flower St. S. Counties Gas Co. of Calif. 810 S. Flower St. Superior Oil Co. 930 Edison Bldg. Modesto Irrigation Dist. 823 Eleventh St. Key System 1106 Broadway Calif. Elec. Power Co. 3771 8th St. Reclamation Dist. 1500 Dept. Pub. Wks., Div. H'ways PW Bldg., 12th & N Sts. San Diego Elec. Ry. Co. 206 Union Bldg. San Diego Gas & Elec. Co. 861 6th Ave. San Francisco Ambrose Gherini 410 Mills Bldg. Havliside Co. 40 Spear St. Pacific Gas & Elec. Co. 245 Market St. Pacific Tel. & Tel. Co. 140 New Montgomery S. Calif. Tel. Co. 140 New Montgomery St. Southern Pacific Co. 65 Market St. Coast Counties Gas & Elec. Co. 22 Pacific Ave.
Modesto	
Oakland	
Riverside	
Robbins	
Sacramento	
San Diego	
San Francisco	
Santa Cruz	

**COLORADO**

Denver	Mountain States Tel. & Tel. Co. Box 960
Montrose	Uncompahgre Valley Water Assoc. 601 N. Park Ave.

**CONNECTICUT**

Hartford	Hartford Elec. Light Co. 266 Pearl St.
New Haven	S. New England Tel. Co. 227 Church St. United Illuminating Co. 80 Temple St.
Waterbury	Conn. Light & Power Co. 250 Freight St.

**DELAWARE**

Wilmington	Del. Power & Light Co. 600 Market St.
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**DISTRICT OF COLUMBIA**

Washington	Capital Transit Co. 36th & M St., NW Chesapeake & Potomac Tel. Co. 725 13th St., NW Potomac Electric Power Co. 10th & E Sts., NW W. M. & A. Motor Lines, Inc. 1510 Southern Ave., SE
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**FLORIDA**

Jacksonville	City of Jacksonville 1040 Laura St.
Miami	Florida Power & Light Co. 25 SE 2nd Ave.
St. Petersburg	City of St. Petersburg City Hall
Tallahassee	Bd. Forestry & Parks Box 1200

**GEORGIA**

Atlanta	S. Bell Tel. & Tel. Co. 67 Edgewood Ave., SE Southern Natural Gas Co. Superior Pine Prods. Co. Cons. Timber Prot. Org'n
Fargo	
Homerville	

**IDAHO**

Coeur D'Alene	Kootenai Rural Electrification Assn.
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**ILLINOIS**

Chicago	Chicago Surface Lines 231 S. 1 LaSalle St. Commonwealth Edison Co. 72 W. Adams Ill. Bell Tel. Co. 212 W. Washington St. Nat. Gas Pipeline Co. of Amer. 20 N. Wacker Dr. Texoma Nat. Gas Co. 20 N. Wacker Dr. Panhandle Eastern Pipeline Co. Ill. Electric & Gas Co. Menard Elec. Coop. 122 S. 6th St. Dept. Pub. Works & Bldgs. 601 Sangamon Ave.
Glanarm	
Herrin	
Petersburg	
Springfield	

**INDIANA**

Browstown	Jackson Co. Rural Electric Mem. Corp.
Edgerton	Panhandle Eastern Pipeline Co.
Elkhart	Indiana & Mich. Electric Co.
Fort Wayne	Indiana Service Corp. 116 E. Wayne St. Northern Ind. Pub. Serv. Co. 220 S. Main St. Huntington Co. Rural Electric Corp. Indiana Bell Tel. Co. 240 N. Meridian Indianapolis Power & Light Co. 17 N. Meridian St. Pub. Service Co. of Ind., Inc. 110 N. Illinois St. Indiana Gen. Service Co. Indiana & Michigan Elec. Co. 220 W. Colfax Ave.
Goshen	
Huntington	
Indianapolis	
Marion	
South Bend	

**IOWA**

Des Moines	Iowa Power & Light Co. 312 Sixth Ave.
Jefferson	Jefferson Telephone Co. 105 W. Harrison
S. Ansgar	Cooperative Electric Co.

**KANSAS**

Independence	Union Gas System, Inc. 122 W. Myrtle
Wichita	Kansas Gas & Elec. Co. 1900 E. Central

**KENTUCKY**

Lexington	Kentucky Utilities Co.
Louisville	Louisville Gas & Elec. Co. 311 W. Chestnut

**LOUISIANA**

Baton Rouge	Gulf States Utilities Co.
New Orleans	Louisiana Power & Light Co. 142 Delaronde St. Public Service, Inc. 317 Baronne St. Superior Oil Co.
West Monroe	

**MARYLAND**

Baltimore	Baltimore Transit Co. Ches. & Pot. Tel. Co. of Balt. City 108 E. Lexington Cons. Gas, Electric, Light & Power Co. of Baltimore 39 W. Lexington St.
Bradbury Heights	W. M. & A. Motor Lines, Inc.

**MASSACHUSETTS**

Boston	Boston Cons. Gas Co. 100 Arlington St. Boston Edison Co. 182 Tremont St. Boston Elevated Ry. Co. 31 St. James Ave. New England Power Co. 441 Stuart St. New England Tel. & Tel. Co. 50 Oliver St. Brockton Brockton Edison Co. 36 Main St. Holyoke Holyoke Water Power Co. 1 Canal St. Cape & Vineyard Co. Lawrence Gas & Electric Co. New Bedford Gas & Edison Light Co. Central Mass. Electric Co. Plymouth Co. Electric Co. Western Mass. Electric Co. 71 State St. Worcester Worcester
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## SPECIAL EMERGENCY SYSTEMS

continued

### MICHIGAN

**Detroit** Detroit Edison Co.  
2000 2nd Ave.  
Dept. of Street Railways  
11200 Shoemaker Ave.  
Michigan Bell Telephone Co.  
1365 Cass Ave.

**Portland** Tri-Co. Electric Coop.  
Box 1838

### MINNESOTA

**Glencoe<sup>7</sup>** McLeod Coop. Power Assn.  
**Minneapolis** Minneapolis Gas & Light Co.  
739 Marquette Ave.  
Northern States Power Co.  
15 S. Fifth St.  
Rainy River Improvement Co.  
500 Baker Arcade Bldg.

### MISSOURI

**Joplin** Empire Dist. Electric Co.  
**Kansas City** Panhandle East. Pipe Line Co.  
1221 Baltimore Ave.  
Kansas City Pub. Service Co.  
728 Delaware St.  
Kansas City Power & Light Co.  
1330 Baltimore St.

**St. Joseph** St. Joseph Railway, Light, Heat & Power Co.  
520 Francis St.

**St. Louis** St. Louis Pub. Serv. Co.  
3869 Park Ave.  
Southwestern Bell Tel. Co.  
1010 Pine St.  
Union Electric Co. of Mo.  
315 N. 12th St.

### MONTANA

**Butte** Montana Power Co.  
40 E. Broadway

### NEBRASKA

**Omaha** Northwestern Bell Tel. Co.  
118 S. 19th St.

### NEW JERSEY

**Atlantic City** Atlantic City Electric Co.  
1600 Pacific Ave.

### NEW YORK

**Adams** Adams Electric Light Co.  
**Binghamton** Home Gas Co.  
267 Court St.

**Buffalo** Buffalo Niagara Elec. Corp.  
535 Washington St.  
Division of Water  
504 City Hall

**Far Rockaway** Queens Boro Gas & Elec. Co.  
1610 Far Rockaway Blvd.

**Jamestown**

**Mineola**  
**Monroe**  
**New York**

Amer. Legion, Ira Lou Spring Post No.  
149, Emerg. Unit  
1 Penton Place  
Long Island Lighting Co.  
Orange & Rockland Electric Co.  
Amer. Tel. & Tel. Co. (L.L. Dept.)  
32 Sixth Ave.  
N. Y. Bd. of Transportation  
250 Hudson St.  
Cons. Edison Co. of N. Y.  
4 Irving Place  
New York Telephone Co.  
140 West St.  
Western Union Telegraph Co.  
60 Hudson St.  
New York & Queens Elec. Light & Power Co.  
Long Island City  
N. Y. State Natural Gas Corp.  
Central N. Y. Power Corp.  
300 Erie Blvd. W.

### OHIO

**Akron** Ohio Edison Co.  
47 Main St.

**Alliance** Ohio Pub. Service Co.  
247 E. Main St.

**Canton** Ohio Power Co.  
606 2nd St. SE

**Cincinnati** Cincinnati St. Railway Co.  
Dixie Term. Bldg., 4th & Walnut

**Cleveland** Division of Transportation  
1404 E. 9th St.  
Ohio Bell Telephone Co.  
750 Huron Rd.

**Columbus** Columbus & Southern Ohio Electric Co.  
215 N. Front St.

**Dayton** Dayton Power & Light Co.  
25 S Main St.

**St. Clairsville** Belmont Electric Coop., Inc.  
**Toledo** Dept. Public Serv., Div. of Water  
Toledo Edison Co.  
Edison Bldg.

### OKLAHOMA

**Oklahoma City** Oklahoma Gas & Electric Co.  
321 N. Harvey

**Tulsa** Public Service Co. of Okla.  
600 S. Main St.  
Stanolind Pipe Line Co.  
PO Box 591

**Wilson** Interstate Oil Pipe Line Co.

### OREGON

**Medford** California Oregon Power Co.  
216 W. Main St.

**Portland** Northwestern Electric Co.  
920 SW Sixth Ave.  
Portland Gas & Coke Co.  
920 SW Sixth Ave.  
Portland Gen. Electric Co.  
621 SW Alder St.

### PENNSYLVANIA

**Allentown** Penna. Power & Light Co.  
901 Hamilton St.

**Charleroi**  
**Johnstown**  
**Parkers Landing**

**Philadelphia**

**Pittsburgh**

**Guayama**

**San Juan**

**Pawtucket**

**Chattanooga**

**Memphis**

**Beaumont**

**Corpus Christi**

**Fort Worth**

**Granbury**

**Houston**

**Mercedes**

**San Antonio**

**San Marcos**

**Seymour**

**Coalville**

**Salt Lake City**

**Alexandria**

**Arlington**

West Penn Power Co.  
Pennsylvania Electric Co.  
Central Electric Coop., Inc.  
Box 397

**Philadelphia** Philadelphia Electric Co.  
1000 Chestnut St.  
Bell Telephone Co.  
1835 Arch St.  
Philadelphia Trans. Co.  
1405 Locust St.  
Duquesne Light Co.  
435 6th Ave.  
Peoples Natural Gas Co.  
545 Wm. Penn Way  
Pittsburgh Railway Co.  
435 Sixth Ave.

### PUERTO RICO

Dept. of the Interior  
Utilization of Water Resources  
P. R. Water Res. Auth.

### RHODE ISLAND

**Pawtucket** Blackstone Valley Gas & Elec.  
5 Hight St.

### TENNESSEE

**Chattanooga** Electric Power Board  
6th & Cherry Sts.  
**Memphis** Light, Gas & Water Div.  
179 Madison Ave.

### TEXAS

**Beaumont** City Water Dept.  
Walnut & Mulberry Sts.  
**Corpus Christi** Gulf States Utilities Co.  
Central Power & Light Co.  
120 N. Chaparral St.

**Fort Worth** Texas Electric Service Co.  
Box 970  
Brazos Riv. Trans. Elec. Coop.  
Box 201

**Houston** Houston Light & Power Co.  
1016 Walker Ave.  
Magic Valley Elec. Coop., Inc.  
109 N. Ohio

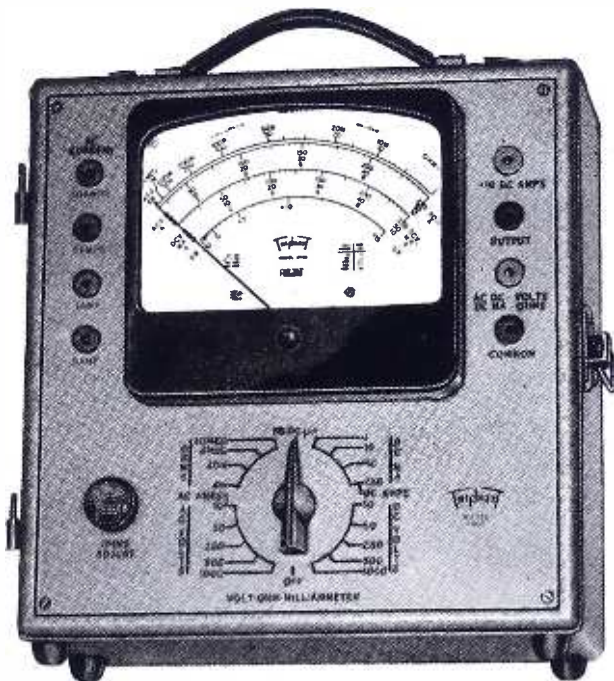
**San Antonio** City Public Service Board  
201 N. St. Mary's  
San Antonio Transit Co.  
310 S. St. Mary's  
Lower Colorado River Authority  
B-K Electric Coop., Inc.

### UTAH

**Coalville** Mountain Fuel Supply Co.  
**Salt Lake City** Telegram Publishing Co.  
137-143 S. Main

### VIRGINIA

**Alexandria** Harcroft & Wash. Trans. Co.  
600 N. Royal St.  
**Arlington** Wash. Va. & Md. Coach Co.  
707 N. Randolph St.



## NEW ENGINEERING • NEW DESIGN • NEW RANGES 30 RANGES

**Voltage:** 5 D.C. 0-10-50-250-500-1000 at 25000 ohms per volt.  
5 A.C. 0-10-50-250-500-1000 at 1000 ohms per volt.

**Current:** 4 A.C. 0-.5-1-5-10 amp.  
6 D.C. 0-50 microamperes — 0-1-10-50-250 milliamperes—0-10 amperes.

**4 Resistance** 0-4000-40,000 ohms—4-40 megohms.  
**6 Decibel** -10 to +15, +29, +43, +49, +55  
**Output** Condenser in series with A.C. volt ranges.

Model 2400 is similar but has D.C. volts  
Ranges at 5000 ohms per volt.

Write for complete description

## MODEL 2405

# Volt-Ohm-Milliammeter

25,000 OHMS PER VOLT D.C.

STANDARDS ARE SET BY  
**TRIPLET**

## SPECIFICATIONS

NEW "SQUARE LINE" metal case, attractive tan "hammered" baked-on enamel, brown trim.

■ **PLUG-IN RECTIFIER**—replacement in case of overloading is as simple as changing radio tube.

■ **READABILITY**—the most readable of all Volt-Ohm-Milliammeter scales—5.6 inches long at top arc.

■ **RED-DOT LIFETIME GUARANTEE** on 6" instrument protects against defects in workmanship and material.

# Triplet

## ELECTRICAL INSTRUMENT CO.

BLUFFTON OHIO.



# Lafayette

## RADIO BARGAIN BUYS

### TUBES

EIMAC 304th medium-mu triode can be used as modulator, oscillator or amplifier. Good up to 10 meters . . . \$9.95  
 327A . . . 3.95  
 807 . . . 1.49  
 829, 829B . . . 4.95  
 813 xmitting tube, 360 w. input Beam Power Amplifier, requires no neutralization . . . 9.95  
 WESTINGHOUSE KLYSTRON 417A . . . 2.95  
 954 . . . .69  
 955 . . . .69  
 956 . . . .69

### RECEIVER

BC-406 is a 15 tube, 205 mc. superhet that's a natural for conversion to the 10, 5 and two meter bands . . . \$19.95

### SPECIAL

SONAR F-M EXCITER Model XE-10 conveniently and economically adapts any cw or phone xmitter for F-M mission. . . . \$39.45

### FILTER CONDENSERS, OIL FILLED

XPS498	2 mfd. 600 v. round.	27/8" x 1 1/2"	.59
XPS499	4 mfd. 600 v. round.	4 1/2" x 1 1/2"	1.19
HR102	6 mfd. 600 v.	4 3/4" x 2 1/2" x 1 1/4"	1.35
HR104	4 mfd. 1000 v.	4 3/4" x 2 1/2" x 1 1/4"	1.49
HR103	1 mfd. 2000 v.	4 1/4" x 2 1/2" x 1 1/4"	1.49
HR105	3 mfd. 2000 v.	4 3/4" x 3 3/4" x 1 1/4"	2.95

### 25TH ANNIVERSARY CATALOG

**FREE!**

It will take you a solid week to chaw over the thousands of items in the new giant-sized Lafayette catalog. And we don't piddle with pennies; these are dollar-saving values. Get on our mailing list right now; use the coupon below.

LAFAYETTE RADIO

25th Anniversary



Frank Lester, W2AMJ, is back in charge of Lafayette's Ham Division — ready to answer questions and pass the time of day with you. Ask for him when you stop in or write.

## LAFAYETTE RADIO

LAFAYETTE RADIO, Dept. HH-6  
 100 Sixth Avenue, New York 13, N. Y.  
 PLEASE SEND ME THE FOLLOWING:

Quan.	No.	Price (each)	Quan.	No.	Price (each)
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

(List additional items on separate sheet and attach to coupon)  
 Enclosed find \$.....  check  M.O.;  send C.O.D.  
 Please send me your new giant-sized catalog FREE of charge.  
 Name.....  
 Address.....  
 City..... Zone..... State.....

### RADIO WIRE TELEVISION, INC.

100 Sixth Ave.  
 New York 13, N. Y.

110 Federal St.  
 Boston 10, Mass.

24 Central Ave.  
 Newark 2, N. J.

### SPECIAL EMERGENCY SYSTEMS continued from page 47

Richmond Chesapeake & Potomac Tel. Co. of Virginia  
 703 E. Grace  
 Roanoke Appalachian Elec. Power Co.  
 129 E. Campbell Ave.  
**WASHINGTON**  
 Davenport Lincoln Electric Corp.  
 Everett City Water Dept.  
 3102 Cedar St.  
 Seattle City of Seattle  
 1015 Third Ave.  
 Puget Sound Power & Light Co.  
 860 Stuart Bldg.  
 Spokane Washington Water Power Co.  
 825 Trent Ave.  
 City Lines, Inc.  
**WEST VIRGINIA**  
 Charleston Chesapeake & Potomac Tele. Co. of W. Va.  
 816 Lee St.

Wheeling Appalachian Electric Power Co.  
 Wheeling Electric Co.  
 51 Sixteenth St.

### WISCONSIN

Appleton Wisconsin Michigan Power Co.  
 137 W. Mill St.  
 Baldwin Daryland Power Coop.  
 Gays Mills Crawford Electric Coop.  
 Marshfield Electric & Water Dept.  
 City Hall Bldg.  
 Milwaukee Wisconsin Electric Power Co.  
 213 W. Michigan St.  
 Wisconsin Gas & Electric Co.  
 231 W. Michigan St.  
 Wisconsin Telephone Co.  
 722 N. Broadway  
 St. Croix Falls Northern States Power Co.  
 Westby Vermont Electric Coop.

### WYOMING

Rock Springs Mountain Fuel Supply Co.  
 615 Conn. Ave.

### SPOT NEWS NOTES

(CONTINUED FROM PAGE 26)

CBS is always so anxious to give FM whatever FM doesn't want and can't use. The band best suited for FM expansion is 44 to 56 mc. but that includes television channel 2, now assigned to CBS in New York.



**Edward N. Wendell:** New vice president of I.T. & T. in charge of Federal Telephone & Radio Corporation. After graduating from M.I.T. in 1925, Mr. Wendell joined I.T. & T. and was

assigned to the Corporation's Cuban and Spanish properties. Later, he directed the construction of overseas telephone stations at Madrid, the Canary Islands, and the Balearic Islands. After serving as chief engineer for the Spanish Telephone Company, he returned to the U.S. in 1937 and was assigned to I.T.D.C., where he did important work on the development of aircraft radio landing equipment. In his present position, Mr. Wendell will have full managerial authority of F. T. & R.

**Inconsistent:** Having buttoned FM broadcasting down to single-market coverage, the FCC is now considering proposals to increase the power of clear-channel AM stations. It isn't consistent to restrict service to listeners from a superior method of broadcasting, and expand the coverage of stations which provide inferior reception.

Trouble is that the experts are drawing circles on maps again, and taking it for granted that signals can be thus regimented. Yet they admit that 60% of the U.S. is dependent on skywave service at night. Well, why not let AM stations give all the skywave service they choose. From the listeners' point of view, it's so uncertain and unsatisfactory that no one will want it when FM programs are available.

**Paul V. Galvin:** Queried about the rumor that he plans to withdraw from radio industry, Paul Galvin assured us: "There is absolutely no foundation to this rumor. I have no intention of selling my interest in the Galvin Manufacturing Company, and I am not even discussing the matter of sale with anyone. Nor do I have any idea of giving up my active management of the affairs of the Galvin Corporation."

**Charlotte, N. C.:** C.P. has been granted to Southeastern Broadcasting Company, operators of WBT, for an FM station of 160 kw. radiated power. Land has been purchased on Spencer Mountain in Gaston County, 16 miles from Charlotte, for the antenna and transmitter site. Antenna will be 1090 ft. above surrounding terrain; Coverage area, 27,600 square miles.



# Eimac Tetrodes lead the way to simplified CRYSTAL FREQUENCY CONTROL FOR DIATHERMY and ELECTRONIC HEATING



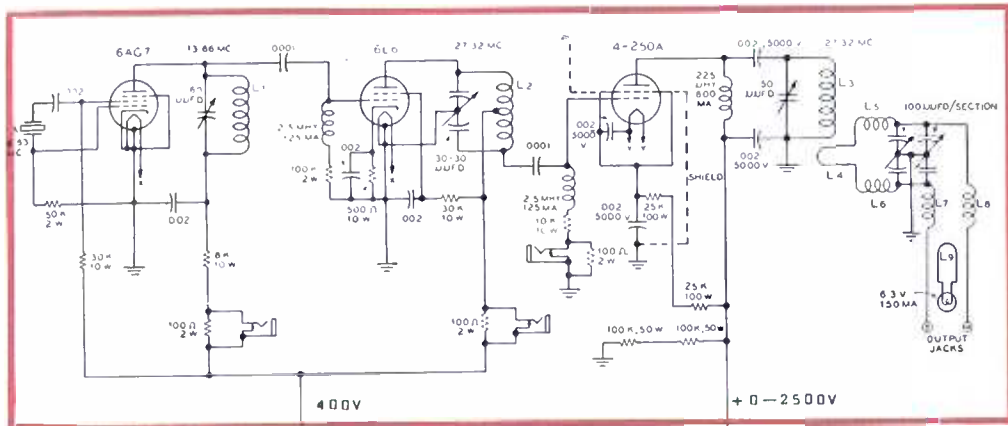
Crystal control of frequency now becomes the practical answer to the new frequency stability requirements. Eimac tetrodes make crystal frequency control feasible and simple. *Crystal control through Eimac tetrodes means maximum frequency stability, end of objectionable radiation, and handy portability for electronic heating units of the future.*



Eimac 4-250A Tetrode

## Here's How an Eimac Tube Makes This Practical

The way just one Eimac 4-250A tetrode makes crystal frequency control practical is shown in this *operative*, experimental circuit assembled by Eimac engineers. The circuit is also applicable to other forms of electronic heating.



Eimac 4-125 Tetrode

## Here's Why Eimac Tubes Make Crystal Frequency Control Practical

Because of their unique characteristics, Eimac power tetrodes such as the 4-250A and 4-125A are ideal for use in circuits like the one above.

These tubes have an unusually high power-gain for efficient performance at medium, high, or the very high frequencies used in diathermy and heating. For example, the 4-250A (at frequencies up to 70 Mc.) develops power output of 750 watts with a driving power of less than 5 watts. The 4-125A tetrode delivers 375 watts output with less than 3 watts drive.

## Greater Stability... Longer Life

Both tetrodes have specially treated elements that insure longer life. Both have non-emitting grids which give great operating stability.

Because of their low grid-plate capacitance (0.12 *u*fd in the 4-250A and 0.05 *u*fd in the 4-125A), these tubes normally require no neutralization at diathermy or heating frequencies. (In fact, the 4-250A normally requires no neutralization up to 70 Mc; 4-125A ordinarily needs none even at 120 Mc.)

## Eimac Tetrodes for Power Amplification Throughout the Useful Frequencies

Dependable, durable Eimac tetrodes are admirably suited for diathermy or electronic heating work, or for almost any power amplification assignment at any frequency, including VHF. Write today to Eimac's local representatives or factory engineers for complete data on these tubes.

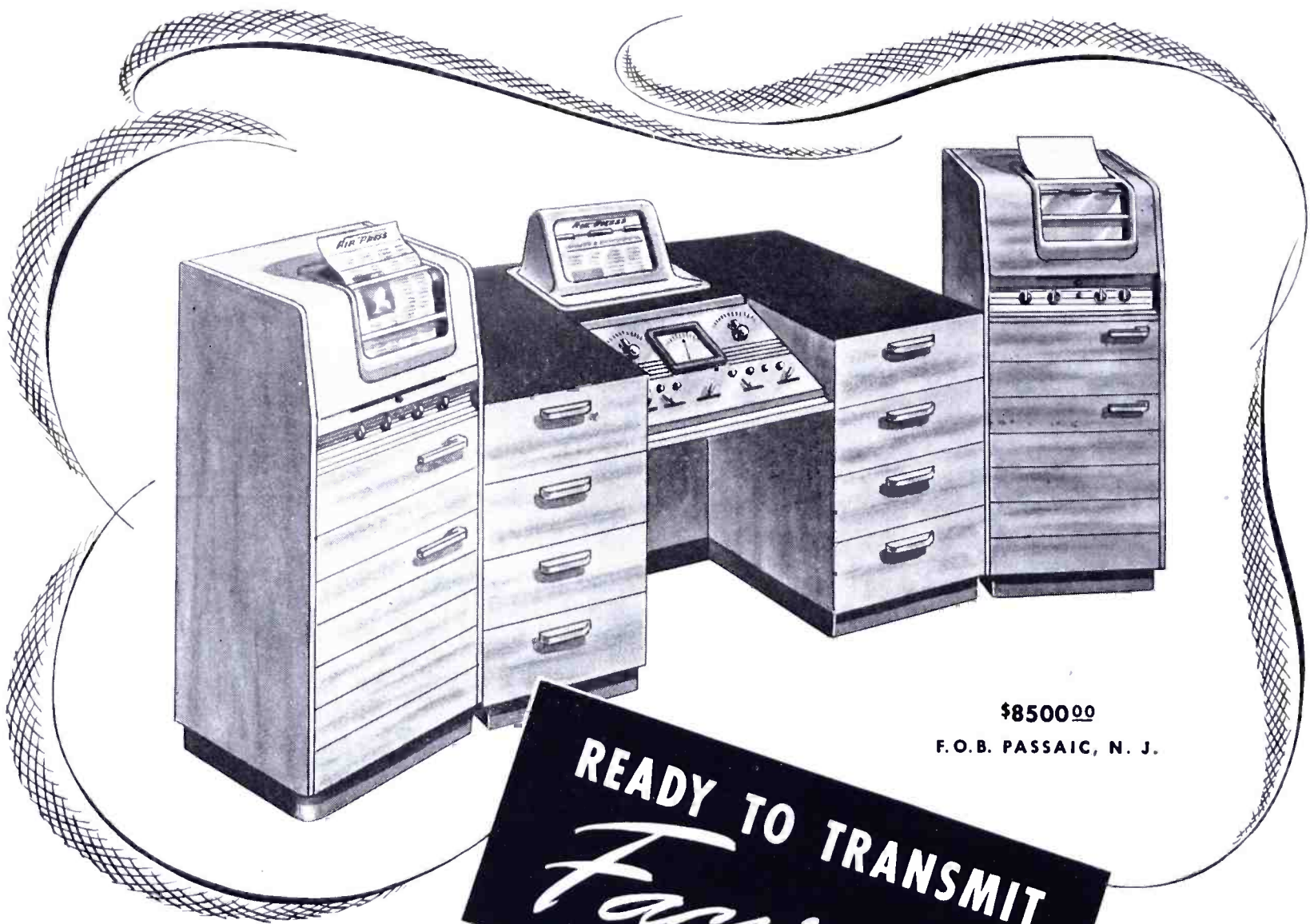
Follow the Leaders to



**EITEL-McCULLOUGH, INC.**

1290L San Mateo Avenue • San Bruno, Calif.  
Export Agents: Frazar and Hansen, 301 Clay St., San Francisco 11, California, U. S. A.





**\$8500<sup>00</sup>**

**F. O. B. PASSAIC, N. J.**

**READY TO TRANSMIT**  
*Facsimile*

## HERE COMES

## PRINTED-AND-ILLUSTRATED RADIO

The new Finch Telefax Facsimile Broadcasting Equipment embraces every new development of Finch experience and research — backed by more than 100 issued patents and many others pending.

Assembly shown above consists of a monitor control desk flanked by two transmitting scanners, which assure a continuous flow of program material through the transmitter.

Operation is simple, reliable, time-saving, with automatic copy loading controlled by push

button, and automatic return of scanner carriage at end of each page. The extra recorder on the control desk provides a file copy of the program.

The Finch sales contract carries with it complete license benefit and rights under the more than 100 facsimile patents and applications owned by Finch for the use of Finch Facsimile equipment. Orders are now being accepted for fall deliveries. And the cost is much less than some estimates have been. Write for full particulars.

 self-synchronizing  
**finch facsimile**

**FINCH TELECOMMUNICATIONS, INC.**  
10 EAST 40th STREET, NEW YORK 16, NEW YORK  
*Also manufacturers of Finch ROCKET Antennas for FM Stations.*





COMPONENTS FOR

# FM and

# TV

FREQUENCIES



Now that the emphasis in communications is turning more and more toward the FM and Television frequencies, there is a great demand for quality components made to increasingly critical specifications. Amphenol products have kept abreast of developments and are available now—in quantity—to manufacturers of equipment operating in these frequencies and to amateurs.

In addition to the long line of standard parts, Amphenol engineers announce the following new products particularly adaptable to FM and Television:

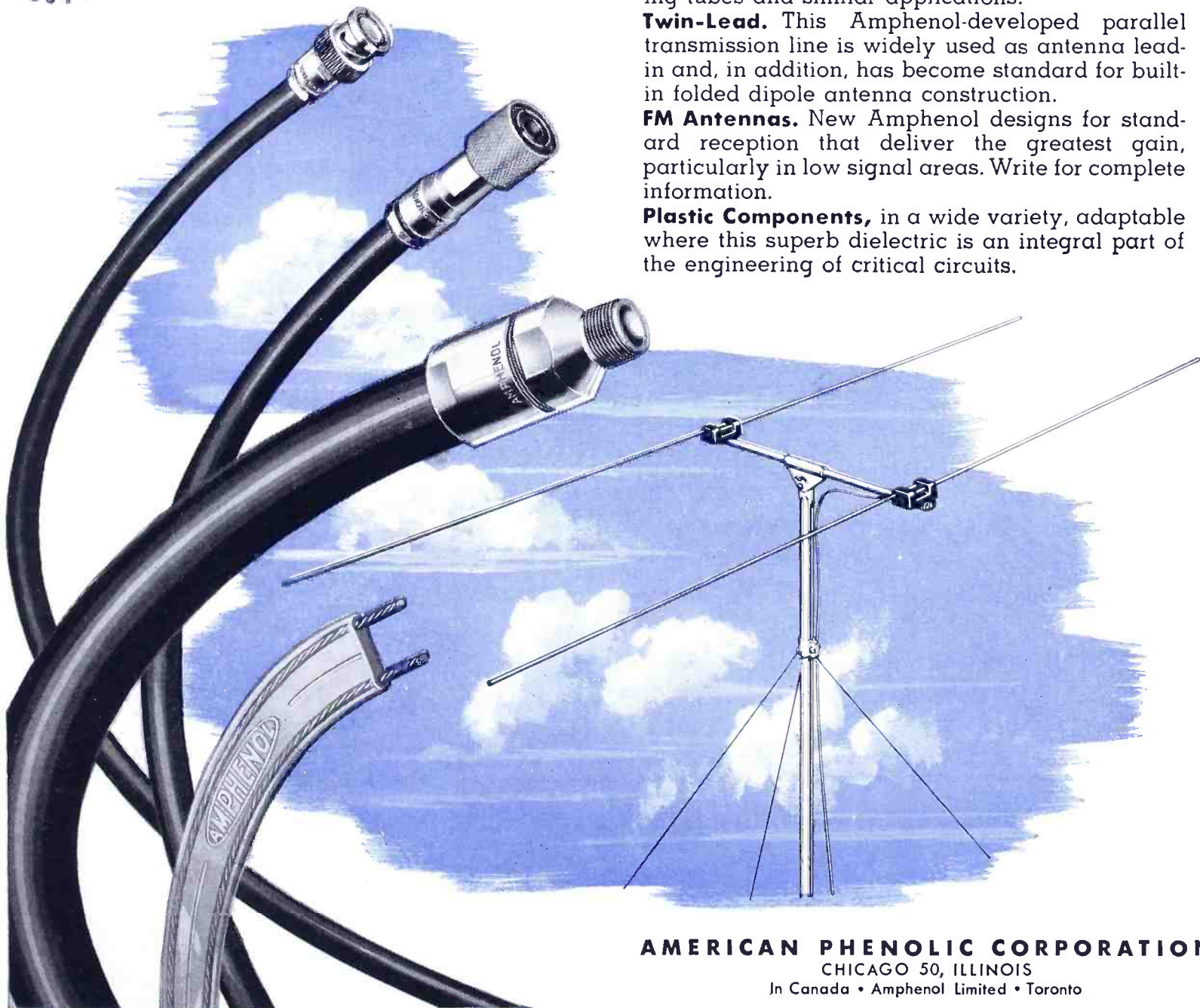
**Radio Frequency Cable and Connectors** and a new line of low-capacitance microphone cables. Also, new cables especially developed for Television color cameras and for Facsimile work.

**Hi-Q Tube Sockets.** Standard, miniature and sub-miniature. Also new sockets for cathode ray viewing tubes and similar applications.

**Twin-Lead.** This Amphenol-developed parallel transmission line is widely used as antenna lead-in and, in addition, has become standard for built-in folded dipole antenna construction.

**FM Antennas.** New Amphenol designs for standard reception that deliver the greatest gain, particularly in low signal areas. Write for complete information.

**Plastic Components,** in a wide variety, adaptable where this superb dielectric is an integral part of the engineering of critical circuits.



**AMERICAN PHENOLIC CORPORATION**

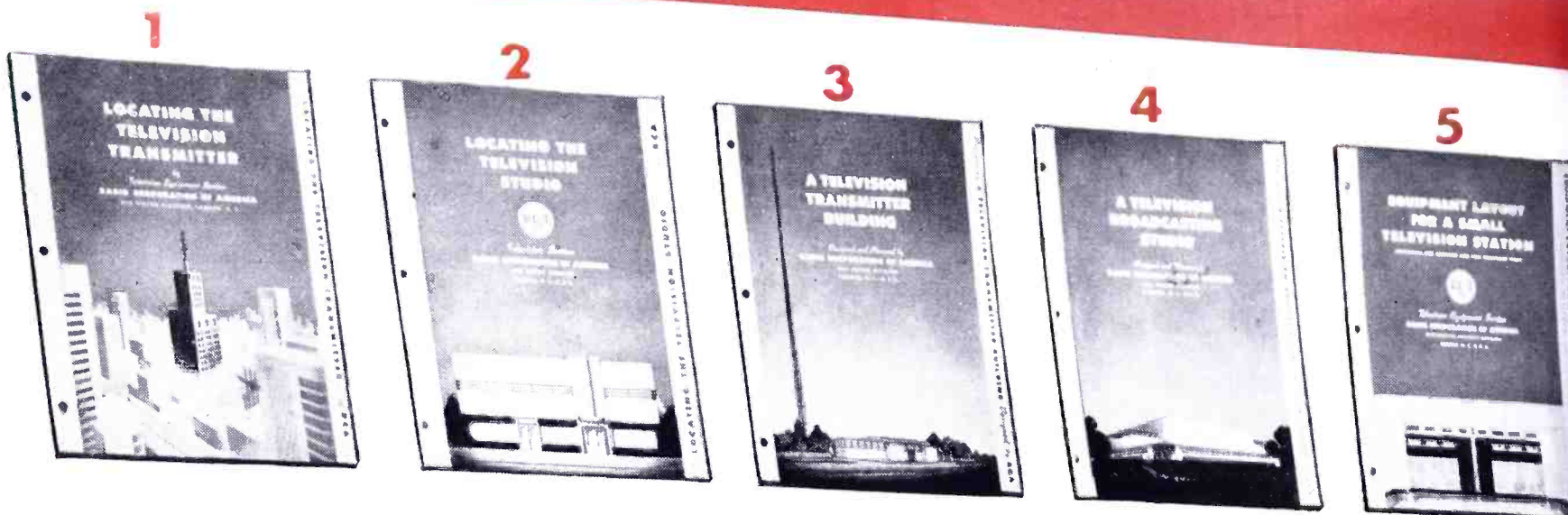
CHICAGO 50, ILLINOIS

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COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS



# 8 FREE GUIDES



## 1 Locating the Television Transmitter

Covers factors governing the choice of site, technical requirements, importance of central location, importance of height, calculation of coverage, various types of sites (tall buildings, mountain tops, existing AM station locations, low buildings with a steel tower, television and FM transmitter at same site using a common antenna).

## 2 Locating the Television Studio

Discusses and illustrates such subjects as: space required for operations, cost of land and buildings, provision for future expansion, freedom of interference, power and water facilities, nearness to outside program sources, and location with relation to transmitter.

## 3 A Television Transmitter Building

Present indications are that most new transmitters will be located, wherever possible, in existing city buildings. However, if you plan to build a special transmitter building now, or in the future, this publication offers practical

suggestions on exterior appearance and floor plans. Covers general requirements, transmitter room, video receiving room, visitors' lobby, laboratory and shop, storage space, living quarters, and other provisions.

## 4 A Television Broadcast Studio

Typical headings include: number of studios required, size and shape of studios, acoustics and lighting, separate control booths, film studio, master control room, audience, and studio-transmitter link.

## 5 Equipment Layout for a Small Television Station

(with provision for network and film programs only.)

Publications 5, 6, 7, and 8 present a complete program on how your television station can grow in easy stages—low investment and operating costs in the initial period, gradual expansion later as your television audience grows. Leaflet 5 covers the minimum layout required to start telecasting.

## 6 Equipment Layout for a Small Television Station

(with provision for live-talent studio

programs and remote field pick-ups.)

This booklet presents Stage 2—the addition of portable pick-up equipment for live-talent programs. Although the equipment is intended primarily for field use, its flexibility is such that it can also be used as studio video equipment. Thus you can increase the diversity of your programs by having remote pick-ups one night, studio shows the next.

## 7 Equipment Layout for a Standard Television Station

This leaflet presents Stage 3—the addition of studio-type cameras and video equipment to provide a permanent studio system. This addition makes it possible to switch immediately from a remote pick-up to a studio show. Then too, this equipment is always available for rehearsal purposes.

## 8 Equipment Layout for a Master Television Station

Presents Stage 4—the addition of more studios and a master control room. Although Stage 3 will cover the needs of most stations for some time to come, Stage 4 will eventually be necessary for all major stations in large cities and for network stations that originate many studio programs.

Get your television station started now with this fully developed, in-production line of RCA equipment



Remote Pick-up Equipment



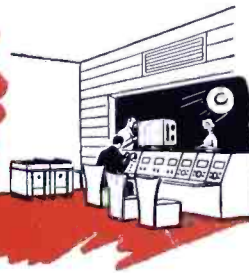
Relay Equipment



Film Equipment



Studio Equipment



Control-room Equipment



Transmitting Equipment



Antennas



# on practical, low-cost television-station planning

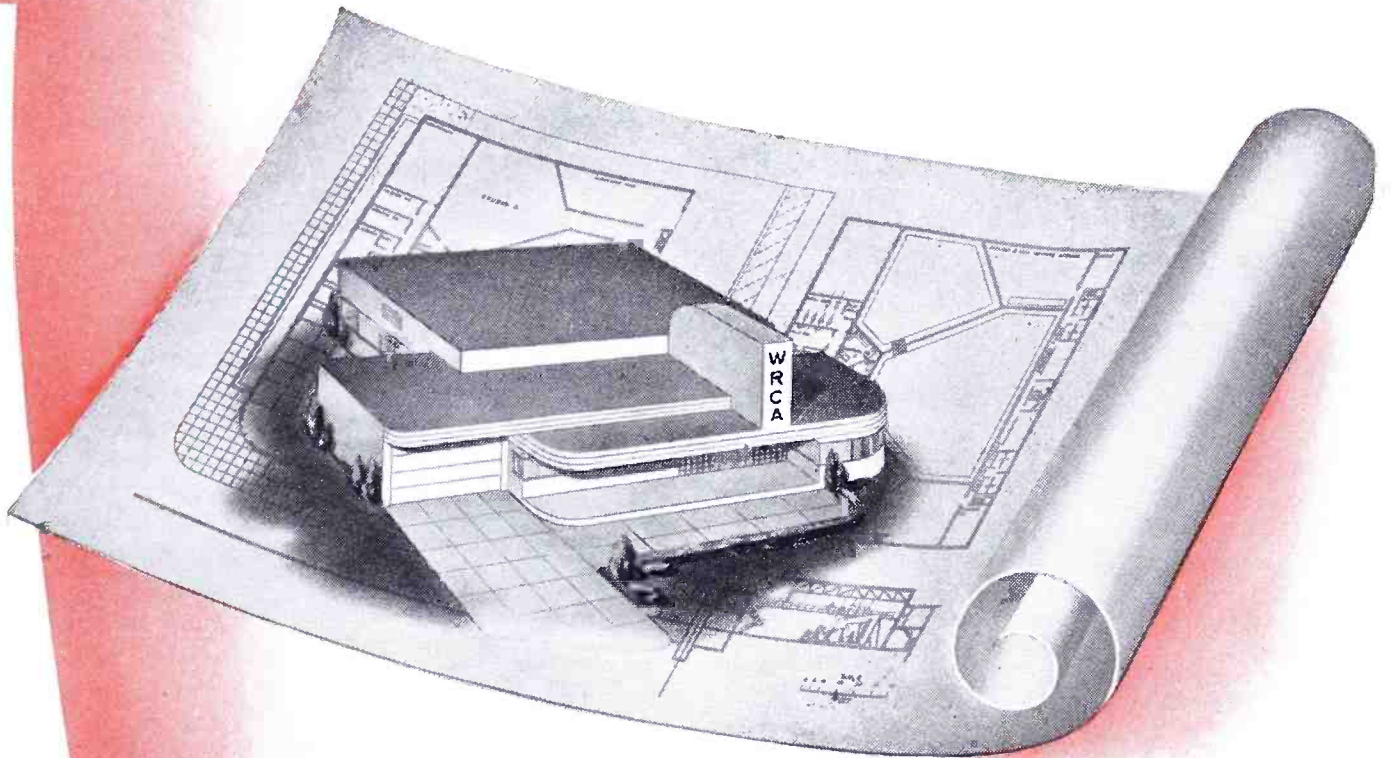
6



7



8



HERE'S a complete file of "how-to-go-about-it" information to help you get your television station started immediately. Many money-saving tips are given to keep your investment cost down—practical short cuts to get you on the air quickly.

The layouts and suggestions given are those that engineers, on the basis of their experience to date, believe they need. Stage-by-stage plans are given to permit easy station expansion as your television audience grows. Expansion can be carried on without making original equipment obsolete and with minimum interference to station operation.

The unique construction and programming problem of stations in small towns have been kept in mind, as well as the requirements of large cities. The emphasis throughout is on "down-to-earth" economy; there are no "blue-sky," costly plans.

Any one or all of these booklets are yours for the asking. You will find them an excellent construction check list from which individual adaptations can be made. Just let us know on your company letterhead which bulletins you need. Write Dept. 35-H, Television Equipment Section, Radio Corporation of America, Camden, N. J.



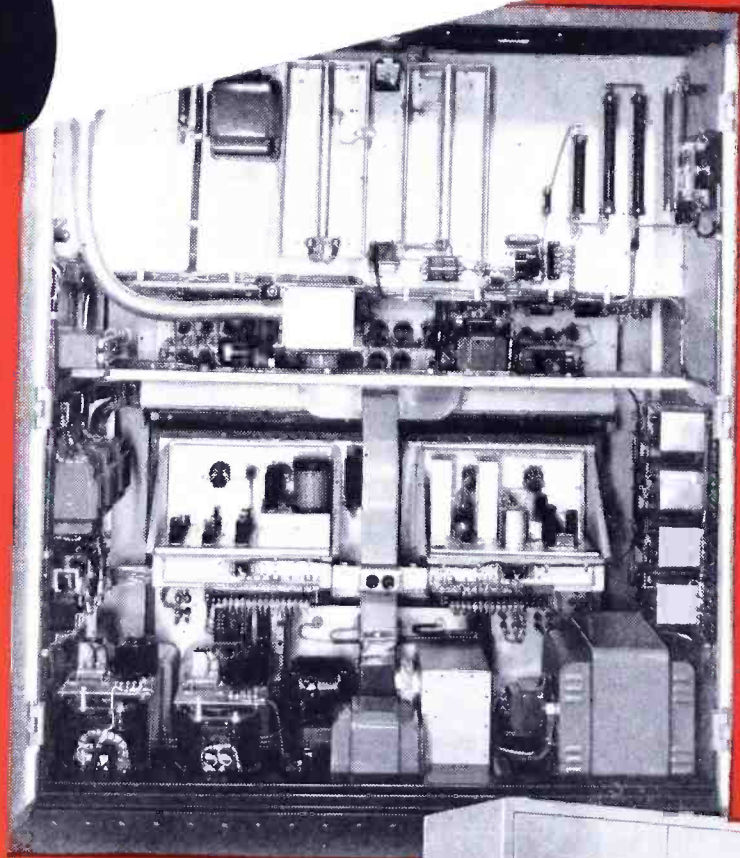
**TELEVISION BROADCAST EQUIPMENT**  
**RADIO CORPORATION of AMERICA**  
**ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N. J.**

In Canada: RCA VICTOR Company Limited, Montreal

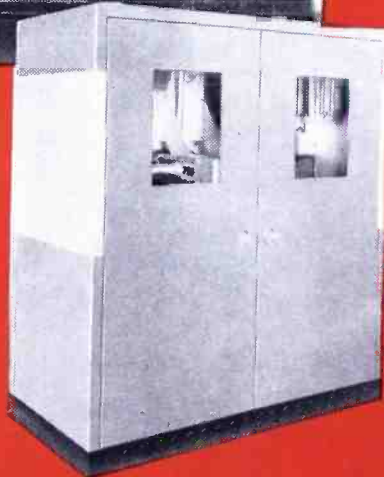


# The Inside Story of New Operating Advantages

... BACKED BY THE  
OPINIONS OF FM OPERATORS  
IN 56 CITIES IN 22 STATES



Large windows in rear doors permit inspection of interior. Note, in open view, the convenience power outlet at the bottom and lamp at top. Upper panel houses, from right to left, the r.f. driver, concentric, line-type, tank circuit, variable coupling loop, and P.A. concentric, cathode line.



If you want a solid basis for analyzing transmitter design, here's one of the best: the opinions of 162 station owners and operators.

Westinghouse used your expert counsel to help design modern FM transmitters with the features you want most. For example, 92% declared the vertical open arrangement was best and 94% thought air-cooled tubes extremely important. These new Westinghouse transmitters have both:

**Example:** Quiet, efficient blower directs rapidly changing filtered air over all tubes to insure clean, cool operating conditions at all times. Dust-tight covers provided for plug-in units.

**Example:** Quick, easy servicing with the vertical open arrangement of the interior.

This inside story of the new advantages in Westinghouse FM transmitters is backed by even more features you have asked for. New 270° meters and indicating instruments are at eye level. All overload protection is fuseless . . . construction makes installation easy. Excellent shielding at 100 mc is also insured.

The combination of Westinghouse engineers and station operators is a natural one, for Westinghouse men have an unmatched background in actual station experience in five FM and six AM stations. Write your nearest Westinghouse office today for the facts. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-02083-A

## Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



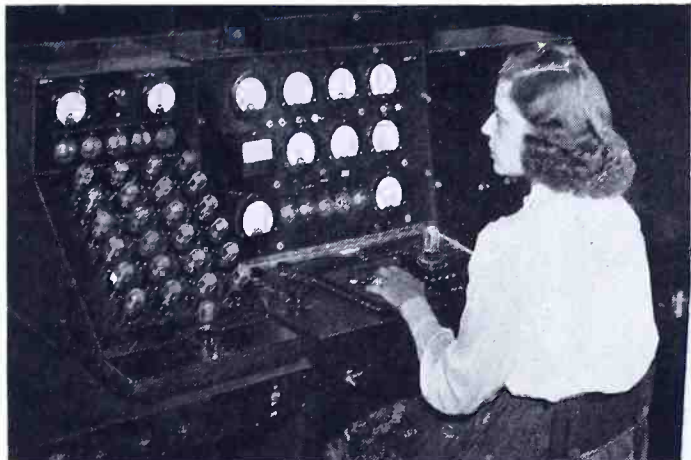
*Electronics at Work*



This new book gives you the complete picture story of the operating advantages built into Westinghouse transmitters and the way operators approved them. Ask for your copy of B-3829.



# MAKING TUBES IS EASY If YOU KNOW HOW!



This standardized Hytron production tester is composed of three units: preheater, characteristics tester, noise tester. To permit a better view of the equipment, only one of three operators is shown.

## HOW THE HYTRON 12SK7GT IS QUALITY CHECKED

Test	100% Production Test	Central Inspection Sampling	Quality Laboratory Sampling	100% Test at Packing
Shorts				
Base shell connection	x	x		
Heater current	x	x		x
Plate current	x	x		
Screen current	x	x	x	
Grid current	x	x	x	
Transconductance	x	x	x	
Suppressor action	x	x	x	
Emission	x	x	x	
Heater-cathode leakage	x	x	x	
R-f noise	x	x	x	
Transconductance cutoff	x	x	x	
Vibration		x	x	
Insulation resistance			x	
Input capacitance			x	
Output capacitance			x	
Grid-plate capacitance			x	
Grid emission			x	
Immersion (basing cement)			x	
Life			x	
Overall length			x	
Mechanical*	x	x	x	x

\*Mechanical tests are covered by a multipage specification. Typical inspection is conducted visually and/or by gages for the following: pin solder, etching, getter flash, diameter, base-bulb alignment, bent base pins, glass defects, and rigidity of internal elements, bases, and base pins.

## AGAIN HYTRON'S LONG EXPERIENCE

## GIVES YOU THE BEST...

**F**OR your protection Hytron tubes are quadruple-checked. On the production floor, each tube is first tested for significant characteristics. In the central inspection department, a random sampling is next taken for statistical control of the production testing—to assure quality within acceptance limits. Failure at this point demands 100% retest.

Daily a smaller random sampling is subjected to a searching design check of characteristics such as inter-electrode capacitances, grid emission, and transconductance cutoff. These characteristics can be controlled by the smaller sampling, and their testing requires laboratory precision. Simultaneously production tests are again repeated for further statistical control. Again failure to meet acceptance limits demands 100% retest—even for design characteristics not production-tested.



Extreme accuracy and flexibility of this Hytron master test station particularly fit it for quality control.

Finally each tube is once more short-tested and mechanically inspected just before packing.

This painstaking quadruple-checking ensures that specification failures of tubes actually shipped will be a practically irreducible minimum. When you buy a Hytron tube, you can be certain that every ounce of Hytron know-how on quality control—reinforced by wartime experience—has been in there punching to give you only the best.

OLDEST MANUFACTURER SPECIALIZING IN RADIO RECEIVING TUBES



# HYTRON

RADIO AND ELECTRONICS CORP.

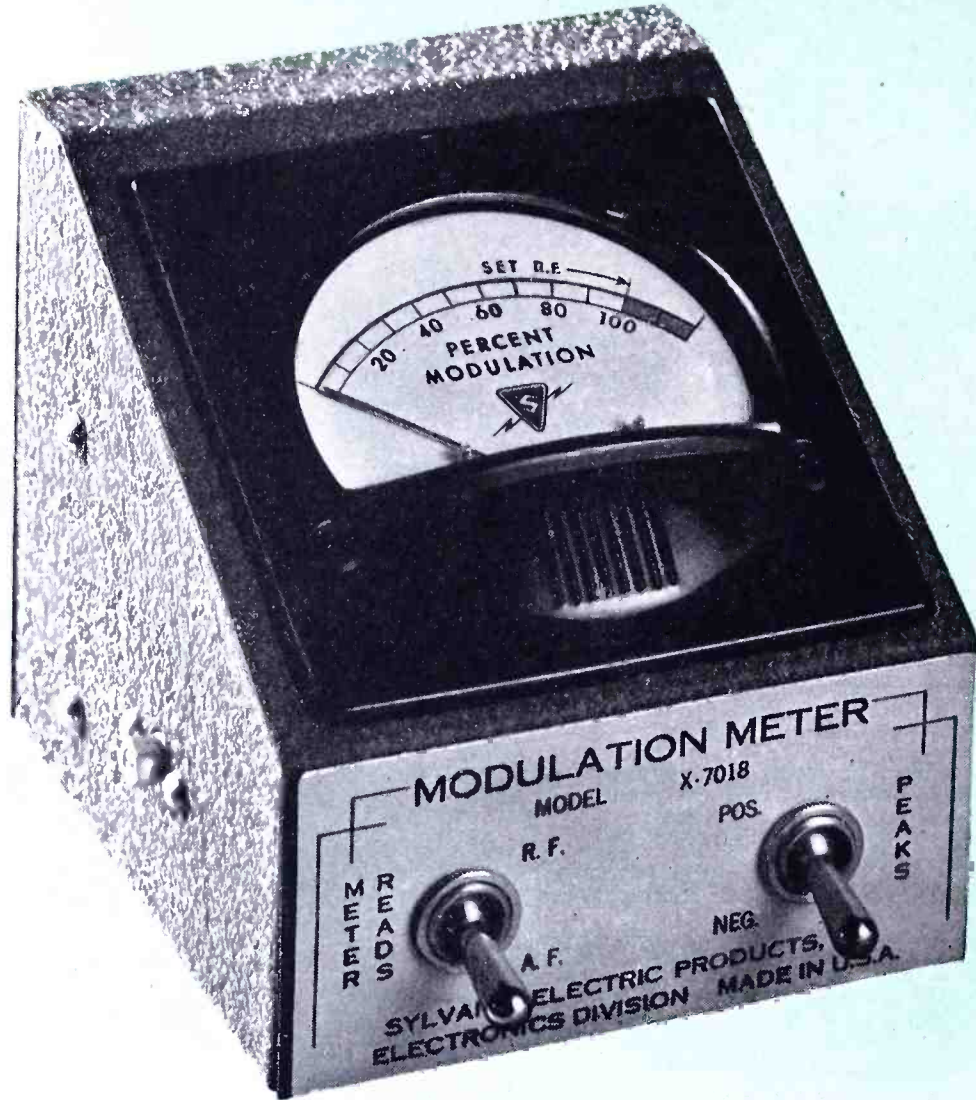
MAIN OFFICE: SALEM, MASSACHUSETTS





*Now-*

**quick, visual determinations  
of percentage modulation...**



**...with this compact SYLVANIA meter**

Here is a new, simple instrument for rapid, accurate determinations of percentage modulation.

An outstanding advantage of the Sylvania Meter X-7018 is the greatly extended useful frequency range.

Triode amplifier stage used in previous types is unnecessary in the Sylvania design. No plate or filament power supply is needed.

This new meter is one of a group of testing instruments built by Sylvania. Other Sylvania devices include Spectrum Analyzers, Synchrosopes, Thermistor Bridges, Capacity Bridges, Dilatometers and Oscilloscopes. Inquiries invited.



**THIS COMPACT DESIGN WAS MADE POSSIBLE BY THE SYLVANIA 1N34 GERMANIUM CRYSTAL DIODE**

The simplicity and compactness of the Sylvania Modulation Meter result largely from the use of the 1N34 Germanium Crystal Diode. This meter affords an ideal application for the 1N34 — no heater element, hence plate and filament power supply is eliminated.

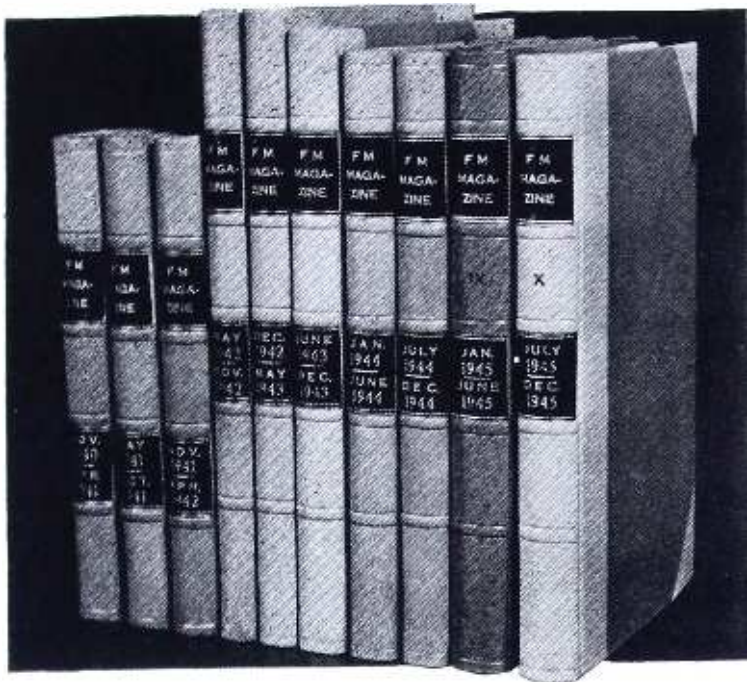
For any diode application, you may find it worthwhile to investigate the 1N34.

# SYLVANIA ELECTRIC

*Electronics Division . . . 500 Fifth Avenue, New York 18, N.Y.*

MAKERS OF ELECTRONIC DEVICES; RADIO TUBES; CATHODE RAY TUBES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS





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Here is an invaluable source of information on the most important radio development—a complete record of FM progress in all its phases. In addition, these bound volumes of FM AND TELEVISION contain a wealth of technical information and design data which should be available in every engineering and patent library.

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- No. 11 January to June 1946 (Now binding)

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Each volume is bound in beautiful three-quarter pigskin and blue cloth by the famous Eggeling Bindery.

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511 Fifth Avenue New York 17, N. Y.

### INQUIRIES INVITED

Patent No. 2,398,641

Low-cost television synchronizing system. Number of lines and frames adjustable. Other applications with two or more programs per channel.

ALSO: Multiplex Radiophone Systems, two to five hundred private conversations per wavelength, for Walkie-talkies, Trains, Cabs, Airplanes.

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# AVAILABLE • NOW •

Excellent Chicago space for radio or television station, recording or audition studios, ad or art agency, any firm needing unusual 2-floor space

Unusual circumstances make immediately available 8,664 sq. ft. on top two floors of nationally known, modern Chicago office building. Space now laid out with private offices and studio workrooms. One 2-story acoustically treated studio is 38' x 46'. Exceptionally attractive opportunity for radio or television station, recording or audition studios, advertising or art agency, commercial photographer—any firm requiring unusual space. Rare chance to acquire prestige downtown location, close to all city and suburban transportation, at a rental which invites immediate attention.

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Send me FREE new B-A Catalog. FM & T

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CATALOG  
FREE**

## Radio Instructors

College Degree Required. Servicing or Industrial Experience helpful. \$3600 to start. \$4200 in four months. Location—Newark, New Jersey—in the center of America's Radio Industry. We will teach you how to instruct in Television. At this school every student builds a complete 17-tube Television and Radio Receiver which he may keep as his own property. School has a complete Television Transmitter under construction. Write to Raleigh G. Dougherty, care of New York Technical Institute of New Jersey, 158 Market Street, Newark, New Jersey.

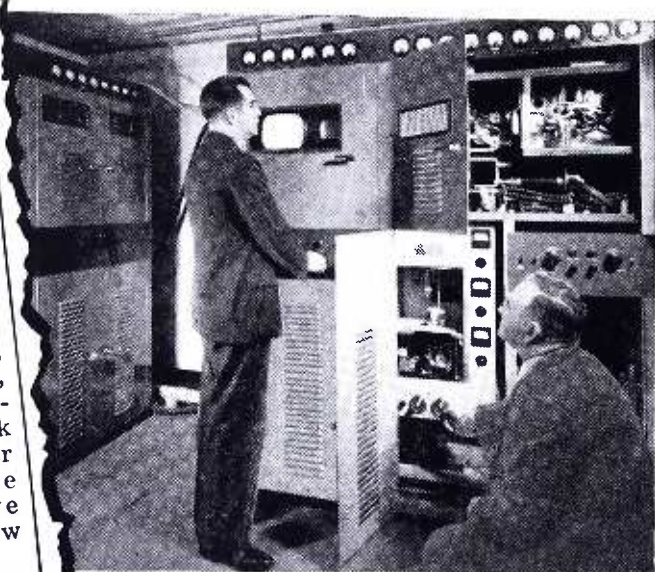


(CONTINUED FROM PAGE 37)

**FCC PREDICTS HUGE COMMUNICATIONS EXPANSION WITHIN NEXT FEW YEARS**

... 400 new AM stations  
 ... 2950 FM stations  
 ... 5000 more radio-equipped planes  
 ... 1800 aviation ground stations  
 ... radio equipped autos, trains, railroads  
 ... facsimile, ship-to-shore, multi-purpose micro-wave relay link systems and many other new services will be readied and operative within the next few years . . .

—from BROADCASTING, 6/14



— R.C.A. PHOTO

of their transmitters by the end of this year.

2. Of the 553 FM applications already filed by AM station owners, how many plan to get FM equipment on the air at the earliest date possible, and how many filed only as a hedge against the future, intending to stall as long as possible?

This is essential information for the industry, and the FCC has decided to dig it out. Accordingly, the following announcement and questionnaire, dated July 26, 1946, have been sent by the Commission to all holders of FM construction permits and conditional grants:

**NOTICE TO APPLICANTS**

It has come to the attention of the Commission that holders of conditional grants and construction permits for new FM broadcast stations have, in some instances, been dilatory in the planning and construction of their FM stations and in providing an FM broadcast service at an early date. In the interest of full development and utilization of FM broadcasting, the Commission feels that such delays cannot be permitted.

**CONDITIONAL GRANTS:** In the conversion of conditional FM grants to construction permits it has often been necessary to request additional information from grantees, and in some cases considerable time has elapsed before this information was received by the Commission. When the Commission announced the policy of making conditional FM grants, a period of 90 days was specified within which additional engineering material could be supplied. This length of time is no longer considered necessary, and it is expected that engineering material or other information, when requested, will be supplied within a maximum of 30 days thereafter. In this respect, the Commission wishes to point out that the recent revision of the FM rules provides brackets of antenna height and effective radiated power for Class A and Class B stations; a considerable number of applications may, therefore, be completed without individual request for further information. Should it appear that undue delay occurs in furnishing necessary information to satisfy the terms of the conditional grant, the Commission will review the grant to determine whether the application should be designated for hearing and the grant cancelled.

**CONSTRUCTION PERMITS:** Construction permits are being issued as quickly as possible following receipt of necessary information, and the Commission expects that FM station construction be carried forward expeditiously. In cases where an application is filed in which to extend the completion date specified by an FM construction permit (8 months after issuance) and where it appears that the permittee

(CONTINUED ON PAGE 59)

# You Can Qualify for One of These New, Good-Paying Jobs . . .

**CREI Technical Training NOW Will Enable You to Gain the Ability to choose Your Job Tomorrow — Right in Your Own Home Town**

You have even greater advantages today! Never before have men like you had the chance to step into brand new jobs in brand new fields. FM, Television, Facsimile and other electronic communications systems for both government and industry will require thousands of highly trained, expert radio communications engineers and technicians.

NOW is the time to take the time to prepare yourself for these important career jobs. CREI home study training can show you the way by providing you with the "tools" with which to build a firm foundation of ability based on a planned program of modern technical training.

This is real, honest-to-goodness practical radio engineering training that leads to better jobs and more rapid promotions . . . the type of training for which many thousands of professional radiomen have enrolled during the past 19 years.

Mail coupon for free booklet today. (CREI training for veterans is available under the "G. I." Bill.)

## INDUCTANCE

Funny how many men are like an electrical conductor that becomes electrified when near a charged body. Expose them to the right training, thinking and study and they turn out "first rate." Men who are looking ahead, place themselves in positions where they are continuously preparing for a better job, tomorrow.

*E. H. Rietzke*  
 President of CREI

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Gentlemen: Please send me your free booklet, "Your Opportunity in the New World of Electronics," together with full details of your home study training. I am attaching a brief résumé of my experience, education and present position.

Name.....  
 Street.....  
 City..... Zone..... State.....  
 Occupation.....  
 I am entitled to training under the G. I. Bill



## WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 58)

has not been diligent in proceeding to construct the station as quickly as possible, the Commission will review the application with particularity to determine whether such extension application should be granted or designated for hearing. In acting on requests for extension of time, the Commission will consider the promptness of a permittee's efforts to secure equipment and other materials and his efforts to provide an FM broadcast service promptly with interim equipment. Even though complete equipment may not be immediately available, the Commission expects permittees to use interim equipment to provide an early FM service and to install remaining equipment as rapidly as it becomes available. Such operation is now being conducted by a number of conditional grantees and permit holders.

In order that the Commission may be kept fully advised in the above matters, information thereon is being requested from FM permittees at the time specified by the permit as the required commencement of construction (2 months after issuance). An inquiry directed to this end is being sent to present permit holders and will be sent with construction permits issued in the future.

Here is the text of the questionnaire:

### INQUIRY CONCERNING CONSTRUCTION OF FM BROADCAST STATIONS

In order that it may be fully advised concerning the progress of construction of your FM broadcast station, the Federal Communications Commission requests that you furnish the information called for below.

Instructions for Replying: (1) Two copies of this form are enclosed. Keep one copy for your files; mail one copy to the Federal Communications Commission, Washington 25, D. C. (2) Fill this form out immediately (within 15 days) after the date specified in your construction permit as the required commencement date for construction. (3) In your answers give the status of your construction as of the date when you are required to commence construction.

1. Has an order been placed for the FM broadcast transmitter specified by your construction permit? Yes ( ) No ( ). If such an order has been placed, give date of purchase order and promised delivery date.

2. Has the transmitter or any unit thereof been delivered? Yes ( ) No ( ). If answer is yes, indicate which units have been received and estimate percentage of installation completed.

3. Has an order been placed for the FM antenna supporting structure? Yes ( ) No ( ). If answer is yes, give date of purchase order and promised delivery date.

(CONCLUDED ON PAGE 60)

## A TRANSCRIPTION TABLE FOR YOUR FM EQUIPMENT

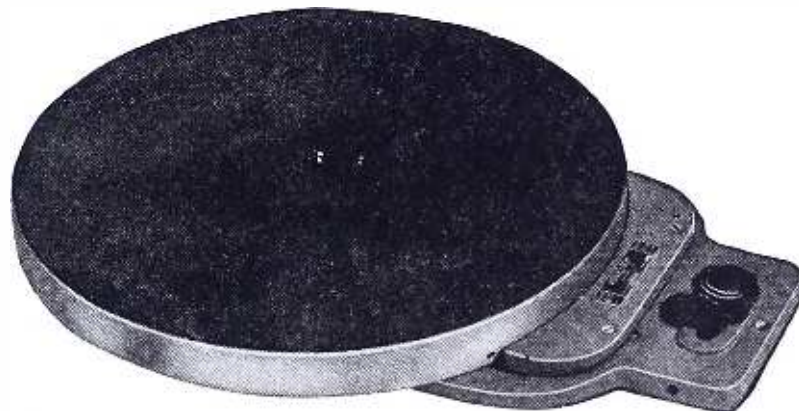
### HOW GOOD IS IT ...



## MASTER-PRO

### MODEL "G-2" HAS PROVED ITSELF

- A large percentage of these tables are operating with WE 9A Pickups. It is well known in the Broadcasting Field that only a perfectly balanced and vibrationless turntable can meet the performance requirement of the 9A.



Our present Model is now featuring a totally enclosed Continuous Duty Start and Run Motor which gives you greater smoothness in operation. There has also been added a Micro Switch for starting the motor before engaging the idlers and stopping the motor only after the idlers have been disengaged from the turntable. This is your insurance against flats due to the idlers remaining engaged after the day's work is over.

**Price**  
**\$125.00**  
**Net**

## REK-KUT COMPANY

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EXPORT DIVISION

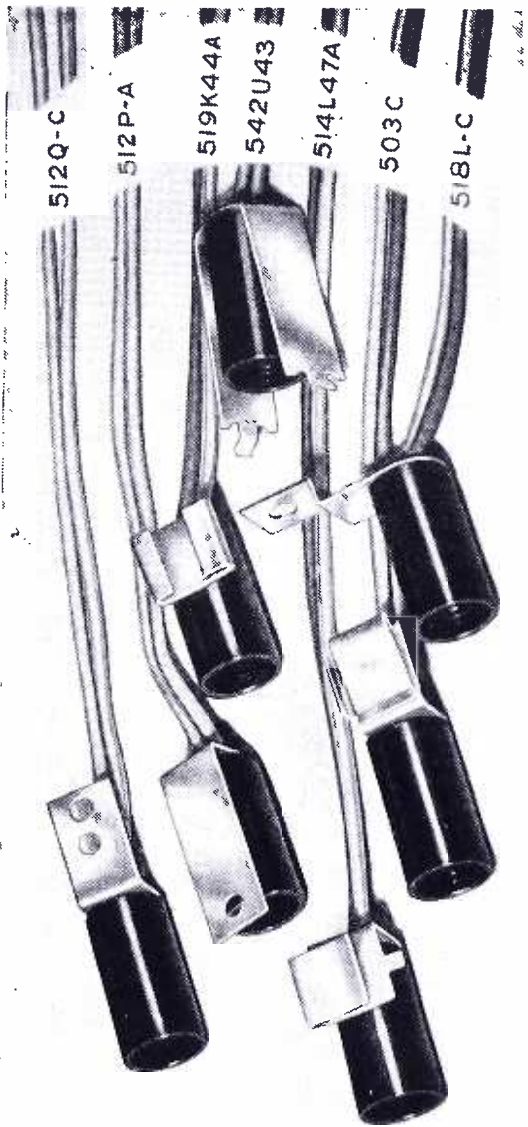
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New York 13, N.Y.

CABLES: MORHANX





## TOP QUALITY AT LOW COST

DRAKE patents plus modern high speed methods and machinery go a long way toward achieving the traditional excellence and economy of our products. It should pay you in better performance and *lower costs* to specify DRAKE for all of the Socket and Jewel Light Assemblies you need. Ask for prices and the newest Drake Catalog.



**DRAKE MANUFACTURING CO.**

1713 W. HUBBARD ST., CHICAGO 22, ILL.

## WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 59)

4. If the antenna supporting structure has been received, estimate percentage of construction completed.

5. Has an order been placed for the FM antenna described by the construction permit? Yes ( ) No ( ). If answer is yes, give the date of the purchase order and the promised delivery date.

6. Has the FM antenna or any portion thereof been received? Yes ( ) No ( ). If answer is yes, estimate the percentage of installation completed.

7. Must property be purchased or leased for the transmitter location? Yes ( ) No ( ). If answer is yes, has a title or lease been secured? Yes ( ) No ( ). Date of title or lease.

8. Must property be purchased or leased for the studio location? Yes ( ) No ( ). If answer is yes, has a title or lease been secured? Yes ( ) No ( ). Date of title or lease.

9. Has construction begun at either transmitter or studio location? Yes ( ) No ( ). If so, estimate percentage of construction completed.

10. Has an application been submitted to the Civilian Production Administration in your local area for a building permit? Yes ( ) No ( ). If answer is yes, has it been acted upon? Yes ( ) No ( ). If so, what authorization has been granted?

11. What steps, if any, have been taken to commence an FM broadcast service with interim equipment pending the completion of full construction?

12. If interim operation is planned, what are the promised delivery dates for the following equipment for such operation: Transmitter, Antenna, other major items of equipment (name them).

13. If interim operation has begun, give the commencement date of such operation. If interim operation is planned but has not begun, give the date at which operation is expected to begin.

14. Give the transmitter power, type of antenna and antenna height employed or proposed for interim operation.

15. If interim operation is not planned, give the reasons therefor.

## PROGRESS IN POSTWAR FACSIMILE

(CONTINUED FROM PAGE 25)

maps, and advertising copy simultaneously with aural programs offers unlimited variations. The relatively small size of a home recorder unit permits it to be installed in an average radio cabinet as an additional unit.

The adoption of facsimile by newspapers to supplement their mechanical methods of distribution is a subject beyond the scope of this article. For those who are interested in this particular phase of facsimile, an article by Lieut. Col. Robert D. Levitt, former promotion di-

(CONCLUDED ON PAGE 61)

**Where nothing but the BEST will do . . .**



● These metal-can capacitors are positively sealed for longest trouble-free service. Once more available in the outstanding choice of types—ring-clamp mounting, insulated threaded stem (as shown, with grounded or insulated can), strap mounting, stud mounting, plug-in, drawn can or "bathtub," and low-cost midget "Dandees."

The Aerovox postwar catalog again lists the greatest selection of electrolytics ever offered.

## ● Ask for CATALOG . . .

Your jobber has a copy of the new Aerovox postwar catalog. Ask him for your copy. Or write us direct.



**FOR RADIO-ELECTRONIC AND INDUSTRIAL APPLICATIONS**

**AEROVOX CORP., NEW BEDFORD, MASS., U.S.A.**  
Export: 13 E. 40th St., New York 16, N.Y. • Cable: 'ARLAB'  
In Canada: AEROVOX CANADA LTD., Hamilton, Ont.



## PROGRESS IN POSTWAR FACSIMILE

(CONTINUED FROM PAGE 60)

rector of the *New York Journal American* and circulation promotion manager of the *American Weekly*, appeared in the January 1945 issue of *FM AND TELEVISION* which thoroughly and logically analyzed this field from the publisher's viewpoint.

One of the distinct advantages of facsimile is its relative immunity to static and other periodic forms of interference. In typewriter systems used to convey intelligence from one point to another via a radio circuit, interference of comparatively short duration with respect to the total intelligence being transmitted can cause a misprint under certain conditions, or possibly a complete loss of copy. In the page facsimile system, under similar adverse conditions, only a small portion of any letter or figure would be mutilated.

Similarly, no error can occur during transmission that is not already on the original copy. A final proofreading and approval is therefore satisfactory. The human element factor involving operators need not be considered. In the emergency services where hastily transcribed information is always a potential source of error, this feature is of particular importance.

Where stations or equipment are, of necessity, left unattended during certain periods, the facsimile receiver may be left in a standby condition so that complete copy is available upon the operator's return.

## HOW MUCH SHOULD FM SETS COST?

(CONTINUED FROM PAGE 22)

entertainment should be at such a high level as to make the phonograph combination a luxury, rather than the necessity it is considered now. A fine FM console receiver can be built for \$275, representing a substantial economy in first cost, and in the considerable expense for even a modest record library. However, it is probable that combinations at \$400 will far outsell \$275 consoles at this time.

**Impossible? \*** The first reaction to this proposal from most manufacturers will be: "FM will never get anywhere with sets at that price. The market will be so limited by such high prices that there won't be enough listeners to support the new stations! Sets must be so cheap that everyone can hear FM."

Well, if the set manufacturers want to continue working for the broadcasters, that's the way to start out. But if they do, they'll kill FM broadcasting and make it just a different way to get AM performance.

Now, and for a long time to come, there will be a market for all the sets that can be produced in the \$400 bracket, just as there will be a market for all the \$1200

(CONTINUED ON PAGE 62)

## STANDARD SIGNAL GENERATOR

**MODEL  
65-B  
RANGE  
75 KC  
to  
30 MC**



### Individually Calibrated Scale

**OUTPUT:** Continuously variable, .1 microvolt to 2.2 volts.

**OUTPUT IMPEDANCE:** 5 ohms to .2 volt, rising to 15 ohms at 2.2 volts.

**MODULATION:** From zero to 100%. 400 cycles, 1000 cycles and provision for external modulation. Built-in, low distortion modulating amplifier.

**POWER SUPPLY:** 117 volts, 50-60 cycles, AC.

**DIMENSIONS:** 11" high, 20" long, 10 1/4" deep, overall.

**WEIGHT:** Approximately 50 lbs.

Catalog on request

**MANUFACTURERS OF**  
Standard Signal Generators  
Pulse Generators  
FM Signal Generators  
Square Wave Generators  
Vacuum Tube Voltmeters  
UHF Radio Noise & Field  
Strength Meters  
Capacity Bridges  
Megohm Meters  
Phase Sequence Indicators  
Television and FM Test  
Equipment

**MEASUREMENTS CORPORATION**  
BOONTON NEW JERSEY

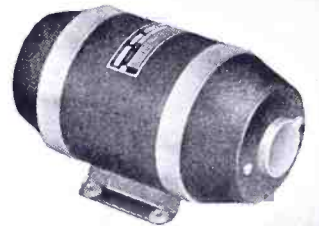


## To Supply a Growing Demand for CARTER DYNAMOTORS

Maintaining leadership in the radio industry is a process of constant growth . . . a development of years which has now led us to relocate in the new factory shown above. In this new location, with 4 times more space, and valuable additions to personnel, and equipment, we have placed ourselves in a better position to improve deliveries and maintain the highest standards of quality and performance you have come to expect in Carter Products.

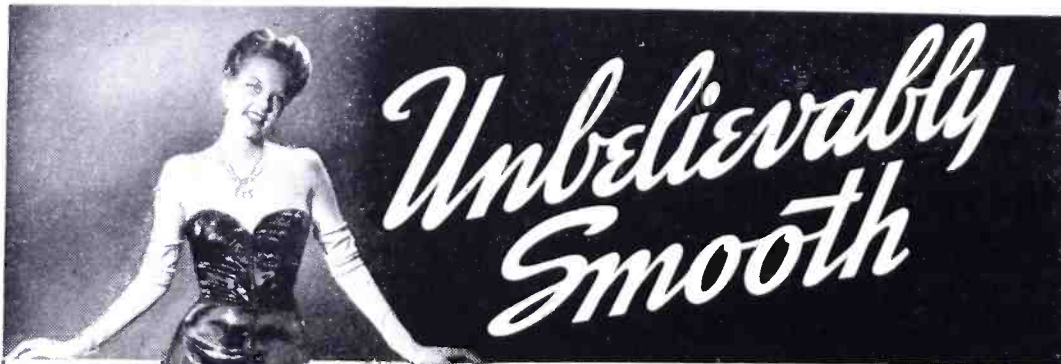
SALES OFFICES IN PRINCIPAL CITIES

New Factory Address:  
2641 N. Maplewood Ave. Chicago 47, Ill.



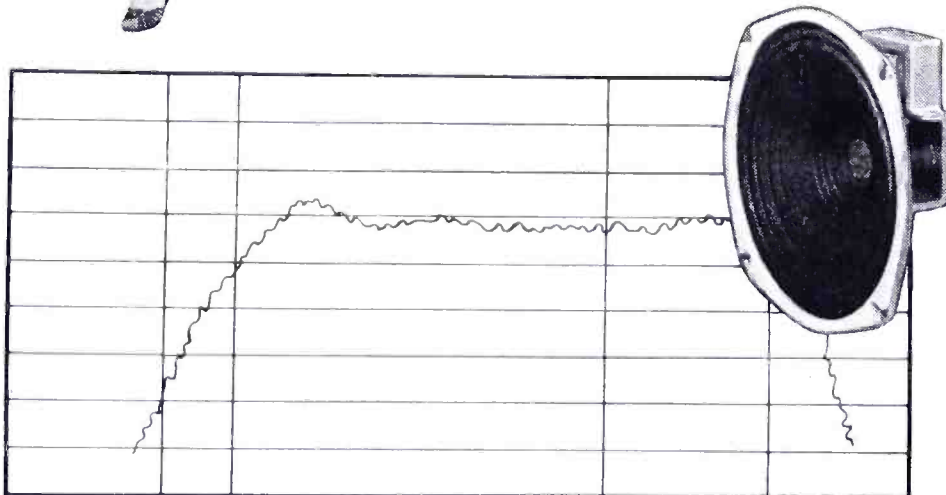
**Carter Motor Co.**  
Chicago, Illinois





*Unbelievably Smooth*

ARE  
THE RESPONSE CURVES  
OF THE  
**OXFORD  
SPEAKERS**



The secret of a fine response curve is in the proper engineering of the speaker as an integral unit, not as a composite assembly of many different parts. Oxford engineers concentrate on this fundamental concept: the resultant speaker provides maximum performance consistently.

**OXFORD RADIO CORPORATION**  
3911 SOUTH MICHIGAN AVE., CHICAGO

### HOW MUCH SHOULD FM SETS COST?

(CONTINUED FROM PAGE 61)

cars the automobile industry can produce.

And there will be something more. A replacement market will be built up, because there will be a market for second-hand sets in the \$400 class!

To be sure, good FM performance, definitely superior to AM, can be obtained from models retailing under \$100. Zenith is producing such sets now, but they aren't making the mistake of AM set advertisers who promise "console performance in a table model." That may be possible with AM sets because AM table models and consoles are equally bad, but the differ-

ence between an FM table set and an expensive model is readily apparent to any listener.

**Prices Can Be Raised** ★ The key to the whole situation lies in focusing effort on models in the \$400 bracket, and setting up advertising, sales promotion, and distribution that is concentrated on those models. Lower-priced sets may be necessary to round out a line and to give dealers the opportunity to trade-up their customers. However, descriptions of the performance of those sets must be accurately related to their relative price class. At the same time, there must be a demonstrable difference in performance at each price bracket, and

(CONTINUED ON PAGE 63)

**CORWICO**  
**WIRES**



*made by engineers  
for engineers.....*

**CORNISH WIRE CO., INC.**  
15 Park Row • New York City, 7

*Sorry!*

Although we printed 7,500 June copies of *FM AND TELEVISION*, and 7,640 for July, both issues are sold out except for untrimmed copies we are holding for Bound Volume No. 12.

However:

To take care of the increasing volume of subscriptions, our print order for this issue has been stepped up to 8,000, and for September it will be 9,000 copies.



## HOW MUCH SHOULD FM SETS COST?

(CONTINUED FROM PAGE 62)

not the phony differences that there have been in AM sets.

Nor is this merely a first-year program. The price brackets must be maintained from year to year. If, the second year, a \$350 model is offered as being superior to the previous \$400 set, then the price levels must be dropped all through the line in succeeding years. Then the prices of second-hand sets will drop proportionately.

Instead, new models in the original price brackets, but of improved performance, must be offered from year to year.

Only in this way can improved sales and distribution methods produce increased annual dollar volume. And only this plan can give listeners increased enjoyment from radio broadcasting. Finally, this is the only way by which people of limited means can own fine radio receivers, since it creates a stable second-hand market and encourages the replacement of original equipment.

Can this setup be put to work in actual practice? Can it be adopted by a few companies, knowing that others will stick to their old methods of price competition?

Well, look back at the automobile manufacturers. They came to adopt this plan in order to survive. By following it from year to year, they have not only built our greatest industry but they have added immeasurably to the fullness and comfort of life in our United States. Of those who have attempted to produce cars of sub-standard cut-price performance, not one has been able to stay in business. The same thing will happen to radio manufacturers who attempt to produce substandard FM receivers.

If the coming of FM is not used by manufacturers as an opportunity to revise their policies and merchandising methods, and by broadcasters to raise their program standards, the retrogression which had already set in before the coming of FM will be continued in the coming years, and at an accelerated rate.

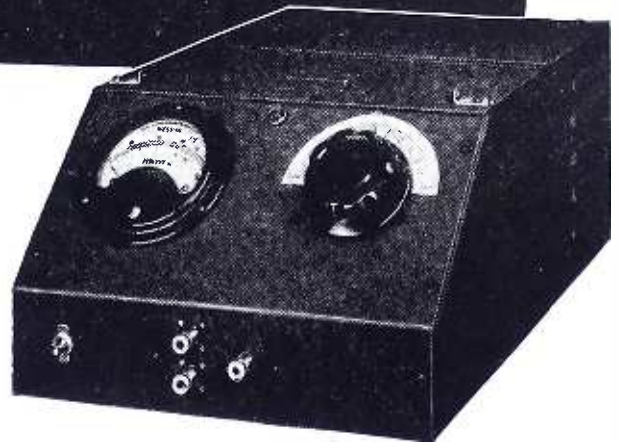
With listeners becoming so critical of AM programming that today a great and increasing number consider it only a means of getting news, and news of less vital importance now that the war is over, the business of radio manufacturing and broadcasting cannot stand still. It will go backward or forward, according to the public service it renders. For a long time, the foundations of this business have been growing steadily weaker. This condition cannot be changed by trying to patch up AM now. It's too late.

A radical improvement in service to listeners is required. This is only possible with FM. And the public will pay for better sets if the broadcasters and manufacturers work together to provide better transmission and reception through the use of FM.

## SPEEDY OPERATION BY FACTORY PERSONNEL

### with a QX CHECKER

TYPE 110-A



#### The Production Line

#### Test and Measuring Instrument for Radio Components

This production test instrument is specifically designed to rapidly and accurately compare relative loss and reactance in one operation and with a single setting. Speedy operation results from the fact that the

deviation of both the reactance and resistance values of any R.F. component are simultaneously indicated when that component is resonated in a tuned circuit which has been previously adjusted against a known standard.

FREQUENCY RANGE: 100 kc to 25 mc using plug-in coils. RANGE OF INDUCTANCE COMPARISON: 10 microhenries to 10 millihenries. RANGE OF CAPACITANCE COMPARISON: Approximately 2 mmf to 1000 mmf. ACCURACY OF INDUCTANCE CHECK: Approximately 0.2 percent.

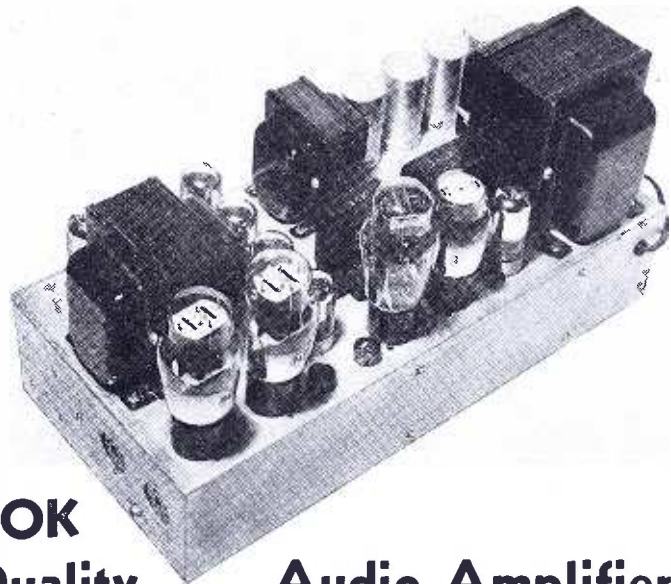


**BOONTON RADIO**

BOONTON · N. J. · U. S. A.



DESIGNERS AND MANUFACTURERS OF THE "Q" METER . . . QX-CHECKER . . . FREQUENCY MODULATED SIGNAL GENERATOR . . . BEAT FREQUENCY GENERATOR . . . AND OTHER DIRECT READING TEST INSTRUMENTS



## The BROOK High Quality Audio Amplifier

*Designed by Lincoln Walsh*

Built to give the lowest possible distortion

AT 5 WATTS, 2nd harmonic is 0.6%—3rd harmonic is 0.3%.

Higher harmonics not measurable.  
Cross modulation less than 0.2%.

AT 35 WATTS, total distortion is 6%.

No transformer saturation at 35 watts at 25 cycles. Frequency Response 20 to 20,000 cycles 0.2 db. Uses all triodes in a patented circuit with automatic bias control. Output 2—2A3's.

**BROOK ELECTRONICS, INC.**

ELizabeth 2-7600

Elizabeth 2, N. J.





# Centralab

## CERAMIC TUBULAR CAPACITORS

... from the ceramic which houses the capacitor to the silver paint and copper plating, every part of these capacitors is completely fabricated by CENTRALAB.  
 ... no wonder that all Centralab Tubular capacitors hold such fine tolerances.  
*Always Specify Centralab.*

# CRL

# Centralab

Division of GLOBE-UNION INC., Milwaukee

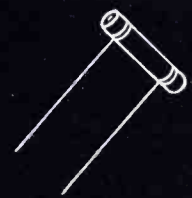
**PRODUCERS OF**



Ceramic Trimmers  
Bulletin 695



Variable Resistors  
Bulletin 697



Tubular Ceramic Capacitors  
Bulletins 630 and 586

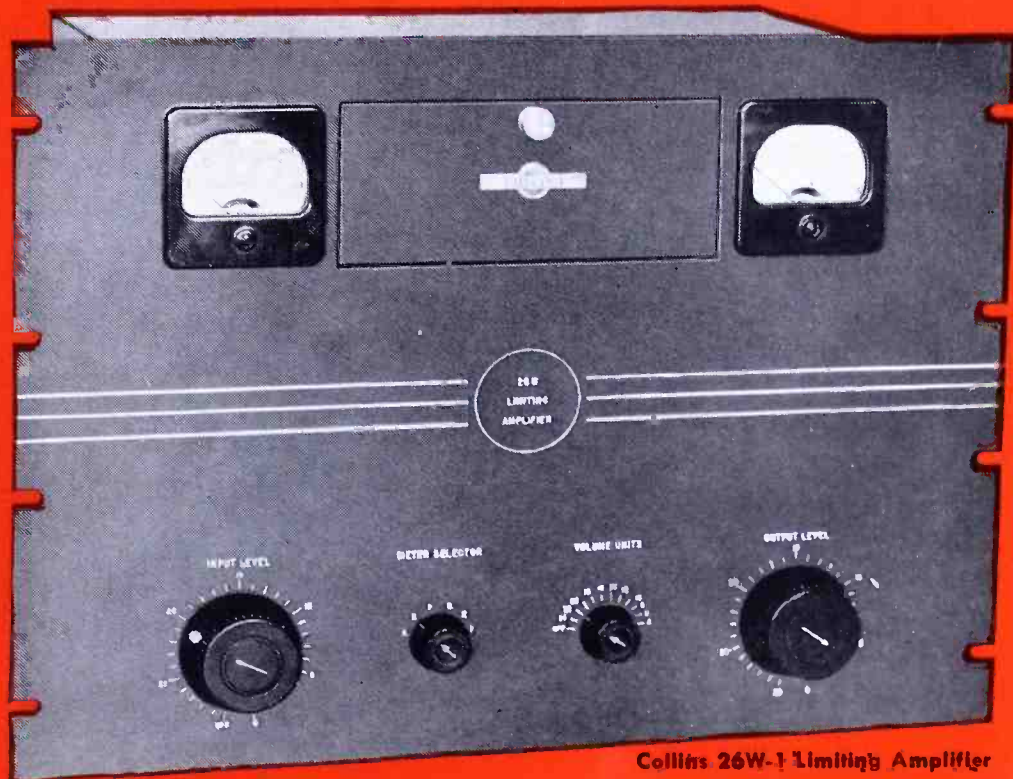


Selector Switches  
Bulletin 722



Ceramic High Voltage Capacitors  
Bulletin 814





Collins 26W-1 Limiting Amplifier

## Collins Speech Equipment

provides better program transmission and stronger signals

The Collins 26W-1 audio limiting amplifier fully meets the advanced standards of broadcast quality inherent in FM. Engineered for true high fidelity FM and AM applications, the 26W-1 maintains a high audio level yet suppresses surges without introducing distortion. The smoothly functioning bridge circuit of this amplifier can be precisely balanced.

The 26W-1 has a frequency response flat from 30-15,000 cps, with a variation less than  $\pm 1.0$  db. The compression ratio above the verge of compression is 20/1 in db. Harmonic and tone distortion are not more than 1.5% at any frequency, any setting of the input and output levels, and with any amount of compression up to 15 db. Hum and noise are 68 db below the operating level. Output range is -4 to +26 dbm.

Complete metering provides measuring facilities for individual tube currents, plate voltage, compression level, and output level. Inside-out chassis construction gives immediate access to all wiring and circuit components upon removal of the slip-on dust cover. Operate and release times are independently adjustable.

Dimensions, for standard rack mounting, 19" w, 14" h, 9" d. Weight, 45 pounds. Available in metallic gray.

Collins speech equipment is thoroughly engineered for highest performance. Reliable in operation, accessible in maintenance, each unit meets rigid inspection and tests before it is approved for delivery. For your requirements, write today.

FOR BROADCAST QUALITY, IT'S . . .



**COLLINS RADIO COMPANY, Cedar Rapids, Iowa**

11 West 42nd Street, New York 18, N. Y.

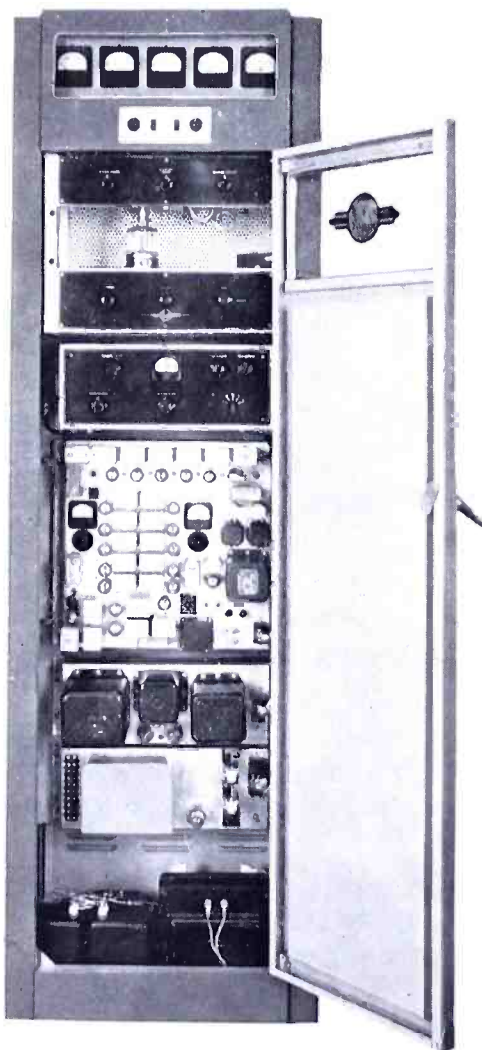
458 South Spring Street, Los Angeles 13, California



# FREQUENCY *Link* MODULATION BROADCAST TRANSMITTERS

250 WATT • ONE KW • THREE KW

WITH THE SAME HIGH STANDARDS THAT HAVE MADE *Link* THE RECOGNIZED LEADER IN EMERGENCY RADIO COMMUNICATIONS EQUIPMENT



## TYPE 250 FMB Specifications

**Frequency Range:** 88 to 108 mc.

**Center Frequency Stability:** Within  $\pm 2000$  cycles of assigned frequency.

**Modulation:** Phase modulation (Armstrong system).

**Audio Input:** Standard 600/150 ohm line.

**Deviation:** Standard  $\pm 75$  KC.

**Frequency Response:** Within  $\pm 1$  DB of standard 75 microsecond pre-emphasis curve from 50 cycles to 15,000 cycles.

**Distortion:** Less than 1.0% rms from 100 to 7500 cycles; less than 1.5% rms from 50 to 100 and 7500 to 15,000 cycles at  $\pm 75$  KC swing.

**FM Noise Level:** At least 65 DB below  $\pm 75$  KC swing within the band of 50 to 15,000 cycles when measured in conjunction with a demodulator of standard 75 microsecond de-emphasis characteristic.

**AM Noise on Carrier:** At least 50 DB below the equivalent of 100% AM modulation level within the band of 50 to 15,000 cycles.

**RF Harmonics:** At least 60 DB below fundamental frequency output level.

**Audio Monitor:** Built-in.

**External Monitoring:** Jacks are provided for operating external carrier and frequency swing monitors.



OPEN and CLOSED VIEWS of Type 250 FMB — 250 W. BROADCAST UNIT

ENGINEER • MANUFACTURER

# Fred M. Link

125 WEST 17th STREET • NEW YORK 11, N. Y.

PREFERRED *FM* RADIO  
COMMUNICATION EQUIPMENT