FM-TV

Price 25 Cents

Nov. '48

★ Edited by ★
Milton B. Sleeper

VISUALIZING TV STUDIO PLAN
WITH EQUIPMENT MODELS

9th Year of Service to Management and Engineering

NEW! ....the Roto Ranger

—automatically rotates one of 18 separate scales into position as you select the range.

SIMPSON MODEL 221 ROTO-RANGER
HIGH-SENSITIVITY A.C.-D.C. VOLT-OHM-MILLIAMMETER

Here is the only multiple scale test instrument of its kind in the world. It definitely reduces the possibility of errors by providing a single scale for each range of this finest of volt-ohm-milliammeters. As the selector switch is moved to the range desired, an ingenious gearing mechanism rotates a drum, bringing into place behind the meter window the proper scale for that range. Here is the equivalent of 25 separate instruments combined in one sturdy and compact unit. (18 scales; 7 additional direct reading ranges through use of high voltage and output jacks.) The patented Roto-Ranger principle eliminates the confusion of numerous readings on one scale, and the multiplying factors common to ordinary multi-range testers, by providing a separate scale for each range. There are no cramped calibrations in these full sized Roto-Ranger scales. Each is designed as it would be for a separate instrument.

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In Canada: Bach-Simpson, Ltd., London, Ontario

Simpson
INSTRUMENTS THAT STAY ACCURATE

Ranges

20,000 Ohms per Volt D.C., 1,000 Ohms per Volt A.C.
Volts, A.C.: 2.5, 10, 50, 250, 1000, 5000
Volts, D.C.: 2.5, 10, 50, 300, 1000, 5000
Milliamperes, D.C.: 10, 100, 500
Microamperes, D.C.: 100
Amperes, D.C.: 10
Output: 2.5, 10, 50, 250, 1000
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Size: 12¾" x 10⅛" x 5⅝"
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Price, complete with test leads and 28-Page Operator's Manual.................................. **$69.85**

High voltage probe (25,000 volts) for TV, radar, x-ray and other high voltage tests, also available.

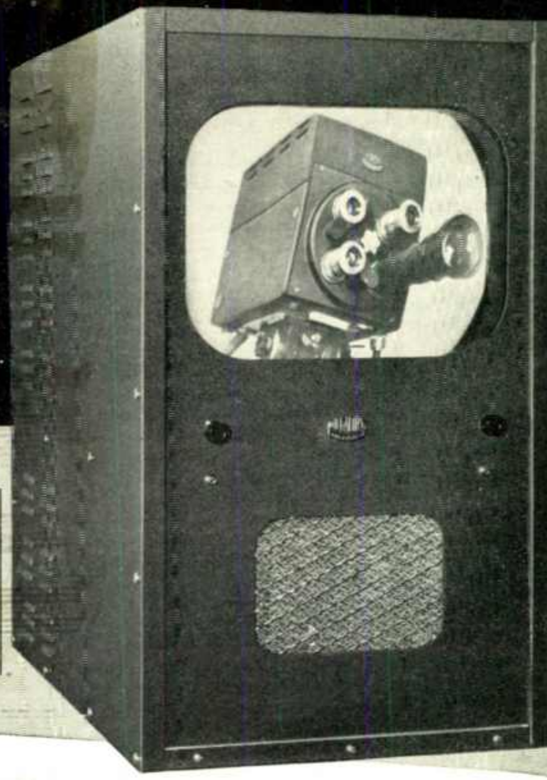
Ask your Jobber, or write for complete descriptive literature

A separate scale for every range—automatically!

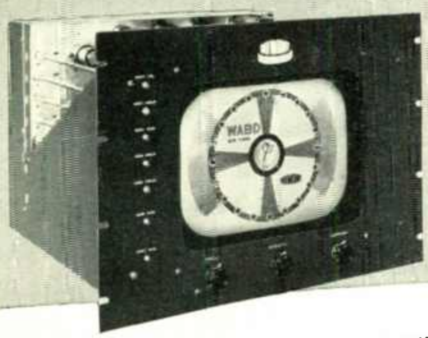
Large 5½" meter, with 18 separate, full length scales!

For the best "look-in" on television programming and transmission . . . they are installing

DU MONT LARGE-SCREEN *Picture Monitors*



START AS SMALL AS YOU WISH, WITH THE DU MONT *Acorn Package*



TYPE 5108 12" PICTURE MONITOR

✓ Used in combination with companion unit, Type 5112-B Low Voltage Power Supply.

✓ Produces a comfortable-sized image on 12" picture tube for program monitoring of picture content.

✓ Operates from standard black negative composite picture signal with level in the range of 0.5 to 2.5 volts peak-to-peak. 1000-ohm input impedance.

✓ A 75-ohm input terminal is provided and is inserted across input terminal by means of toggle switch at rear.

✓ Type 5108-C fitted with 13⅜" x 17⅛" panel fitting into control consoles.

✓ Type 5108-D fitted with standard 14" x 19" relay rack panel.

✓ Overall dimensions, less panel: 12-11/16" h. x 16¼" w. x 18¾" d. Weight, 50 lbs.

Resolution exceeds that of usual commercial equipment.

TYPE 2116 20" PICTURE MONITOR

✓ Du Mont deflection system for better-than-usual focus.

✓ Full light output from 20" picture tube operated from 15KV supply. An excellent image thoroughly enjoyed even in lighted room.

✓ 215 square inches of picture. Excellent resolution — 450 lines.

✓ High voltage automatically removed should horizontal sweep fail, in order to protect picture tube.

✓ Monitor operates from a composite signal on a 75-ohm line with a level between .5 and 2.5 peak-to-peak voltage.

✓ Foolproof. Front panel carries brightness and contrast controls. At rear are the linearity, focus and other occasionally-adjusted controls.

✓ Type 2116-A includes a 10-inch high-fidelity speaker installed with baffle and grille assembly.

✓ Overall dimensions: 38" h. x 22" w. x 30" d. Weight, 300 lbs.

➧ Superlative rendition — that accounts for the growing popularity of Du Mont large-screen picture monitors.

Two models: Type 5108, 12-inch tube, 72-square-inch screen. Type 2116, 20-inch tube, 215-square-inch screen. The direct-view images are brilliant, sharp, and pleasingly contrasty yet retain the full range of all the half-tone values so necessary for pictorial beauty.

The 12-inch model in combination with Type 5112-B Low Voltage Power Supply unit, is intended primarily for control functions. The 20-inch giant-image monitor is ideal for use on a dolly in the studio, for visual cueing of actors and studio personnel during a performance. It may also be placed in the lobby, in the studio manager's office, in other executive offices, and in clients' rooms.

• • •

For superlative monitoring, as in every other TV function from camera to transmitter and again to receiver, make it DU MONT for "The First with the Finest in Television."

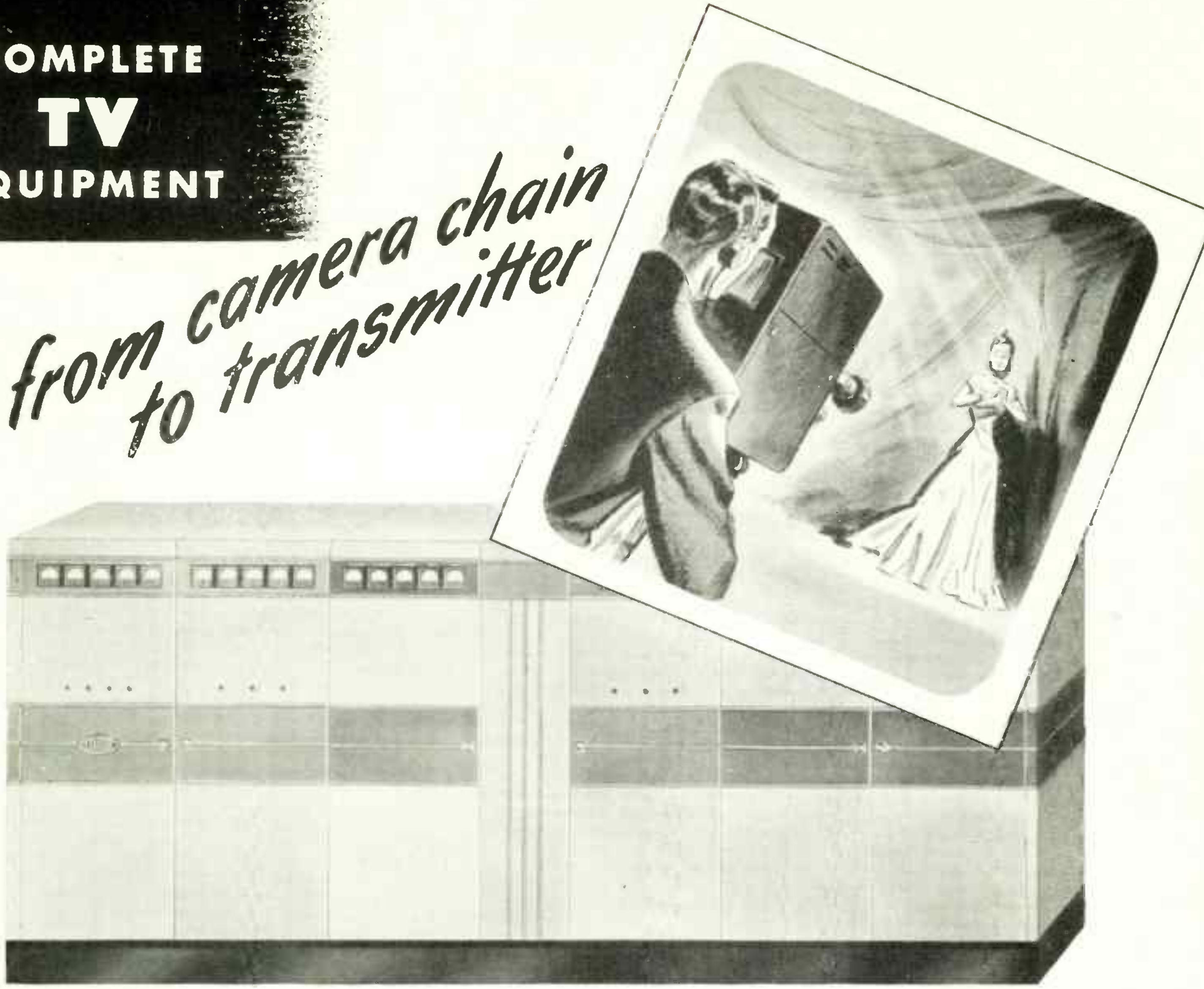
➧ ***Details on request. Submit your telecasting plans for that Du Mont "know-how" guidance.***

DUMONT *First with the Finest in Television*

ALLEN B. DU MONT LABORATORIES, INC. • TELEVISION EQUIPMENT DIVISION, 42 HARDING AVE., CLIFTON, N. J. • DU MONT NETWORK AND STATION WABD, 515 MADISON AVE., NEW YORK 22, N. Y. DU MONT'S JOHN WANAMAKER TELEVISION STUDIOS, WANAMAKER PLACE, NEW YORK 3, N. Y. • STATION WTTG, WASHINGTON, D. C. • HOME OFFICES AND PLANTS, PASSAIC, N. J.

COMPLETE
TV
EQUIPMENT

from camera chain to transmitter



LOOK TO RAYTHEON FOR *ALL* YOUR NEEDS

RAYTHEON is prepared to furnish complete equipment for television stations. Through this one dependable and reliable source of supply you can obtain any single item or an entire installation ranging from camera chains to antenna and associated equipment . . . including 50 watt microwave equipment for remote pickup, STL, or point-to-point relay. Raytheon stands ready to provide you with prompt and intelligent service at all times.

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Industrial and Commercial Electronic Equipment,
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Formerly, *FM* MAGAZINE and *FM* RADIO-ELECTRONICS

VOL. 8 NOVEMBER, 1948 NO. 11

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MEMBER, AUDIT BUREAU OF CIRCULATIONS

Set Production

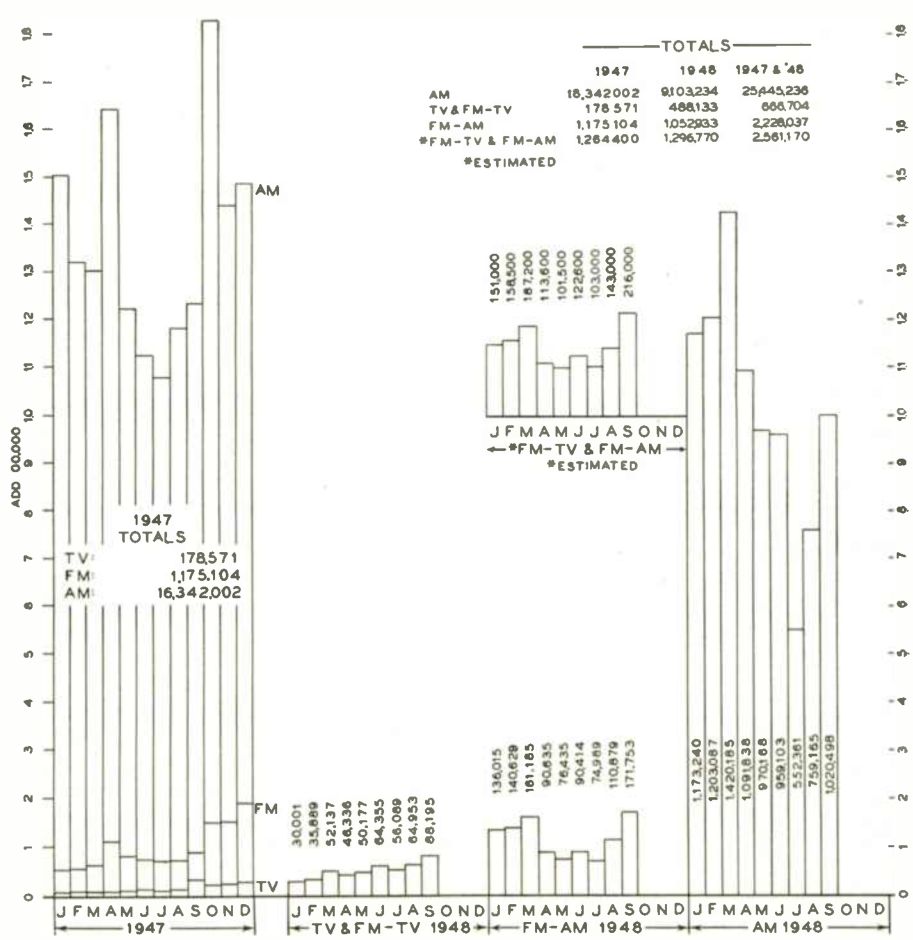
SEPTEMBER ran up a 1948 record for FM and TV set production. Even AM showed further recovery from the low point last July, although September was the fifth successive month in which AM production was below the lowest month of 1947. This can be seen from the accompanying Barometer.

Specifically, September TV production was 75 per cent above the average of the eight preceding months; FM was up 56 per cent, and AM up 9 per cent. This increase was due in part to the 5-week month, but it reflects the steadily growing demand for FM and TV receivers.

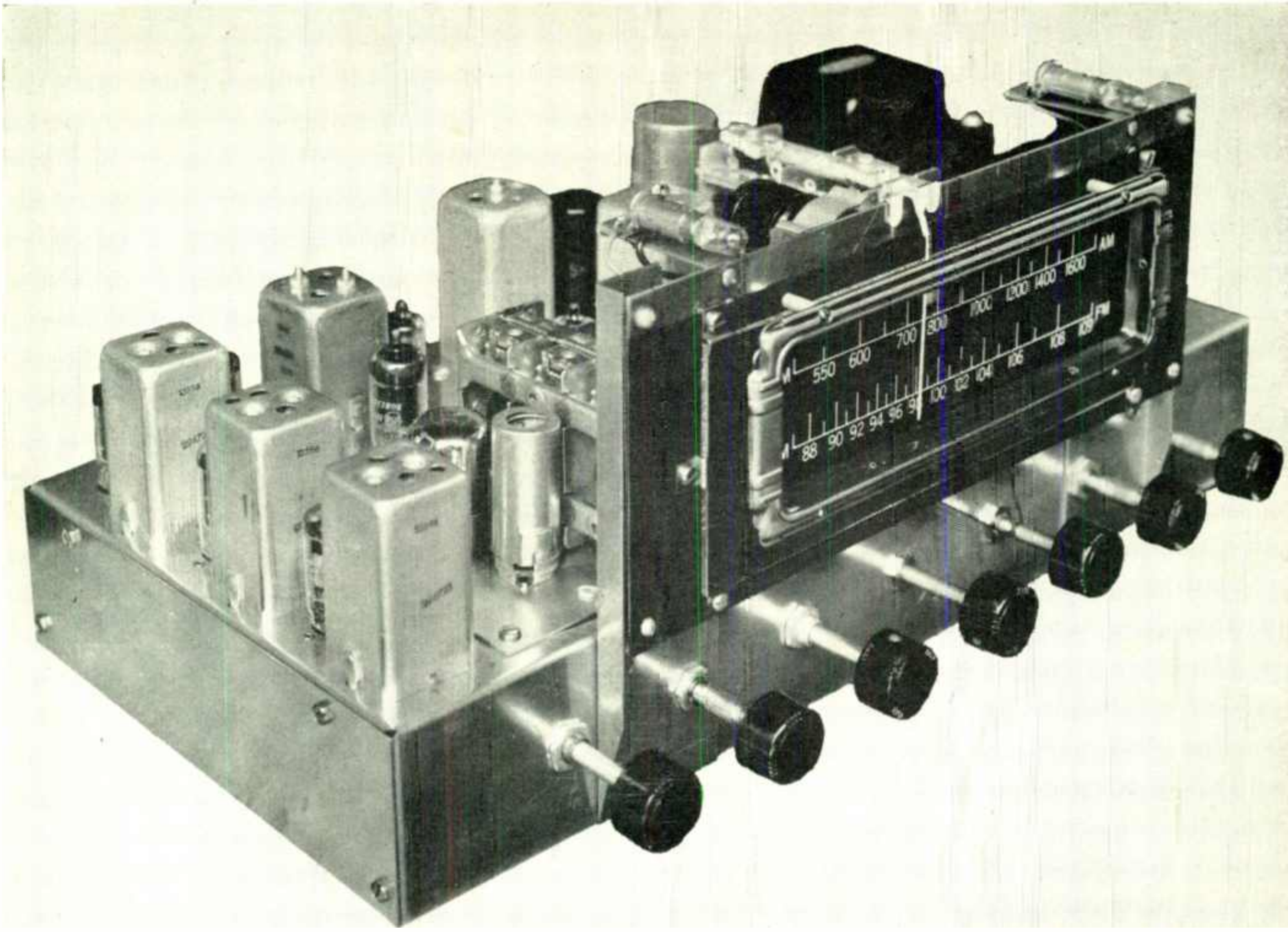
Since RMA figures for AM sets include export models, there is no way of telling what part of the 9 per cent gain referred to above was due to foreign shipments.

Percentagewise, 1948 figures break down this way: TV 4.5 per cent, FM 10 per cent, and AM 85.5 per cent. As to dollar volume, however, it appears TV sets are definitely in the lead, followed by FM, with AM in the low position. With low-price, straight FM sets now in production by Emerson, a similar model readied at Belmont, and the output of Zenith's very successful FM-AM table models rising steadily, monthly FM figures should climb at a rapid rate. Straight FM sets have a particular significance to broadcasters, since their owners can only use them for FM listening. It can be expected that straight FM table models will be introduced by a number of companies to take up the slack in their AM sales.

The manufacture of TV sets is still a rat-race to get components, to train workers, and to set up adequate testing facilities. The latter is a headache because the precision equipment required is not readily available, and it runs into telephone-number prices. That and lack of engineering talent are the reasons why the number of companies manufacturing TV sets is relatively small.



FM-AM-TV Set Production Barometer, based on monthly figures compiled by the RMA



THE GENUINE ARMSTRONG FM CIRCUIT IN THIS RJ-20 FM-AM TUNER GIVES THE FINEST OVERALL PERFORMANCE OF ANY CIRCUIT AVAILABLE TODAY.

WITH THIS RJ-20 TUNER, USE THE NEW MODEL AA-20

BROWNING ALL-TRIODE AUDIO AMPLIFIER

CUSTOM set-builders asked for it, and here it is — an all-triode amplifier to supplement the superlative performance of the RJ-20 FM-AM tuner.

Audio experts were quick to recognize the advantages of having a 2-stage audio system for the treble and bass boosts in the RJ-20 tuner chassis. But they wanted a compact, moderately-priced amplifier to use with the tuner. Now we have it in the model AA-20, *an amplifier engineered for audio engineers.* Just check these specs:

POWER: 15 watts output with .15 volts input

CLEAN TONE: Total harmonic distortion is down to 1.4% at 14 watts

QUIET: Hum level 65 db below maximum output

FLAT RESPONSE: Plus or minus 1 db from 10 to 17,000 cycles

IMPEDANCE: Input is 500,000 ohms. Output is 1.2 to 30 ohms. (500 ohms on special order)

TUBES: One 6SN7GT, two 6B4G, one 5U4 rectifier, one 6X5 bias rectifier

You'll delight your most critical clients when you use the BROWNING RJ-20 tuner in combination with the AA-20 amplifier for custom-built installations. Write at once for a complete set of FMT-11 data sheets.

If you want to feed a separate high-fidelity system, use the BROWNING RJ-12A for FM-AM, or the RV-10 for straight FM

BL

BROWNING
LABORATORIES, INC.
WINCHESTER, MASS.

ENGINEERED FOR ENGINEERS

IN CANADA, ADDRESS:

MEASUREMENT ENGINEERING, LTD., ARNPRIOR, ONT.

TELEVISION NEWS

16-Inch Glass Tubes: Developed by the Kimble Glass division of Owens-Illinois Glass Company, Toledo. Production will start early in '49. Price will be lower than metal envelope sealed to glass face.

Color Television: Development is continuing at CBS laboratories, 485 Madison Avenue, New York City. Recent demonstration was given to FCC Chairman Coy, Commissioners Hyde, Webster, and Hennock, and representatives of the l gal and engineering departments.

Sets for Public Places: Will be manufactured by the newly-organized Tele-Video Corporation, 241 Fairfield Avenue, Upper Darby, Pa. President is Paul Weathers, associated with RCA for the past 16 years.

TV at Fort Monmouth: Headquarters for Army radio development is all set up for television. Each company has a receiver, and one has constructed a TV theatre.

Cincinnati Audience: Station WLWT expects that their audience, which numbered 5,911 on September 15, will grow to 10,000 by the end of this year.

WDTV Pittsburgh: Antenna for the Du Mont station is completed, and test patterns should be on the air in December. Operation will be on channel 3, with 16.6 kw. video and 8.3 audio power. Acting chief engineer is Raymond W. Rodgers, formerly of WFIL-TV.

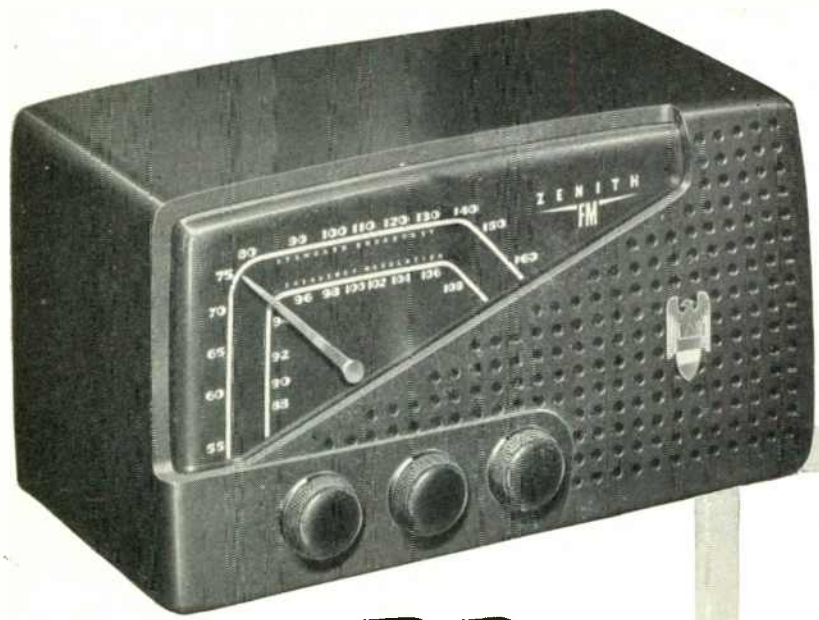
Baltimore Expansion: According to the Baltimore TV Circulation Committee, sales of 36 different makes of TV sets, in addition to kits, totalled 4,000 units in October. This increases the number of sets in use to 26,000.

Free Testing Service: Newark Electric Company has installed TV set-testing facilities at its New York and Chicago stores. Use of the equipment for aligning kits purchased from Newark is available without charge.

Joseph B. Elliott: RCA vice president in charge of the home instrument department, addressing the Engineering Society of Detroit, on October 20: "A third of the nation's population already lives within service range of television. By the end of the year, about half the population should be within reach of at least one station."

FM BROADCASTERS:

Here's the answer to YOUR audience-building problem...



A Really Good

FM-AM RECEIVER

with Genuine

ARMSTRONG FM

The Triumph

Ask Your ZENITH Distributor or Dealer to DEMONSTRATE IT!

Hear your own station, as you want your audience to hear it . . . crystal-clear and static-free, with genuine Zenith-Armstrong FM. The powerful Zenith built Alnico "5" speaker reproduces your programs in full, natural tone quality. See it, hear it, compare the value . . . and you'll agree that the low-priced Triumph is the answer to your audience building problem.

USE THIS NEW ZENITH YOURSELF!

You will want these radios throughout your offices for monitoring purposes. Your time salesmen will want them, too, for the "Triumph" is so small and compact. It's easy to carry about and to demonstrate—in the prospect's own office—the static-free, true-fidelity quality of FM. Zenith's patented Light-Line Antenna eliminates the need for a dipole . . . insures perfect reception almost anywhere.

*Reg. U. S. Pat. Off.

PRICED FOR VOLUME BUSINESS

$59.95 *West Coast Slightly Higher*

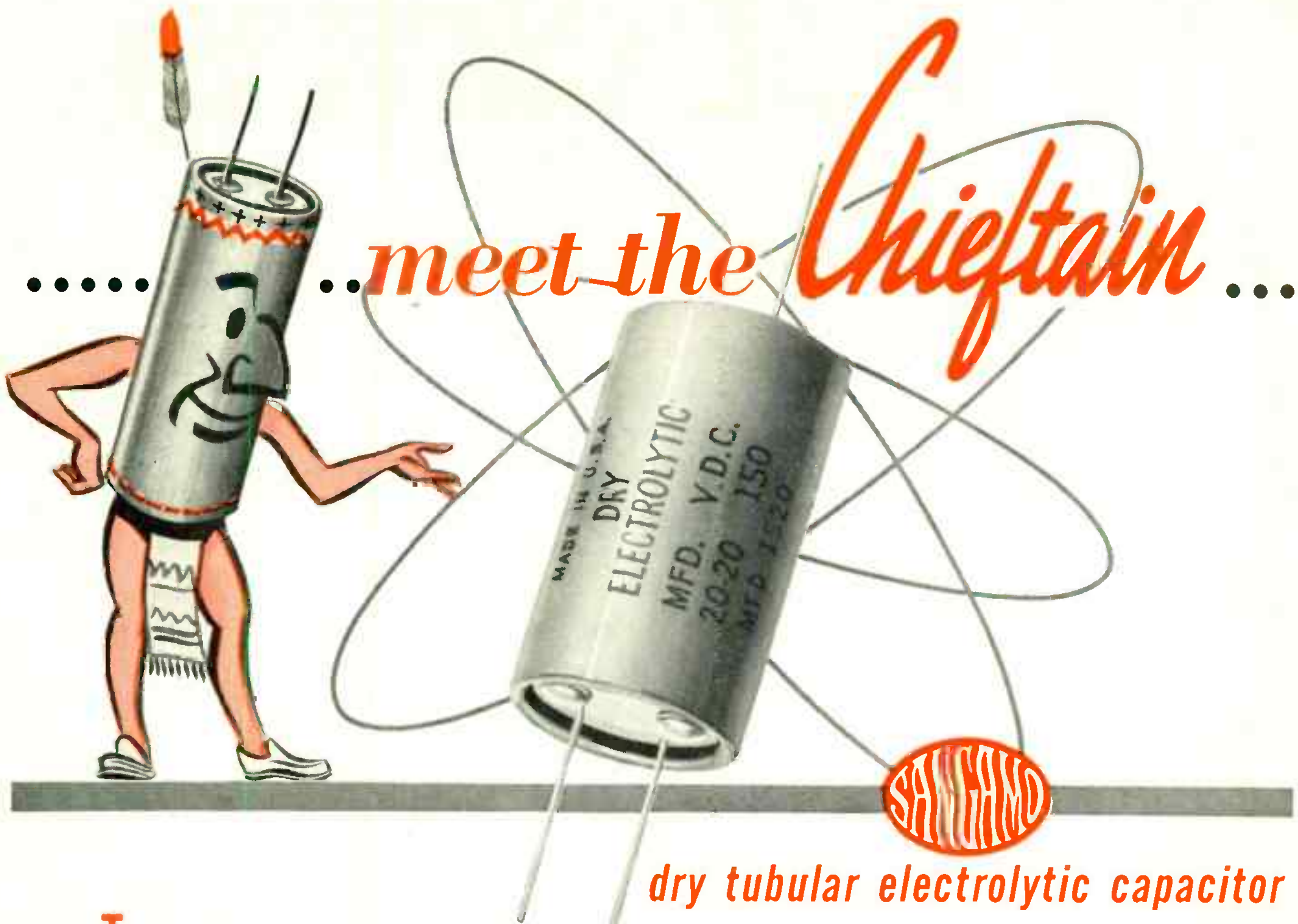
HERE'S HOW TO GET MORE OF THESE RADIOS INTO YOUR TERRITORY

Talk to your local Zenith dealer or distributor today. He's anxious to help you plan a program to make listeners as completely FM-conscious as possible! He has up-to-the-minute information, suggestions and sales promotion plans, designed to get more Zenith* Triumphs into your territory. Yes, your Zenith dealer or distributor is ready to help you develop an effective campaign—to sell Zenith Triumph radios, and to increase YOUR listening audience. Call him today!

Prices Subject To Change Without Notice

Keep An Eye On

ZENITH RADIO CORPORATION • 6001 DICKENS AVENUE • CHICAGO 39, ILL.



dry tubular electrolytic capacitor

Type MT and MTD electrolytic capacitors, "Chieftains" of the Sangamo line, are built to provide longer life, greater dependability, and better electrical characteristics. Ideal for replacements, they fit anywhere! Their small physical size makes them a "natural" for application in tight spots beneath a chassis, and the bare tinned-copper wire leads make them easy to mount.

Sangamo "Chieftains" are contained in hermetically-sealed round aluminum cans and are tightly encased in heavy cardboard sleeves on which polarity is clearly indicated. Double, pure paper spacers assure adequate breakdown characteristics and all sections are tightly held in place within the container. Multiple staking connects the terminal tabs to the electrodes, providing permanent low resistance contact throughout the life of the capacitor. The low voltage units are supplied with etched cathodes to maintain uniform capacity when the capacitor is subjected to heat and high ripple currents.

"Chieftains" are manufactured under controlled conditions of almost surgical cleanliness, utilizing the very finest materials and production procedures available in the industry, for your assurance of quality in every respect.

Your own trial-use will convince you that new standards of dependability and longevity have been built into Sangamo Electrolytics. Order from the new Sangamo Electrolytic Capacitor Catalog No. 825F, which is yours for the asking, and without obligation.

SC 4810

SANGAMO ELECTRIC COMPANY

SPRINGFIELD • ILLINOIS

links the ship and the shore

IN ADDITION TO producing radiotelephone equipment for the largest ocean liners, Western Electric for many years manufactured the 224, 226 and 227 type sets, which brought the benefits of radiotelephone facilities to coastwise vessels and small craft.

These sets provided power capacities ranging up to 100 watts. As the Bell System had tremendously expanded its chain of harbor stations, coastal craft were normally near a shore station. Hence these capacities were ample to maintain contact with land.

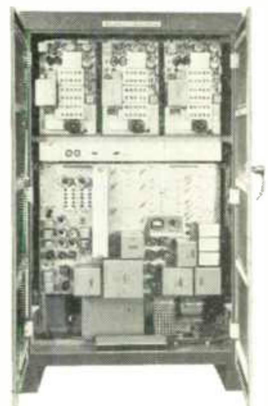
There still existed, however, no equipment specifically designed for tankers, freighters and smaller passenger ships plying the *ocean* lanes. This need has been filled by the introduction of the Western Electric 248A.

This new equipment provides 250 watts of transmitted radio frequency carrier power, resulting in greatly increased range. Provision is made for transmission and reception on the frequencies of the high-seas shore stations (as well as on the coastal harbor and ship-to-ship channels). Because of these two features, a ship equipped with the 248A, at practically any point on world trade routes, can establish contact with a land station.

The 248A combines this advantage with the compactness and simplicity of operation essential on smaller ships.

—QUALITY COUNTS—

THE NEWEST IN MARINE RADIOTELEPHONE EQUIPMENT



Left: Main cabinet of 248A mounting transmitter and three receivers.
Above: Remote control unit.

The long experience of Bell Laboratories and Western Electric in design and manufacture of marine radiotelephone equipment has culminated in the 248A—compact, powerful, simple to operate.

A single cabinet houses the transmitter and three receivers. Each of the three receivers can be tuned to any one of 10 pre-set frequencies; the transmitter to any one of 30. Transfer from one frequency to another is accomplished simply by turning knobs on the remote control panel.

Because three receivers are used, it is possible for the ship to monitor simultaneously on three different channels. The set is designed to permit easy installation of selective equipment to allow dialing the ship from shore stations.

Western Electric

Manufacturing unit of the Bell System and the nation's largest producer of communications equipment.

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THIS MONTH'S COVER

Planning TV transmitters and studios involves many considerations that are new to broadcast engineers. Moreover, TV calls for some serious work of educating customers as to what they will require, and why.

Scale models have proved to be an invaluable aid to visualizing engineering problems, space requirements and related factors. They are equally useful to customers who, contemplating large investments, want an idea of what so much money will buy.

This month's cover shows RCA television engineer John H. Roe with a scale model showing one TV station layout. Every piece of equipment is represented, from equipment cabinets and cameras to turntables and film-scanners.

WHAT'S NEW THIS MONTH

1. Our Abbreviated Title
2. AM Techniques Won't Do for FM
3. Mobile Systems Are Multiplying
4. TV Survey in Cleveland Area

1. We hope you'll like the abbreviated form of *FM* and Television as it appears this month on the front cover. Frequency modulation was shortened to FM from the very start, and so accepted by all. When television was first cut down to TV, we didn't quite approve. This form was shunned in our editorial pages for a long time. But TV is so convenient to use in speech and type that we adopted it, too.

It was in April, 1944 that we first used the title *FM* and Television. At lunch with Dr. Allen Du Mont some time earlier, we were talking about probable developments in civilian radio when the war would be over. Allen was so busy increasing his production of cathode-ray tubes for radar and other military purposes that you'd suppose he had no time to think of television. But, given a few free moments to talk about it, his enthusiasm over the peacetime possibilities of television conveyed the impression that he thought of nothing else.

With that same enthusiasm, he suggested that we should modify the name of this magazine by adding and Television. "Not FM alone," he said, "but FM and television will support the industry after the war is over."

Because his suggestion seemed sound at the time, we adopted it. That's how it happened that *FM* and Television first appeared on our April, 1944 cover. Subsequent events proved the change to be a wise move.

Later, several other trade papers followed suit. The only variation was the change in *Broadcasting*, to which name *and Telecasting* was added.

Recently, because confusion does arise in magazine names when there are several concerned with one industry, we sought a modification that would give distinction without requiring a basic change. First, we put *TV* in a red block, connected to the *FM* block with the word and. We weren't quite satisfied, but it seemed to be the best solution.

Just at the time the new design was finished, we had a session with John West, RCA's vice president in charge of public relations. We had a photostat of the lettering tucked away in the briefcase, and this was an opportunity to get an expert opinion of the design. John West looked at it. Then he said: "Look, we're a nation of initial-users. Why don't you drop out the and, and substitute a hyphen?" We said, *"FM-TV"* aloud. Of course, that was the right answer! It was much easier to pronounce with the conjunction omitted. Next day, the change was made on the original design.

And that's the story behind the modified title that you see on this month's cover!

2. There's a world of smart thinking in the article on microphone techniques, by Harold Ennes, which appears in this issue. We first heard of the anti-mike-mugging idea from Dan Gellerup when we were at WTMJ in the summer of 1945. Dan told us: "We use mikes rated at 8,000 cycles for the high-fidelity transmission of frequencies which approach 15,000 cycles." We were so impressed by his success with the keep-'em-back-from-the-mike technique for FM programs that we asked him for an article on this subject. It appeared in our September, 1945 issue.

The war just ended then, and there were many other things to think about, including a proposed shift in FM frequencies. Later, when FM broadcasting

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Special Services Directory

WHAT'S NEW THIS MONTH

(Continued from page 12)

really got under way, it was generally tagged onto AM operation, or treated as an expense which had to be kept down to a minimum of personnel and facilities. Very little money and even less care, in many cases, were spent on FM programming.

Harold Ennes, in his article, confirms what Dan wrote back in 1945: "It is perfectly natural for engineers of long AM experience to proceed along the lines of established practices, making only limited concessions to the special requirements of FM.

"Such methods, however, will not produce the best end results in FM broadcasting. A much more effective method, and I say this because of our experience at *The Milwaukee Journal* station is to study the special requirements of FM broadcasting, and base all plans for facilities and equipment on those considerations, without regard to AM practice.

"Only in this way is it possible to anticipate the increasingly critical judgment of radio listeners which will result from widespread use of high-fidelity FM receivers, and to assure them of the full entertainment value which FM can deliver."

Those were prophetic words. The tremendous impetus FM has given to audio developments is making listeners increasingly dissatisfied with AM reception in general, and specifically critical of substandard FM programs. Time has proved Dan right except in one respect. It isn't necessary to have a high-fidelity receiver in order to tell the difference between good and bad studio practice. With the small Zenith table model, which we have come to use as a standard of low-cost FM reception, anyone can hear a great improvement in Continental Network's 15,000-cycle programs over the best FM reception of AM net originations. To be sure, such a set gives only a part of the improvement afforded by such programs, but it's such a big part that the least critical listener is pleasantly aware of the difference.

Harold Ennes is one broadcaster who has discovered this. As he puts it: "Microphone techniques are more important on FM than AM. In other words, AM listening discloses the difference between precise and sloppy handling of a program only to a limited degree, but FM listening generally shows up the difference very clearly, even on a set of only limited audio capabilities."

Too many audio broadcasters feel that what they have been doing in the past will still be good enough in the future. They forget that those who have put millions of dollars into television are employing the smartest, most aggressive brains that money can buy to assure the

(Continued on page 14)

Special Services Directory

WHAT'S NEW THIS MONTH

(Continued from page 13)

soundness of their investment. Their job is to make more people tune in to their stations for more and more hours every day. This situation exists in 21 areas today. It will soon prevail in 48 additional areas where the construction of TV stations has been authorized already. Video competition can be met only by better audio programs with improved reception in listeners' homes.

3. Operators of 2-way mobile communications systems have put up a real fight this year for more channels. Their pleading at the FCC has been opposed by TV interests because they, too, want more ether space. Even more effective opposition has come from the Government's indifference to making a realistic appraisal of its needs, with the view to releasing channels that it clings to for selfish reasons rather than actual need.

Well, what about communications systems? Do they really need more channels now, or are they just trying to throw an anchor to windward?

We can give a quantitative answer to this question. Stella Duggan, from our New York office, is at the FCC right now, working on the revision of our Communications Directory, to be published in the January issue. She has just sent in the first sheets of the January 1948 Directory, with the latest additions and corrections. To our dismay, an actual count reveals that more systems have been added than were listed last year!

In an accompanying letter, we are told: "As for public utility systems, just since I was here last June the number of file trays in this group increased from 26 to 48."

The increase in the number of communications systems has us worried, too. Last January, nine full pages were required just for taxi, public utility, truck, bus, highway maintenance, transit, limited common carrier, pipe-line, and geophysical systems. Now it looks as if we may need close to twenty pages to list this group in our January, 1949, issue!

We've been sorely tempted to give up the semi-annual Communications issues, because their preparation and the space required has become a real burden. However, this information, available from no other source, has proved so valuable to those engaged in this field that we can't drop it now.

4. One of the most informative surveys of TV set owners that we have seen was made by the Ohio Advertising Agency, 2300 Payne Avenue, Cleveland. All the information presented is factual, since it was obtained from owners of sets, in contrast to questionnairing non-owners as to their ideas and intentions.

(Continued on page 15)

WHAT'S NEW THIS MONTH

(Continued from page 14)

Here are the net results obtained from approximately 1,000 TV owners in Cleveland, an area now served by Scripps-Howard station WEWS.

90% of the sets were in homes; 10% in public places.

88% of the home sets were in living room; 12% in various other rooms.

12% of the home sets had been moved after they were first installed.

95% of the home sets had outside antennas; 5% had inside antennas.

Most of the sets were manufactured by Philco, Admiral, and RCA, in that order.

34% were bought in furniture stores; 29% in radio stores; 17% in hardware and appliance stores; 14% in department stores; 6% in other types of stores.

Price-wise, they were divided as follows:

5% cost less than $200
11% cost $200 to $300
19% cost $300 to $400
26% cost $400 to $500
19% cost $500 to $600
8% cost $600 to $700
5% cost $700 to $800
7% cost over $800

98% of the owners were satisfied with the performance of their sets.

85% were satisfied with the size of their pictures; 10% required magnifiers for satisfactory viewing; 5% were dissatisfied.

99% said that their sets were easy to operate.

47% of the sets had not required service; 44% had been serviced once; 5% twice; and 4% three times or more.

93% of those who had called for service said the work had been handled in a satisfactory manner.

73% of the TV owners use their audio receivers less often than before; 27% use their audio sets as much as before they bought TV receivers.

Program types, in order of preference, were listed as follows:

1. Sports
2. News events
3. Variety shows
4. Feature films
5. Children's programs
6. Stage plays
7. Audience-participation programs
8. Women's programs

The average number of viewers during the day was found to be 6, and 10 at night. This count was somewhat influenced by including the number of people looking at television in public places.

It might be said that owner reactions in a 1-station area are not completely informative. However, out of the 21 areas where there is TV service, 12 have only 1 station, 4 have 2 stations, 4 have 3 stations, and 1 has 5 stations.

You can match the characteristics of most transcriptions and recordings...

...with the 109 Type Reproducer Group

Recording characteristics vary widely from one company's recordings to another. But... when you use the Western Electric 109 Type Reproducer Group, with its 7-position Equalizer, you can correct for practically *any* of the more commonly used recording characteristics.

Note in the adjoining panel how closely the 109 Type Group equalizes not only for the NAB and Orthacoustic curves, but also for commercial records and lateral transcriptions. *In fact, you can match within close tolerances all vertical and most lateral transcriptions and 90% of phonograph records.*

That's *one* factor in the high-quality performance of the 109 Type Group. Another is the exceptionally low intermodulation distortion of the 9 Type Reproducer. Hear the Group for yourself — note how this feature reduces "hash" at the higher frequencies.

The 109 Type Group consists of reproducer arm, your choice of 9A or 9B Reproducer, equalizer and cable assembly, and repeating coil. You can easily mount this top-performance group on your present turntables—*and you can get it from stock!*

Place your order with your local Graybar Representative — or write Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

Distributed by Graybar — Offices in 100 principal cities

— QUALITY COUNTS —

DISTRIBUTORS: IN THE U. S. A.—Graybar Electric Company. IN CANADA AND NEWFOUNDLAND—Northern Electric Co., Ltd.

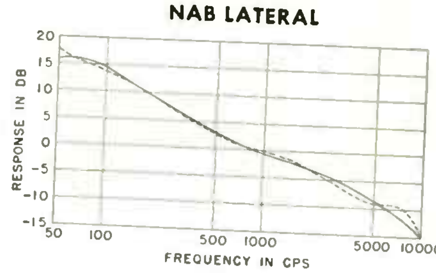
Western Electric

See how closely the 109 duplicates all of these recording curves

Recording Characteristic ————

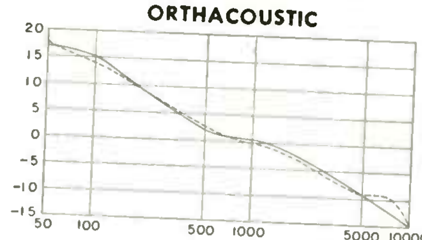
109 Type Reproducer Group (using average production reproducer) - - - - - - -

NAB LATERAL



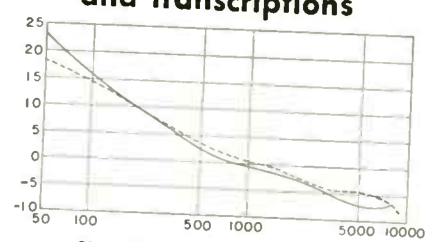
Equalizer Curve B, Pos. L2

ORTHACOUSTIC



Equalizer Curve B, Pos. L2

Typical curves for commercial records and transcriptions



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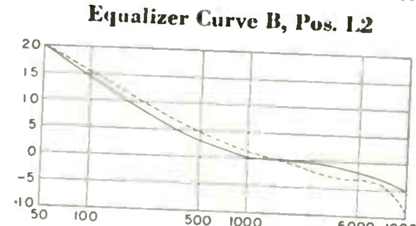

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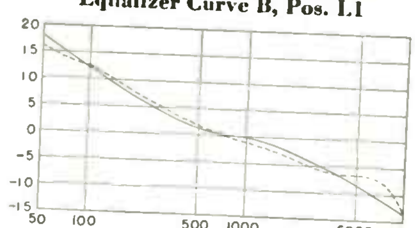

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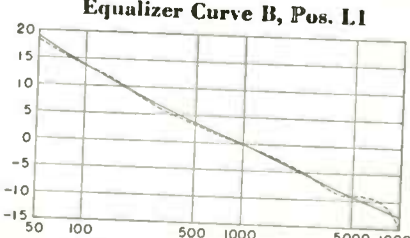

Equalizer Curve B, Pos. L2

Left: Students meet to discuss and plan a program feature. Right: Instruction in the techniques of using transcriptions.

CAMPUS BROADCAST STATION

SUCCESS OF SYRACUSE EXPERIMENT OPENED WAY FOR FCC APPROVAL OF LOW-COST 10-WATT TRANSMITTERS OPERATED BY SCHOOLS AND COLLEGES – *By* ED. JONES*

EARLY in 1947, Syracuse University went on the air with what has since become known as a campus broadcasting station. A $2\frac{1}{2}$-watt FM transmitter was furnished for this purpose by the General Electric Company as an experimental investigation of educational services that might be performed by such a station.

The experiment proved highly successful from every point of view. In fact, the operation at Syracuse and concurrently at De Pauw Universities prompted the FCC last June to propose that the regulations for non-commercial educational stations be amended to permit the use of 10-watt transmitters. The amendment was made effective on September 27, 1948.

Students Run the Station:

When the experimental transmitter was installed on the Syracuse campus by General Electric, approximately 600 students were enrolled in one or more radio courses. About 5% of these were enrolled in a major course in one of the four schools of which radio is a department. Here was a tremendous pool of talent which, heretofore, had only limited practical experience over the facilities of two local commercial stations and their FM affiliates.

When WJIV (now permanently licensed as WAER) went on the air, the students were immediately organized into a staff modeled after a regular radio station from program director down the line to typists and file clerks. Five seniors, interviewed and screened by the six professionally-trained instructors comprising our radio faculty, took the positions of program director, production chief, chief writer, news and promotion director, and chief engineer.

These seniors, heading up about 40 staff members, handle the entire operation from the overall planning of schedules to the details of mimeographing publicity pieces.

However, while much responsibility in the operation of WAER is delegated to students in the belief that responsibility breeds ability, the faculty is in direct supervision of all programs aired over the station.

Faculty members are advisors to the student group, each serving one full broadcast day a week in close supervision in order to insure that at no time will the quality of programs broadcast be sacrificed in the name of training. No program is aired without direct faculty advice and monitoring.

Studios & Transmitters:

It was a relatively simple matter to set up the FM broadcast equipment. The transmitter, about the size of a large console receiver, was installed in a corner of one of the small control rooms of our Radio Workshop.

The roof of the main library was chosen for the antenna site. A 20-ft. pole supports the doughnut-shaped antenna, as shown in one of the accompanying illustrations. Other facilities, including five

* Radio Center, Syracuse University, Syracuse, N. Y.

Left: Newscasting is an important subject, and the object of critical listening. Right: Practical experience in the control room.

Left: Setup for a dramatic show at Syracuse University. Right: Intimate criticism by studio and radio audiences has great value.

studios and their equipment, were already on hand at the beginning of the experiment, being the regular facilities of the Workshop.

Transmitting Range:

Engineering estimates of the radius of the signal of the 2½-watt transmitter were about 3 miles. This encompasses a population of about 245,000 or, roughly, the City of Syracuse.

Original estimates of the signal radius have since proved to be surprisingly short in certain instances, however. For example, a commercial broadcaster in Syracuse says he is able to receive WAER with good volume and quality at his home 20 miles away. Frequent requests for program schedules come from as far as 6 or 7 miles.

These results are particularly surprising since the antenna only radiates 1 watt, the other 1½ watts being lost in the transmission line to the antenna.

Purposes, Programs, Policies:

The question of programs to be offered our audience resolved itself to a decision to provide service whenever possible which is not or cannot be furnished by existing commercial AM or FM stations in the city.

The overall plan of WAER is shown by the following policies which guide program personnel in shaping the schedules:

1. To widen the educational service of the University by presenting, often in their entirety, lectures, discussions, forums, concerts, and special events occurring on the campus, or under University supervision.

2. To experiment in the development of an all-cultural radio program service.

3. To give the student body a service supplementing the information normally provided by a student newspaper.

4. To supplement classroom instruction in radio broadcasting by affording an opportunity for those specializing in radio to have access to a station operated by the University.

5. To develop the talent normally found on the university campus.

WAER now broadcasts a regular schedule of 25 hours each week, 4 p. m. to 9 p. m. Monday through Friday, with frequent special events broadcasts wherever and whenever they are considered to be of interest to the campus community.

One aim of WAER is to supplement service offered by other stations in the area. For example, WAER broadcasts special events in their entirety, a function seldom possible on stations which have commercial committments. When Paul Appleby, formerly assistant director of the Budget, was installed as dean of the Maxwell School of Citizenship in 1947, WAER covered the affair as a special event and devoted 10 hours to the broadcast.

Plans for the Future:

The future goals for our station are 1) an increase in power as soon as possible in order to expand the influence of the University to a larger area, and 2) to continue to supply programs not provided by other stations.

While the campus-type transmitter has proved that it can serve a limited area with a minimum initial cost for transmitting equipment,[1] it is felt that any institution entering the educational broadcasting field should consider it only as a "budget entrance," and that it should plan as soon as possible to seek an increase in power to gain more effective coverage, as provided for in FCC regulations for educational FM stations.

This gives the educators the incentive to meet the unfilled needs of the community with programs which reflect the cultural activities of educational institutions.

The way is open for students in our schools and colleges to gain experience in all phases of broadcasting, and to perin the useful service on the campus and in the adjacent community. With low-cost equipment available, the number of such stations should grow rapidly.

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[1] The new 10-watt GE transmitter for campus broadcasting costs less than $2,500.

Left: Dean Kenneth Bartlett is head of the Radio Workshop. Center: Location of antenna. Right: Student checks transcriptions.

Fig. 1. Frequency and modulation monitor.

MOBILE SYSTEM MONITOR

CHECKS FREQUENCY & MODULATION ON 1 TO 4 CHANNELS FROM HQ STATION—*By* HOWARD V. CARLSON*

THE bands allocated to communications services are already crowded to the saturation point. Still, more and more transmitters are being assigned to the relatively limited number of channels available. The situation has now reached the point where, in nearly any part of the Country, adjacent-channel interference is so serious that off-frequency operation reduces the operating range of a system very severely, and raises havoc with other systems assigned to the same channel. And it is equally necessary to maintain the modulation swing within the limits specified for the operating frequency, for over-modulation may cause as much interference as off-frequency operation.

Prior to the postwar crowding of communications channels, engineers in charge of communications systems generally checked the frequency of the headquarters and mobile transmitters every two or three months. They did not consider it necessary to check modulation at all. Now, interference has become so severe that every system should maintain a constant check of frequency and modulation for the headquarters station and all mobile units as well.

Frequency & Modulation Monitor:

The Doolittle monitor, type FD-12, is designed for this purpose. This monitor, illustrated in Figs. 1, 2, and 3, is intended for permanent installation at the headquarters control point of a communications system. It can be used to check frequency and modulation on any number of channels up to four, anywhere from 25 mc. to 170 mc. The number of channels and the frequency of each one must be specified when the instrument is ordered. Any channel can be shifted, but that necessitates returning the instrument to the factory.

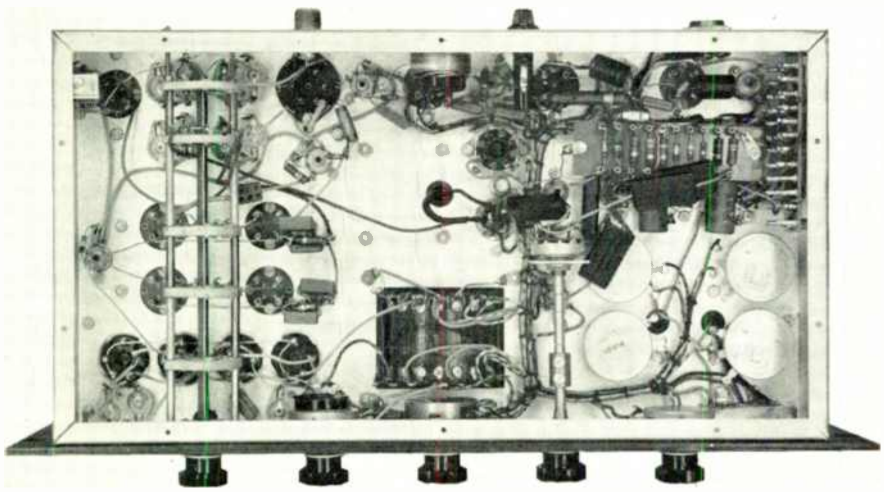


Fig. 2. Underside of monitor chassis. Band switch at left has calibrate position.

The center-zero meter, at the left of the front panel, is calibrated in center-frequency deviation from the assigned frequency, over a range of plus and minus 15 kc. Each scale division is 1 kc. The modulation meter, at the right, is calibrated from 0 to 20 kc. A panel switch controls this meter so that it shows either positive or negative modulation. In addition, there is a peak flasher to show modulation peaks of such short duration as not to be indicated by the meter. This flasher can be set by a panel control to operate at any degree of modulation from 5 to 20 kc.

Use of the Monitor:

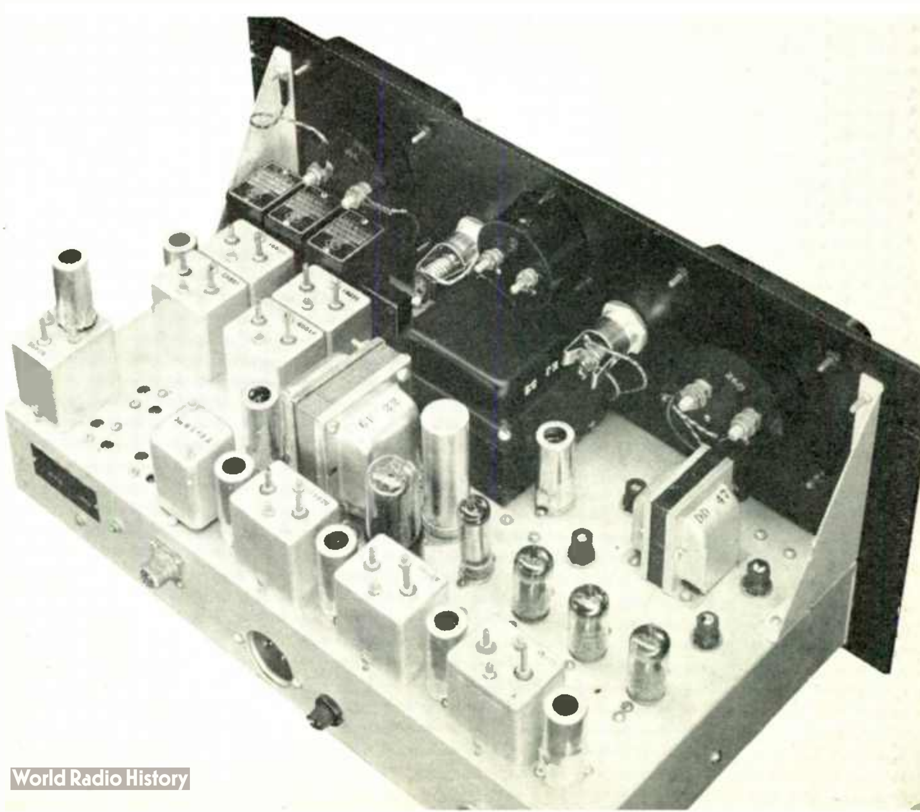
The monitor is operated by signals picked up from the fixed transmitter or any of the mobile units. For the former, a short length of wire is generally adequate as an antenna. However, in order to monitor mobile transmitters also, a resonant antenna should be connected to the monitor. A signal of at least 500 microvolts is necessary at the antenna terminal.

Usually, the instrument is set at the main transmitter frequency for continuous monitoring. If the mobile units are on the same frequency, they can be checked whenever they come within range. This is a great convenience, since it is not necessary to call the cars to headquarters in order to check the frequency and modulation. Thus their performance can be kept under regular observation. In the case of cars ordinarily stationed at distant points, their equipment can be checked whenever they are in the vicinity of the headquarters station.

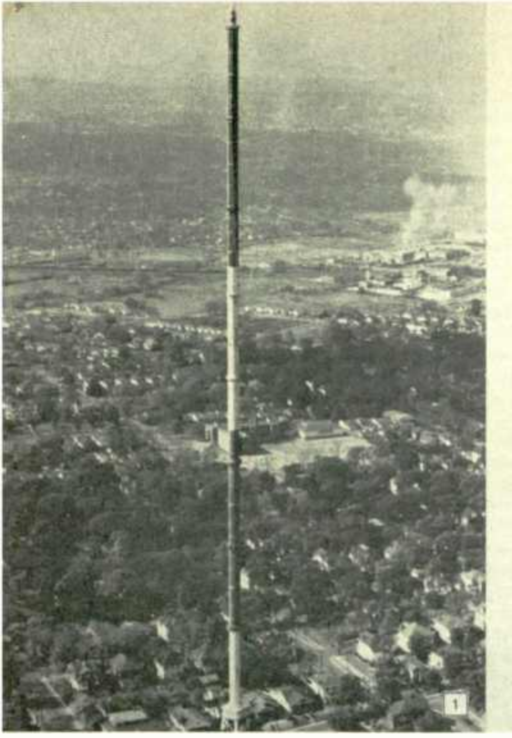
If the cars operate on a separate

(*Continued on page 44*)

Fig. 3. This view shows the plug-in input transformer behind the filterchoke.



* Doolittle Radio, Inc., 7421 Loomis Boulevard, Chicago 36.



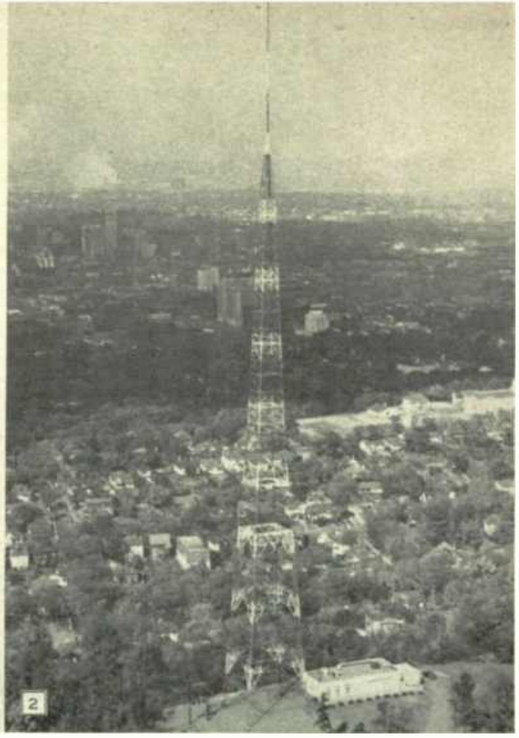


Fig. 1. Close-up of the 8-day Pylon. Fig. 2. The tower and the transmitter building

546,000 WATTS ON FM

WBRC-FM BIRMINGHAM, WORLD'S MOST POWERFUL FM STATION, HAS 200-MILE PRIMARY SERVICE RADIUS

ALABAMA not only has 14 FM stations on the air, but it has the most powerful of all FM stations. It is WBRC-FM, an RCA installation just completed on Red Mountain, near Birmingham. The transmitting radius of 200 miles gives primary service coverage over an area of about 125,000 square miles. This station is unique in another respect. It is owned, together with WBRC and WBRC-TV now under construction, by a woman, Mrs. Eloise Smith Hanna.

The transmitter has an output of 50 kw., but the effective radiation is stepped up to 546 kw. by the use of an 8-bay Pylon antenna, Figs. 1 and 2.

Fig. 6 shows the power output end of the transmitter, the panels of which extend in Fig. 7 to the modulator and driver sections. In Fig. 7, C. P. Hamann, technical director of WBRC-FM is standing at the right, and RCA engineer C. Starner is at the left.

Except for the modulator and driver sections, the design of this equipment departs radically from conventional transmitters. Fig. 10 is a rear view of the 1- and 3-kw. RF amplifiers in the left cabinet, and the 10-kw. amplifier at the right. These employ grounded-grid RF circuits with concentric-line construction. All three stages have 7C24 tubes.

The 50-kw. stage, Fig. 9, is mounted behind the open doors, with space enough to walk through to the area at the rear. One of the 5592 tubes is shown in this view, wheeled up and ready for installation. Actual arrangement of the 50-kw. section can be seen more clearly in Fig. 8, where the doors appearing in Fig. 9 are at the left. The sheet metal cabinet that looks like a fancy air-conditioning unit is actually the grounded concentric-tank assembly.

Electrically and mechanically, each of these two final sections form an integral part of the grounded-grid circuit. This construction eliminates neutralization and RF radiation that would affect the RF circuits in adjacent units. The base of the enclosure forms a plenum chamber for cooling air, and contains the control wiring and high-voltage bus. The plate line is tuned by shorting bars carrying contact fingers which move vertically along the center conductor. Motor-driven lead screws actuate the shorting bars, with the control located on the front panel. Input tuning is accomplished by two flat-plate air capacitors, one motor-driven and other operated manually. For output coupling, motor-driven loops are used, with series capacitors for reactance tuning. The amplifiers feed equal load impedances, also individually motor-controlled, providing easy load balancing and smooth adjustment of output power. At the top right are the transmission-line monitor and harmonic attenuator. The latter, used to insure maximum suppression of harmonic radiation, consists of a pre-tuned low-pass filter capable of 38 db attenuation.

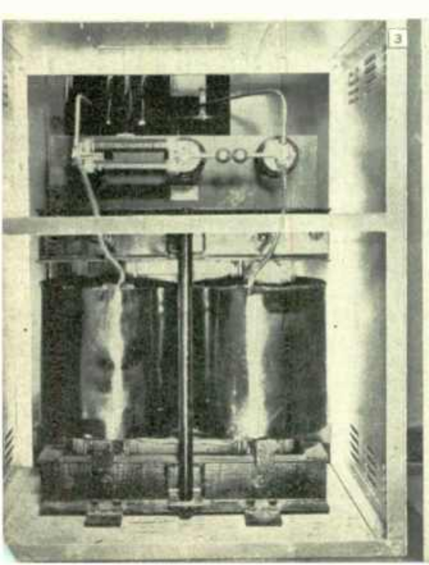
In case of any appreciable change in signal intensity, the transmission-line monitor actuates relays which shut down the transmitter. A reclosing mechanism then puts the transmitter on the air again. If the fault persists, the process is repeated, locking out after the third unsuccessful attempt.

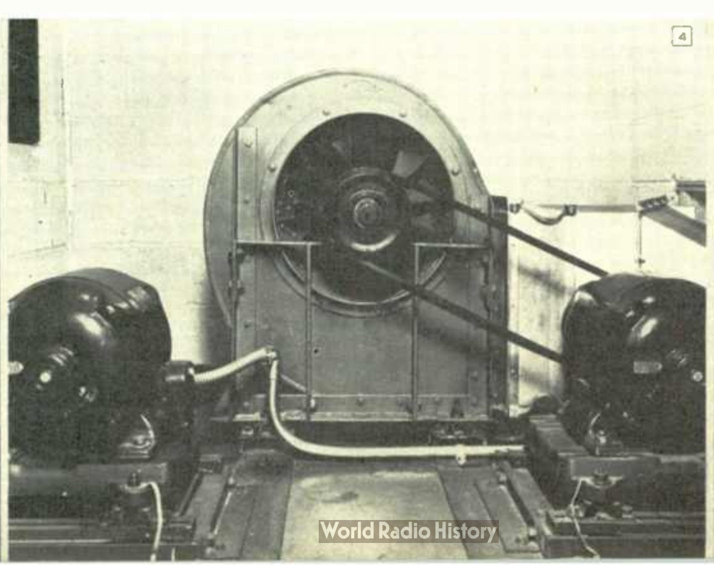
A more complete view of the transmitter is given in Fig. 11. Panels at the right enclose the 50-kw. rectifier section at the far end. Also in this line are the plate transformer, and the control and distribution section. There is a close-up of the latter in Fig. 12.

Fig. 3 shows the filter reactor unit for the high-voltage, high-power rectifier. The big blower with the spare motor, Fig. 4, provides forced-air cooling to the 50-kw. amplifier, while the smaller one, Fig. 5, takes care of the tubes in the driver, sections.

While this installation was being made, a similar transmitter was under construction for WTMJ-FM Milwaukee, with 349-kw. effective radiation. These are the first FM transmitters of such high power rating to go on the air.

Fig. 3. High-voltage, high-power filter reactor. Fig. 4. Blower for the 50-kw. tubes. Fig. 5. This blower supplies the other tubes.





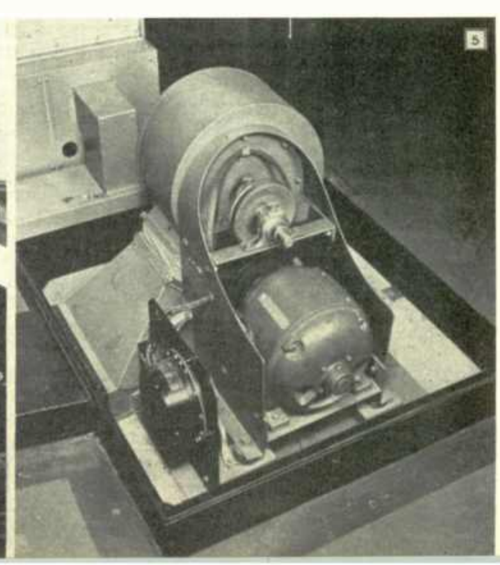
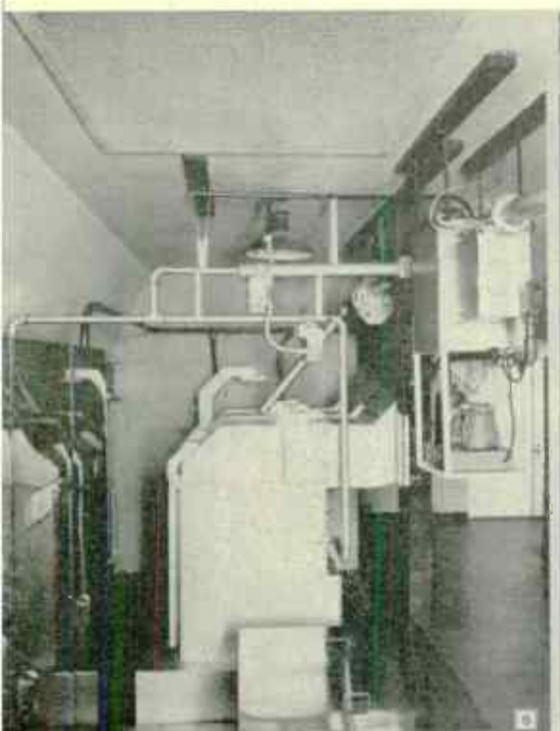


Fig. 6 Output end of the transmitter panel. Fig. 7. Modulator and driver section. Fig. 8. Close-up of the 50-kw. output amplifier.



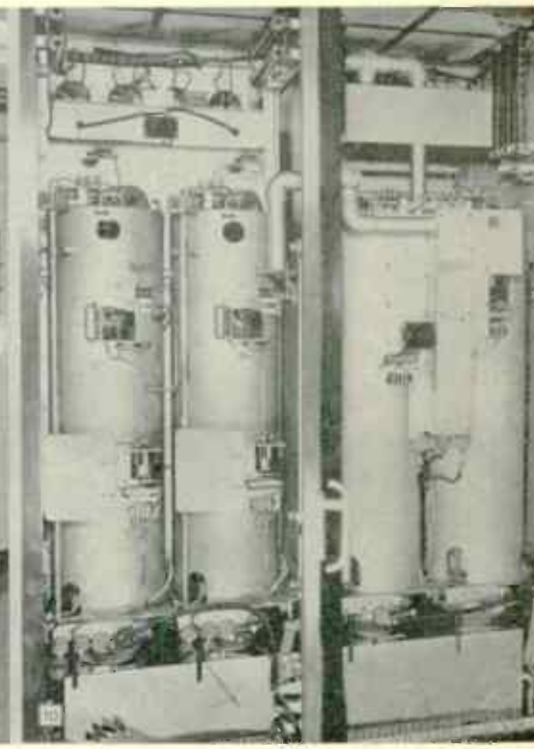
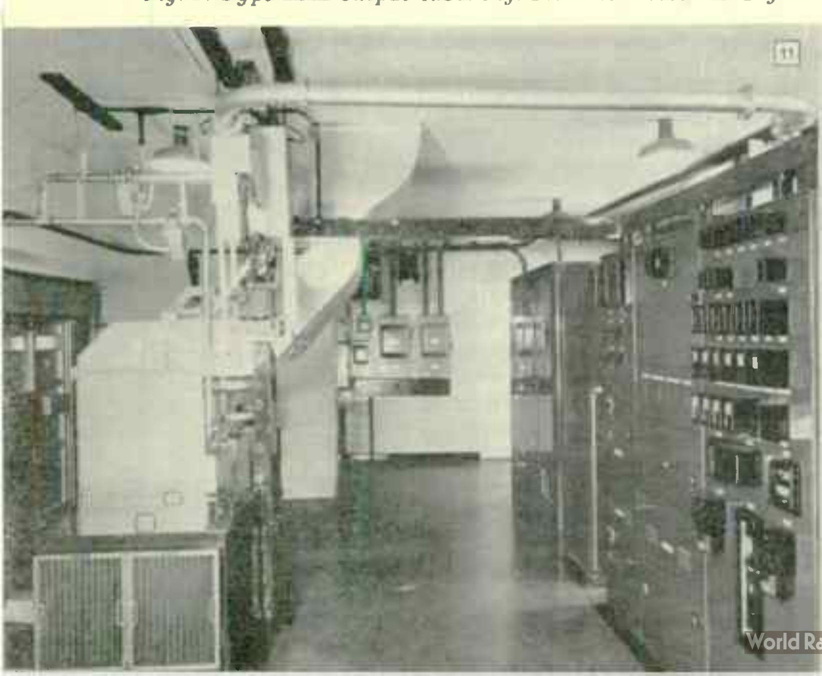
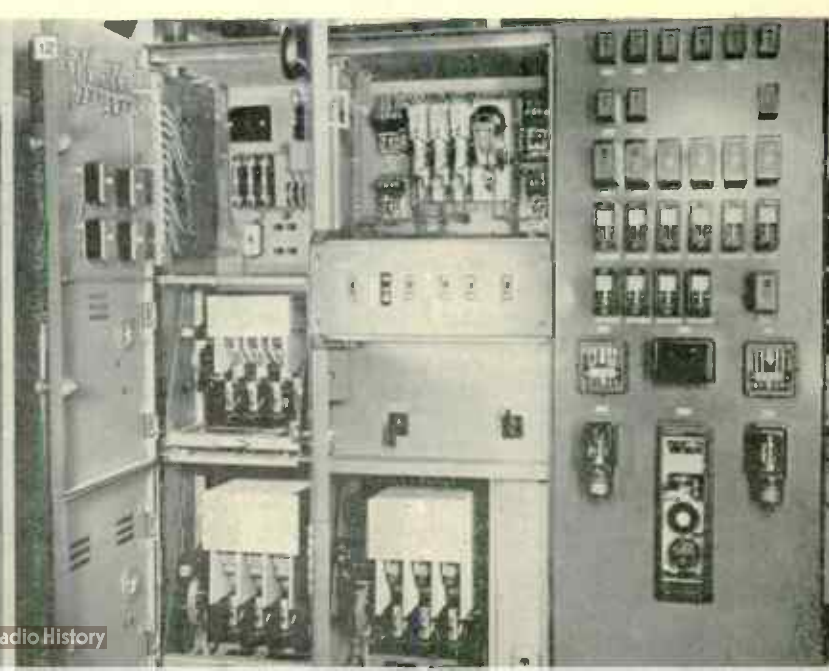


Fig. 9. Type 5592 output tube. Fig. 10. Driver sections. Fig. 11. View behind panel. Fig. 12. Control and distribution sections.





SPOT NEWS NOTES NOTES AND COMMENTS ABOUT SIGNIFICANT ACTIVITIES OF PEOPLE & COMPANIES

Unfair to AM Listeners: The only play-by-play report of the top-favorite Penn State-Penn football game aired in Washington was carried by WASH-FM. It was a special treat for FM listeners, but one feminine voice phoned the station to complain angrily: "It's just another one of those tricks the AM station people are using to make the public buy FM sets!"

Set for Volunteer Firemen: To meet the problem of party lines in rural areas, Motorola has brought out a home receiver for the use of volunteer firemen. Operating on 152 to 162 mc., the set is designed so that after a message is received the squelch noise is heard continuously until it is turned off manually. Selective calling permits calling any one or all the firemen.

For Custom Set-Builders: In line with their contributions to custom installations, Altec Lansing has announced an FM-AM tuner and an associated amplifier. FM section of the tuner employs a ratio detector. The AM end has a tuned RF circuit.

WMRI Marion, Indiana: Chronicle Publishing Company's FM station will be operating before Christmas with 34 kw. effective radiation on 106.9 mc. Guy B. Farnsworth is station manager, and Dane L. Ulrich is chief engineer.

E. E. Loucks: Former export manager of International G. E. in charge of radio receiver sales is now directing Zenith's new international division. Previously, Zenith export sales were handled by American Steel Export.

Stuart L. Bailey: Member of the consulting firm of Jansky and Bailey has been elected president of the Institute of Radio Engineers for 1949. Vice president is Arthur S. McDonald, chief engineer of the Overseas Telecommunication Commission, Sydney, Australia.

Our Apologies: If you have been in the habit of buying FM-TV Magazine from your local parts jobber, and couldn't get a copy of the October issue, it was probably our fault. An unprecedented number of subscriptions left us short of copies, with the result that we didn't have enough for all our orders. We can't fill any further orders by mail, because we haven't a single October copy left.

19-Hour FM Schedule: WCOP-FM Boston, an ABC affiliate, is on the air from 6:00 a. m. to 1:00 a. m. Effective radiation is 20 kw. on 100.7 mc., covering a radius of 65 miles from the transmitter site at Lexington. Chief engineer is Roland C. Hale.

AC TV Sets Operated on DC: A converter with accurate AC voltage and frequency regulation, designed to operate AC television sets from DC lines, is being produced by Carter Motor Company, 2641 Maplewood Avenue, Chicago 47. With DC input of 110 to 135 volts, the AC output of 125 watts gives perfect operation of sets with 7-in. picture tubes.

New FM Program Stunt: From Robert M. Beer, manager of WATG-FM Ashland, Ohio, we have learned of a new program idea. Round table discussions by students at Ashland and Cleveland are being aired simultaneously by both WATG-FM and Cleveland's educational FM station WBOE. That is, each transmitter is fed by a line from its own studio and by signals picked up from the other station. Tests indicate highly successful and interesting results without wire expense.

Microwave Communications: Australian Post Office Department has purchased RCA microwave equipment to supplement existing wire lines between Sydney and Goulburn. Apparatus will be manufactured by RCA Victor of Canada.

FM Audience in New York: Survey just released by WGYN shows 549,000 sets in use with upper-band FM tuning in the metropolitan New York City area. That exceeds the total number of lower-band FM sets manufactured before the war.

Kenneth W. Jarvis: Independent engineering consultant has been appointed to head Automatic Electric's new electronics department. This department will handle carrier and FM facilities for independent telephone companies and industrial, pipeline, and railroad organizations. Address is 332 S. Michigan Avenue, Chicago 4.

Gene Crow: Former member of the engineering staff at WBKB Chicago has been appointed chief engineer of the Meredith TV station now under construction at Syracuse.

50 Kw. at WMBI-FM Chicago: Moody Bible Institute, operating at 1-kw. FM station since 1943, now has 50 kw. radiated power on 95.5 mc. New antenna, designed by chief engineer A. P. Frye, employs 32 folded dipoles, Station is on the air from 8:00 a. m. to 9:00 p. m.

Railroad Radio: New York Central will install extensive FM communications systems for freight yards in Air Line Junction and Stanley Yard at Toledo, Mott Haven and 72nd Street Yard at New York City, and at Rochester, Buffalo, and Albany. Systems now operating at DeWitt Yard near Syracuse and Gardenville Yard near Buffalo will be expanded. This will add more than 100 mobile units for locomotives in the yards.

Organization Changes: Top-level realignment at Andrew Corporation, in preparation for expanded activities, puts C. Russell Cox in a newly-created position as director of sales and engineering, while Walter F. Kean is now sales manager, with John S. Brown as chief engineer.

FM Tape Service: Continental Network is now supplying programs to KSBR San Francisco. Transcriptions of live-talent shows are being made in Washington, D. C. on the Rangertone tape recorder. One-hour shows can be recorded on one spool. After editing, copies are made on a multiple machine and sent to affiliates by air express.

Receiver for 152 to 162 Mc.: Anticipating 60-kc. adjacent-channel operation for the mobile services, Communications Company, Coral Gables, Fla., has brought out an FM receiver for fixed-station use that has a selectivity rated at better than 80 db down at 60 kc. off resonance. Compactly designed, the complete receiver occupies only 5½ ins. on a standard 19-in. equipment rack.

More Transmitter Tubes: Under new plans just announced, Machlett Laboratories will take over the manufacture of some 30 types of Western Electric high-power transmitter tubes. Bell Laboratory designs and W. E. techniques will be employed in three-cornered collaboration. Machlett, one of the world's largest manufacturers of X-ray tubes, will install additional facilities for radio tube production at their plant in Springdale, Conn.

Spot Scanner TV Service: WCAU-TV Philadelphia is on the air 85 hours per week now, using news tape to augment regular programs. The tape passes across a test pattern to the accompaniment of recorded music. This is an inexpensive way to operate the TV transmitter. Also, the music entertains those who can't stop to look at the screen. WCAU-TV plans to sell time on this service.

NEWS PICTURES

LEFT: Slide projectors are essential equipment for TV stations. G. E. has designed this model PF-3-C unit for standard slides 3¼ by 4¼ ins., or 4-in. strips of any length. Dual sections, with dissolving action and iris control enable the operator to superimpose one image on another or to project them singly or simultaneously at any relative brightness.

Shreveport, Louisiana's second largest city, has replaced its old AM mobile system with 152-mc. Federal FM equipment. Commissioner of Public Safety A. B. Morris looks very happy about the results as he congratulates Capt. June Merrit, head of Shreveport's Traffic Division. This city first installed a 2,430-kc. AM system in 1935. Three years later, operation was shifted to 33.22 mc. on AM. New FM equipment includes a 250-watt headquarters transmitter with 40 mobile units for the police and fire departments and 4 for Water Department trucks.

Here is G. E.'s low-priced 10-watt FM broadcast transmitter for schools and colleges. Intended primarily to serve campus residents, actual coverage radius is 5 to 10 miles. Meeting all performance specifications for FM broadcasting, it can be used as a driver for a power amplifier.

RIGHT: Chassis assembly section at Philco's plant where model 1040 TV receivers are being produced. Steadily increased production has required a vast program of re-education for employees, and drastic changes in production facilities, inspection, and test equipment.

One feature of Western Electric's ultramodern plant now operating at Allentown, Pa. is the complete control of temperature, humidity, and dust, planned for manufacture and assembly of high-precision tubes and associated components. At the right, Klystron tubes are assembled in a chamber where there is a constant pressure of filtered air to keep dust particles away.

When the operator puts 7 pins and a glass tube on a mandrel of this machine, the tube is rotated and exposed to successively hotter flames until the glass is automatically formed into a tube-base button with the contact pins in exact position. This is just one of the super-super machines at the W. E. Allentown plant.

In step with the increased demand for high-quality, custom-built FM and phonograph installations, the 127-A Langevin amplifier was designed as a medium-price unit small enough to fit on a bookshelf. Output at 4 watts is rated at less than 5% total RMS distortion on 50 to 15,000 cycles.

DIRECTORY OF TV MARKETS

OFFICIAL FCC LIST, GROUPED TO SHOW STATIONS ON THE AIR, PERMITS GRANTED, AND APPLICATIONS FILED ON SEPTEMBER 29th, WHEN THE FREEZE ORDER WAS ISSUED.

BECAUSE television service areas delineate the markets for television receivers, the accompanying directory shows 1) the existing markets built up around stations now on the air, and 2) the potential markets where stations have been authorized by the issuance of construction permits.

We have no complete information at this time as to the status of stations for which CP's have been issued. Some are actually under construction. Some will be started as soon as equipment is delivered. Others are on the doubtful list, and the permittees may be waiting the outcome of the allocations freeze now in effect. If you want specific information on individual stations as to when they will be operating, the best thing to do is to write the general manager and ask him.

The third group in this directory shows applications now being held in the FCC's pending file, and applications on which hearings will be held. No action will be taken on these applications until the FCC investigation of interference is completed, and a new table of allocations has been finally approved. That will be some time the latter part of 1949.

TV STATIONS ON THE AIR

CALIFORNIA

		Ch.	V.Kw	A.Kw	Ft.
LOS ANGELES					
O Earle C. Anthony	KFI-TV	9	29.6	15.7	2420
O KMTR Radio Corp.	KLAC-TV	13	28.1	14.8	2955
O Paramount Tele.	KTLA	5	30	15	2921

CONNECTICUT

NEW HAVEN					
O Elm City Bcstg. Co.	WNHC-TV	6	1.8	1	510

DISTRICT OF COLUMBIA

WASHINGTON					
O Allen B. Du Mont	WTTG	5	6.2	2.5	45
O Evening Star Bcstg.	WMAL-TV	7	27.7	13.9	542
L Nat'l Bcstg. Co.	WNBW	4	20.5	10.5	330

GEORGIA

ATLANTA					
O Atlanta Journal	WSB-TV	8	21.6	11.4	515
O Liberty Bcstg. Co.	WAGA-TV	5	17.8	9.4	555

ILLINOIS

CHICAGO					
O Amer. Bcstg. System	WENR-TV	7	25	14	650
L Balaban & Katz	WBKB	4	1.8	1.8	390
O WGN, Inc.	WGN-TV	9	18.4	9.4	496

MARYLAND

BALTIMORE					
O A. S. Abell	WMAR-TV	2	17.1	17.1	397
O Hearst Radio	WBAL-TV	11	32.6	17.2	525

MASSACHUSETTS

BOSTON					
O Westinghouse Rad.	WBZ-TV	4	14.3	7.1	547
O Yankee Network	WNAC-TV	7	32.7	32.7	566

MICHIGAN

DETROIT					
O Even. News Assn.	WWJ-TV	4	17.1	17.7	588
O Fort Industry Co.	WTVO	2	16.5	8.3	485

MINNESOTA

ST. PAUL					
O KSTP, Inc.	KSTP-TV	5	24.7	17.3	560

MISSOURI

ST. LOUIS					
O Pulitzer Pub. Co.	KSD-TV	5	18.1	18.7	524

NEW JERSEY

NEWARK					
O Bremer Bcstg. Corp.	WATV	13	30.5	15.3	595

NEW YORK

BUFFALO					
O WBEN, Inc.	WBEN-TV	4	15	8	335
NEW YORK					
O American Bcstg. Co.	WJZ-TV	7	29.5	14.8	565
L Columb. Bcstg. Sys.	WCBS-TV	2	1.7	1.7	937
L Allen B. Du Mont	WABD	5	14.2	9.4	640
L Nat'l Bcstg. Co.	WNBT	4	7	5.7	1280
O WPIX, Inc.	WPIX	11	16.3	8.2	560
SCHENECTADY					
L Gen. Electric Co.	WRGB	4	40	21.3	761

OHIO

CINCINNATI					
O Crosley Bcstg.	WLWT	4	23.5	19.5	670
CLEVELAND					
O Scripps-How'd Rad.	WEWS	5	16.3	8.1	640
TOLEDO					
O Fort Industry Co.	WSPD-TV	13	27.4	14.4	524

PENNSYLVANIA

PHILADELPHIA					
O Phila. Inquirer	WFIL-TV	6	17.2	9.3	725
L Philco Television	WPTZ	3	2.7	2.8	340
O WCAU, Inc.	WCAU-TV	10	25	26.4	676

UTAH

SALT LAKE CITY					
O Intermountain Bcstg.	KDYL-TV	4	14.5	7	542

VIRGINIA

RICHMOND					
O Havens & Martin	WTVR	6	12.2	6.4	431

WISCONSIN

MILWAUKEE					
O The Journal Co.	WTMJ-TV	3	16.1	17	319

TV CONSTRUCTION PERMITS

ALABAMA

BIRMINGHAM					
CP Birm'ham Bcstg. Co.	WBRC-TV	4	14.5	7.7	500
CP Voice of Alabama	WAFM-TV	13	26	27.2	875

ARIZONA

PHOENIX					
CP Phoenix Television	KTLX	5	17.5	8.7	400

CALIFORNIA

LOS ANGELES					
CP American Bcstg. Co.	KECA-TV	7	29.8	14.8	3040
CP Nat'l Bcstg. Co.	KNBH	4	15	8	3130
CP Times-Mirror Co.	KTTV	11	31.5	16.6	2345
RIVERSIDE					
CP Bcstg. Corp. of Amer.	KARO	1	18	1	5132
SAN DIEGO					
CP Jack Gross Co.	KFMB-TV	8	20	20.2	710
SAN FRANCISCO					
CP Amer. Bcstg. Co.	KGO-TV	7	29.1	14.6	1260
CP Associated Bcstrs.	KPIX	5	29.9	15.4	540
CP Chronicle Pub. Co.	KRON-TV	4	18.2	19.2	2281
STOCKTON					
CP E. F. Peffer	KGDM-TV	8	1.9	1.8	337

DELAWARE

WILMINGTON					
CP WDEL, Inc.	WDEL-TV	7	1	.5	380

DISTRICT OF COLUMBIA

WASHINGTON					
CP Bamberger Bcstg.	WOIC	9	27.3	14.4	460

FLORIDA

JACKSONVILLE					
CP Florida Bcstg. Co.	WMBR-TV	4	14.8	7.4	430
MIAMI					
CP Southern Radio & Tele. Equip. Co.	WTVJ	4	1.6	.8	340
ST. PETERSBURG					
CP Sunshine Television	WSEE	7	26.2	13.1	385

GEORGIA

ATLANTA					
CP Const. Publ. Co.	WCON-TV	2	15.8	9.1	500

ILLINOIS

CHICAGO					
CP Nat'l Bcstg. Co.	WNBQ	5	21.8	11.8	595
PEORIA					
CP Peoria Bcstg. Co.	WMBD-TV	6	17.2	8.6	560
ROCK ISLAND					
CP Rock Island Bcstg.	WHBF-TV	4	13.6	7.6	400

INDIANA

BLOOMINGTON					
CP Sarkes Tarzian	WTTV	10	1	1	215
INDIANAPOLIS					
CP Wm. H. Block Co.	WUTV	3	14.4	7.6	331
CP WFBM, Inc.	WFBM-TV	6	28.2	18.1	400

IOWA

AMES					
CP Iowa State College	WOI-TV	4	13	10.4	506
DAVENPORT					
CP Central Bcstg. Co.	WOC-TV	5	22.9	22.9	350

KENTUCKY

LOUISVILLE					
CP WAVE, Inc.	WAVE-TV	5	16.6	10	355
CP WHAS, Inc.	WHAS-TV	9	9.6	7.2	529

LOUISIANA

NEW ORLEANS					
CP Maison Blanche Co.	WRTV	4	14.5	7.6	380
CP Stephens Bcstg. Co.	WDSU-TV	6	19	9.5	450
CP Times-Picayune	WTPS-TV	7	21.5	18	575

MARYLAND

BALTIMORE					
CP Radio-Tele. Co.	WAAM	13	31.6	20	410

MASSACHUSETTS

BOSTON					
CP Raytheon Mfg. Co.	WRTB	2	50	30.7	373

MICHIGAN

DETROIT					
CP WXYZ, Inc.	WXYZ-TV	7	32.1	16.7	485
GRAND RAPIDS					
CP Leonard Versluis	WLAV-TV	7	19.7	9.9	550
KALAMAZOO					
CP Fetzer Bcstg. Co.	WKZO-TV	3	15.7	7.9	360
LANSING					
CP WJIM, Inc.	WJIM-TV	6	20.6	10.3	420

MINNESOTA

MINNEAPOLIS					
CP Minn. Bcstg. Co.	WTCN-TV	4	17.9	9.2	490
CP N'west Bcstg. Co.	KTRV	9	20.5	15.5	700

MISSOURI

KANSAS CITY					
CP Kansas City Star	WDAF-TV	4	17	14	745

NEBRASKA

OMAHA					
CP May Bcstg. Co.	KEYT	3	17.8	8.9	510
CP Radio Sta. WOW	WOW-TV	6	16.2	8.5	590

NEW MEXICO

ALBUQUERQUE					
CP Albuquerque Bcstg.	KOB-TV	4	4.5	4.5	48

NEW YORK

BINGHAMTON					
CP Clark Associates	WNBF-TV	12	12	8.5	855
NEW YORK					
CP Bamberger Bcstg.	WOR-TV	9	9.5	11	940
ROCHESTER					
CP Stromberg-Carlson	WHTM	6	16.7	8.7	505
SYRACUSE					
CP Meredith Pub. Co.	WJTV	8	15	7.5	810
CP Radio Projects	WTTE	5	23	12.8	680
CP WAGE, Inc.	WAGE-TV	10	30	15	470
UTICA					
CP Copper City Bcstg.	WKAL-TV	13	13	11.3	830
CP Utica Observer	WVTL	3	15.5	7.5	805

NORTH CAROLINA

CHARLOTTE					
CP Jefferson Standard	WBT-TV	3	15.2	8	1160
GREENSBORO					
CP Greensboro News	WTLE	2	1.7	.8	470

OHIO

CINCINNATI					
CP Radio Cincinnati	WKRC-TV	11	23	12	640
CP Scripps-Howard Ra.	WCPO-TV	7	21	12	695
CLEVELAND					
CP Empire Coil Co.	WXEL	9	21	13	725
CP Nat'l Bcstg. Co.	WNBK	4	18.8	9.6	585
COLUMBUS					
CP Crosley Bcstg. Co.	WLWC	3	15.2	12.8	882
CP Picture Waves	WTVN	6	14.3	9	363
CP TV, Inc.	WBNT	10	28.4	14.2	485
DAYTON					
CP Crosley Bcstg. Co.	WLWD	5	50	25	506
CP Miami Valley Bcstg.	WHIO-TV	13	24	25.2	570

OKLAHOMA

OKLAHOMA CITY						
CP	WKY Radiophone	WKY-TV	4	12.1	6.2	940
TULSA						
CP	Geo. E. Cameron, Jr.		6	16.6	8.5	625

OREGON

PORTLAND						
CP	Video Bcstg. Co.	KTVU	3	15.5	9	865

PENNSYLVANIA

ERIE						
CP	Dispatch, Inc.	WICU	12	3	1.5	165
JOHNSTOWN						
CP	WJAC, Inc.	WJAC-TV	13	6.5	7	1100
LANCASTER						
CP	WGAL, Inc.	WGAL-TV	4	1	.9	260
PITTSBURGH						
CP	Allen B. Du Mont	WDTV	3	14.6	7.3	8.8

RHODE ISLAND

PROVIDENCE						
CP	The Outlet Co.	WJAR-TV	11	30	15	615

TENNESSEE

MEMPHIS						
CP	Memphis Pub. Co.	WMCT	4	13.6	7.1	650
NASHVILLE						
CP	WSM, Inc.	WSM-TV	4	14.4	7.2	755

TEXAS

DALLAS						
CP	KRLD Radio Corp.	KRLD-TV	4	46	TBD	519
CP	Lacy-Potter Tele.	KBTV	8	35	18.5	489
FORT WORTH						
CP	Carter Pub.	WBAP-TV	5	17.6	8.2	490
HOUSTON						
CP	W. Albert Lee	KLEE-TV	2	16	8.5	500
SAN ANTONIO						
CP	San Antonio Tele.	KEYL	5	17.9	9	440
CP	Southland Industries	WOAI-TV	4	21.6	10.8	480

UTAH

SALT LAKE CITY						
CP	Radio Service	KSL-TV	5	18.4	9.2	436

WASHINGTON

SEATTLE						
CP	Radio Sales Corp.	KRSC-TV	5	18.9	9.8	408

WEST VIRGINIA

HUNTINGTON						
CP	WSAZ, Inc.	WSAZ-TV	5	18.2	9.1	500

TV APPLICANTS

ALABAMA

BIRMINGHAM					
A	Birmingham News	9	25.8	12.8	911

ARKANSAS

LITTLE ROCK					
A	Mid-South Tele. Co.	10	3.1	1.6	399
A	Southwestern Pub. Co.	8	2.5	1.3	540

ARIZONA

PHOENIX					
A	KTAR Bcstg. Co.	4	15.3	7.6	294

CALIFORNIA

BAKERSFIELD					
A	Paul R. Bartlett	8	2.5	1.2	283
A	Mrs. Pearl Lemert	10	1	1	441
FRESNO					
A-H	California Inland Bcstg. Co.	5	17.1	9	1931
A-H	Danroy Bcstg. Co.	4	15	7.5	218
A-H	KARM, Geo. Harm Station	7	20	10.6	358
A-H	Edward Lasker	7	30	15	1183
A-H	McClatchey Bcstg. Co.	7	26.9	13.4	317
A-H	Tele. Fresno	2	14.2	7.1	512
LOS ANGELES					
A-H	Don Lee Bcstg. Co. W6XAO	2 (Exp. Station)			
OAKLAND					
A-H	KROW, Inc.	11	28.2	14.8	275
SACRAMENTO					
A-H	Central Valleys Bcstg. Co.	6	25.9	12.9	365
A-H	HARMCO, Inc.	3	17	8.5	415
A-H	McClatchy Bcstg. Co.	10	29.3	14.6	263
A-H	Sacramento Bcstrs.	6	15	7.5	350
A-H	M. R. Schacker	6	1.5	750w	282
SAN DIEGO					
A-H	Airfan Radio Corp.	10	19.8	10.4	436
A-H	Balboa Bcstg. Co.	3	18	9.5	747
A-H	Don Lee Bcstg. Co.	6	20	10	645
A-H	McKinnon Pub., Inc.	6	19.8	10	500
A-H	Television Bcstg. Co.	10	2.7	1.3	669
A-H	San Diego Bcstg. Co.	10	20	10	743
A-H	Video Bcstg. Co.	3	18	9.4	803
A-H	Leland Holzer	10	30	15	2066
SAN FRANCISCO					
A-H	Columbia Bcstg. System	9	31.4	15.7	1306
A-H	Don Lee Bcstg. Co.	2	32.5	16.2	2371
A-H	Paramount Television	9	30.5	15.3	2523
A-H	Tele. California	11	31.3	15.7	1235
A-H	20th Century-Fox	11	28.2	14.9	2378
SAN JOSE					
A-H	F.M. Radio & Television	13	33.2	16.6	2263
A-H	Radio Diablo	13	250w	250w	3098
A-H	Video Bcstg. Co.	13	35.3	18.6	2068

SAN LUIS OBISPO					
A	The Valley Electric Co.	3	1.7	870w	773
SANTA BARBARA					
A	M. R. Schacker	6	1.5	750w	260

COLORADO

DENVER					
A-H	Alladin Television	9	31.6	15.8	922
A-H	Daniels & Fisher Stores	4	16.3	8.4	147
A-H	KLZ Bcstg. Co.	7	23	11.5	350
A-H	KMYR Bcstg. Co.	4	29.6	14.8	403
A-H	Landon Tele. Bcstg. Co.	5	16.9	8.5	370
A	Edward Lasker	2	15	7.5	217
A	Gifford Phillips	9	27.9	13.9	314
A-H	Denver Television Co.	2	25.8	12.9	511

CONNECTICUT

BRIDGEPORT					
A	Yankee Network	10	38.2	19.1	637
HARTFORD					
A-H	Conn. Bcstg. Co.	10	20	11.1	740
A-H	Hartford Times	10	29.1	29.1	833
A-H	Travelers Bcstg. Service	10	15	11.6	802
WATERBURY					
A-H	Nutmeg State Bcstg. Co.	12	27	14.7	790
A-H	Conn. Radio Foundation	12	29.6	14.8	500

FLORIDA

JACKSONVILLE					
A	City of Jacksonville	2	15	7.5	501
A	Jacksonville Bcstg. Co.	6	19.4	10	298
A	Metropolis Bcstg. Co.	8	25.1	13.2	381
MIAMI					
A-H	Fort Industry Co.	7	18.6	9.8	436
A-H	Isle of Dreams Bcstg. Corp.	5	23.9	12.6	318
A-H	Miami-Hollywood Tele. Co.	7	17.1	12.2	502
A-H	Miami Bcstg. Co.	5	16.2		328
MIAMI BEACH					
A-H	A. Frank Katzentine	7	18	19.6	741
A	WKAT, Inc.	7	18.6	9.8	742
ORLANDO					
A	Orlando Daily Newspapers	3	14.3	7.4	534
A	Sunshine Television Corp.	10	3.1	1.6	240
ST. PETERSBURG					
A	Pinellas Bcstg. Co.	5	16.8	8.6	417
TAMPA					
A	Gulf Theatres	2	15	7.5	540
A	Tampa Times	4	22.5	11.2	497
A	The Tribune Co.	9	25.8	12.9	511

GEORGIA

ATLANTA					
A-H	University of Ga.	11	25.3	12.6	428
A-H	E. D. Rivers, Jr.	8	27.2	14.3	500
A-H	General Bcstg. Co.	11	36.8	36.8	388
MACON					
A	Southeastern Bcstg. Co.	7	3.1	1.5	214

ILLINOIS

CHICAGO					
A-H	Columbia Bcstg. System	11	21	22.2	553
A-H	Johnson-Kennedy Radio	2	16.5	8.5	520
A-H	Sun & Times Co.	13	37.5	31.8	562
A-H	Warner Bros.	13	31	15.5	631
A-H	Zenith Radio Corp.	2	15	7.5	566
PEORIA					
A	West Central Bcstg. Co.	12	29	14.5	393
QUINCY					
A	Lee Bcstg., Inc.	11	23.6	12.4	934
ROCKFORD					
A	Rockford Bcstrs., Inc.	12	30.1	15.9	155

INDIANA

FORT WAYNE					
A	Northeastern Ind. Bcstg.	4	16	8	338
A	Farnsworth Tele. & Radio	4	16	10	280
INDIANAPOLIS					
A-H	Crosley Bcstg. Co.	12	33.4	28.2	426
A-H	Indiana Bcstg. Corp.	12	27.8	13.9	498
A-H	Indianapolis Bcstg., Inc.	8	27.8	13.9	415
A-H	Universal Bcstg. Co.	8	24.1	12.9	440
SOUTH BEND					
A	South Bend Tribune	13	27.7	13.8	561

IOWA

CEDAR RAPIDS					
A	The Gazette Co.	7	22.1	11.6	332
DAVENPORT					
A	Davenport Bcstg. Co.	2	1.6	813w	236
DES MOINES					
A-H	Central Bcstg. Co.	12	16.5	8.2	100
A-H	Cowles Bcstg. Co.	9	25.5	12.7	1665
A-H	Independent Bcstg. Co.	5	23.9	12.6	379
A-H	Murphy Bcstg. Co.	2	16.9	8.4	497
A-H	Tri-State Meredith Bcstg.	2	16.8	8.4	497
IOWA CITY					
A	State Univ. of Iowa	11	32.6	16.1	169

KANSAS

TOPEKA					
A	Midland Bcstg. Co.	7	950w	425w	187
A	Topeka Bcstg. Assn., Inc.	7	21.1	10.6	319
WICHITA					
A	Okkan Tele. Chain, Inc.	4	5	2.5	500

LOUISIANA

BATON ROUGE					
A	Baton Rouge Bcstg. Co.	9	26.9	13.9	416
NEW ORLEANS					
A-H	Loyola University	10	29.3	15.6	350
A-H	New Orleans Tele. Co.	2	29.3	15.6	350
A-H	Mississippi Valley Bcstg.	10	31.7	16	376
SHREVEPORT					
A	Mid-South Tele. & Bcstg. Co.	6	18.3	9.1	522
A	International Bcstg. Co.	8	24	13	600
A	Shreveport Tele. Co.	8	26.4	13.2	494
A	Fairfield Manor Tele. Co.	11	18.2	9.1	514
A	Radio Station KTBS	4	14.2	7.7	500

MAINE

PORTLAND					
A-H	Congress Square Hotel	11	30.5	15.2	500
A-H	Guy Gannett Bcstg. Svcs.	8	27.5	13.7	525
A-H	Oliver Bcstg. Corp.	8	29.3	15.4	327

MARYLAND

CUMBERLAND					
A	Tower Realty Co.	2	1	500w	410
HAGERSTOWN					
A	Hagerstown Bcstg. Co.	6	767w	384w	1308

MASSACHUSETTS

BOSTON					
A-H	Boston Metropolitan Tele. Co.	9	27.5	14.5	500
A-H	Columbia Bcstg. System	9	26	27.4	504
A-H	Mass. Bcstg. Corp.	9	20	10	546
A-H	Matheson Radio Co.	13	29	19	493
A-H	New England Tele. Co.	13	22	15.7	540
A-H	New England Theatres, Inc.	13	6	2	402
A-H	20th Century-Fox New England	13	32.2	16.2	454
FALL RIVER					
A-H	Fall River Herald	8	1	500w	459
A-H	New England Tele. Co.	8	3	1.4	581
HOLYOKE					
A	Hampden-Hampshire Corp.	3	8.5	4.2	1005
LAWRENCE					
A-H	Hildreth & Rogers Co.	6	15.2	7.8	565
LOWELL					
A-H	Lowell Sun	6	16.2	8.4	631
NEW BEDFORD					
A-H	E. Anthony & Sons	1	1	798w	500
SPRINGFIELD					
A-H	New England Tele. Co.	3	18	9	503
A-H	Yankee Network	3	18.9	10.1	541
WORCESTER					
A-H	New England Tele. Co.	5	18	9	503
A-H	WTAG, Inc.	5	16.9	8.4	693

MICHIGAN

DETROIT					
A-H	United Detroit Theatres	5	16.4	8.3	293
A-H	WJR, Inc.	5	17.8	8.9	530
FLINT					
A-H	Advertisers Press, Inc.	11	2.9	1.5	205
A-H	Booth Radio Stations, Inc.	11	2.8	1.4	347
GRAND RAPIDS					
A	Furniture City Bcstg. Corp.	9	21.6	15.4	420
A	Grandwood Bcstg. Co.	9	25.9	20.7	486
SAGINAW					
A	Saginaw Bcstg. Co.	13	2.3	1.3	389

MINNESOTA

MINNEAPOLIS					
A	Beck Studios, Inc.	7	18	9	500
A	Ind. Merchants Bcstg. Co.	7	25	13	397
ST. PAUL					
A-H	WMIN Bcstg. Co.	2	13.7	6.8	406

MISSISSIPPI

JACKSON					
A	Mid-South Tele. Bcstg. Co.	7	20.2	14.4	408

MISSOURI

CLAYTON					
A-H	Evan. Lutheran Synod	2	980w	639w	533
KANSAS CITY					
A-H	KCKN Bcstg. Co.	2	15.4	7.7	561
A-H	KCMO Bcstg. Co.	5	18.1	18.1	407
A-H	New England Tele. Co.	5	20	10	552
A-H	20th Century Fox of Mo.	9	27.5	13.7	503
A-H	WHB Bcstg. Co.	5	18	10	497
A-H	Midland Bcstg. Co.	9	20.8	10.4	491
ST. JOSEPH					
A-H	KFEQ, Inc.	13	2.3	1.2	613
A-H	Midland Bcstg. Co.	13	3.1	1.5	303
ST. LOUIS					
A-H	Globe Democrat Pub. Co.	13	31.5	15.8	555
A-H	New England Tele. Co.	4	20	10	554
A-H	Thos. Patrick, Inc.	9	29.6	15.6	595
A-H	St. Louis University	7	22.2	15.4	586
A-H	Star-Times Pub. Co.	4	14.2	7.1	500

NEBRASKA

OMAHA					
A-H	Central States Bcstg. Co.	7	26.2	13.1	578
A-H	KFAB Bcstg. Co.	7	24.4	12.7	415

NEW HAMPSHIRE

MANCHESTER					
A	Grandview, Inc.	12	10	5	955
PORTSMOUTH					
A	WHEB, Inc.	5	27.5	14.5	172

(Continued on page 48)

One Equipment Source for

RCA FM BROADCAST EQUIPMENT

READY TO SHIP

RCA's 250-WATT FM TRANSMITTER

Type BTF-250-A

Completely self-contained, this pace-setting 250-watt FM transmitter offers low-power stations the easy way to get on the air immediately with true FM quality. It includes RCA's "Direct FM" system using only 16 inexpensive tubes (about half the number used in many exciters)—with only 7 tubes in the r-f chain. All r-f circuits are single-ended. Multi-unit construction permits easy addition of higher power units later on. The BTF-250-A is the ideal standby for higher-power FM stations.

READY TO SHIP

RCA's 3-KW FM TRANSMITTER

Type BTF-3B

The BTF-3B is designed and built strictly for professional transmitter engineers who know transmitters. It uses only 36 tubes (15 regulator and voltage control tubes do not contribute to outages) and employs RCA's simple, straightforward "Direct FM" type exciter. The driver and final are "Grounded-Grid" for easy tuning and maximum stability. Shielded final tank circuit reduces housing radiation and r-f pick-up in nearby a-f circuits. Single-ended output provides greater stability and easier matching. Every component is easy to reach. Unit-type design makes for easy installation and simple modification to higher power. All air-cooled and self-contained. Can be tuned by inexperienced personnel in minutes.

READY TO SHIP

RCA's 1-KW FM TRANSMITTER

Type BTF-1-C

Here is a self-contained 1-kw transmitter with a "Direct FM" exciter inherently capable of lower noise and distortion than any exciter yet developed. No fussy, complicated circuits. No trick tubes. Only 8 tubes in the r-f chain. Grounded-Grid circuits in the final amplifier provide greater stability than conventional amplifiers—require no neutralizing. The shielded tank circuit of the final amplifier provides near-perfect shielding. Output is single-ended for maximum stability. Unit-type design provides easy installation, flexibility, and simple modification for higher power. Type BTF-1-C is all air-cooled.

Everything in the FM Station

...RCA

IMMEDIATE DELIVERY FROM STOCK

• Continuing its active production of FM equipment, RCA today is manufacturing the most complete line of well-engineered FM station equipment in the industry—*and is stocking it.* Nothing in your station "specs" that RCA cannot supply. Nothing in the transmitter equipment line that RCA cannot ship promptly.

Who are RCA's best references?

The station men of the nation's leading FM stations. These are the men who like the practical engineering that goes into each piece of RCA FM equipment. They like the completeness of the RCA FM line—with one manufacturing source for everything they need in the station. They like the undivided responsibility RCA assumes for its equipment. They like the prompt delivery RCA gives them on every item on the list.

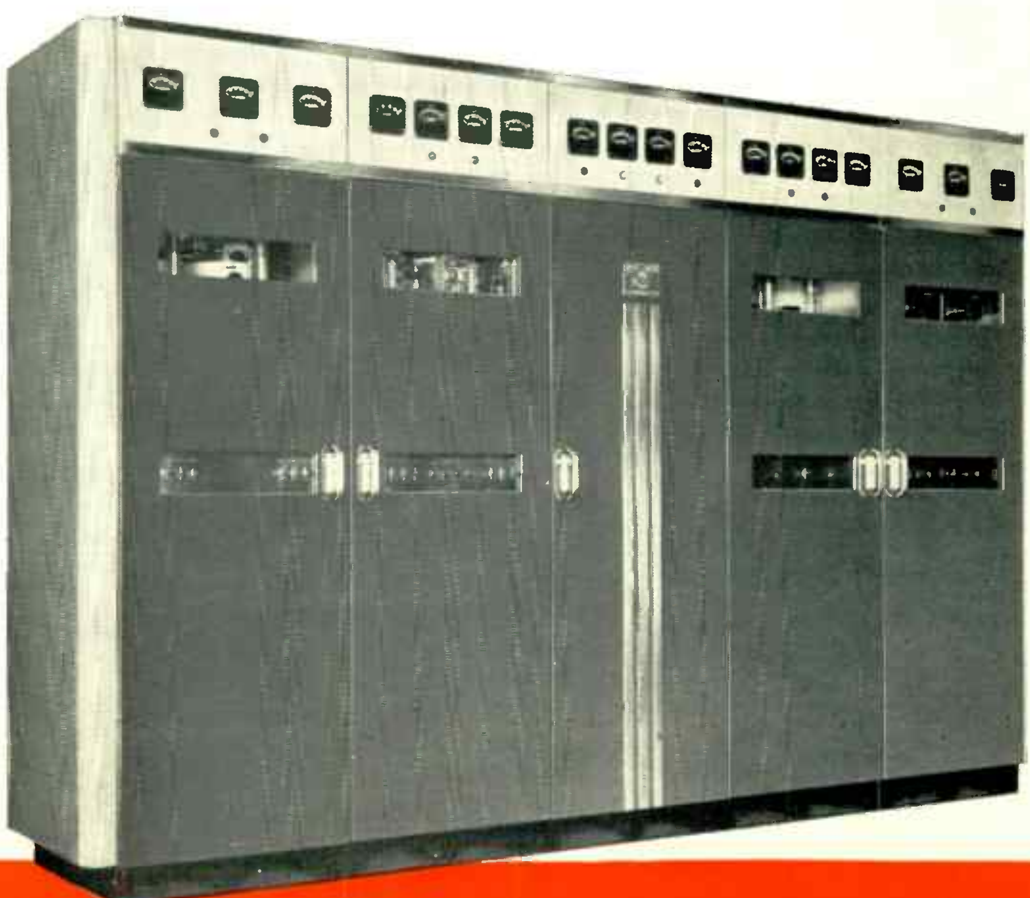
Call your RCA Broadcast Sales Engineer for information and help. He's an FM specialist. Or write Dept. **38 L,** RCA Engineering Products, Camden, N. J.

RCA's 10-KW FM TRANSMITTER

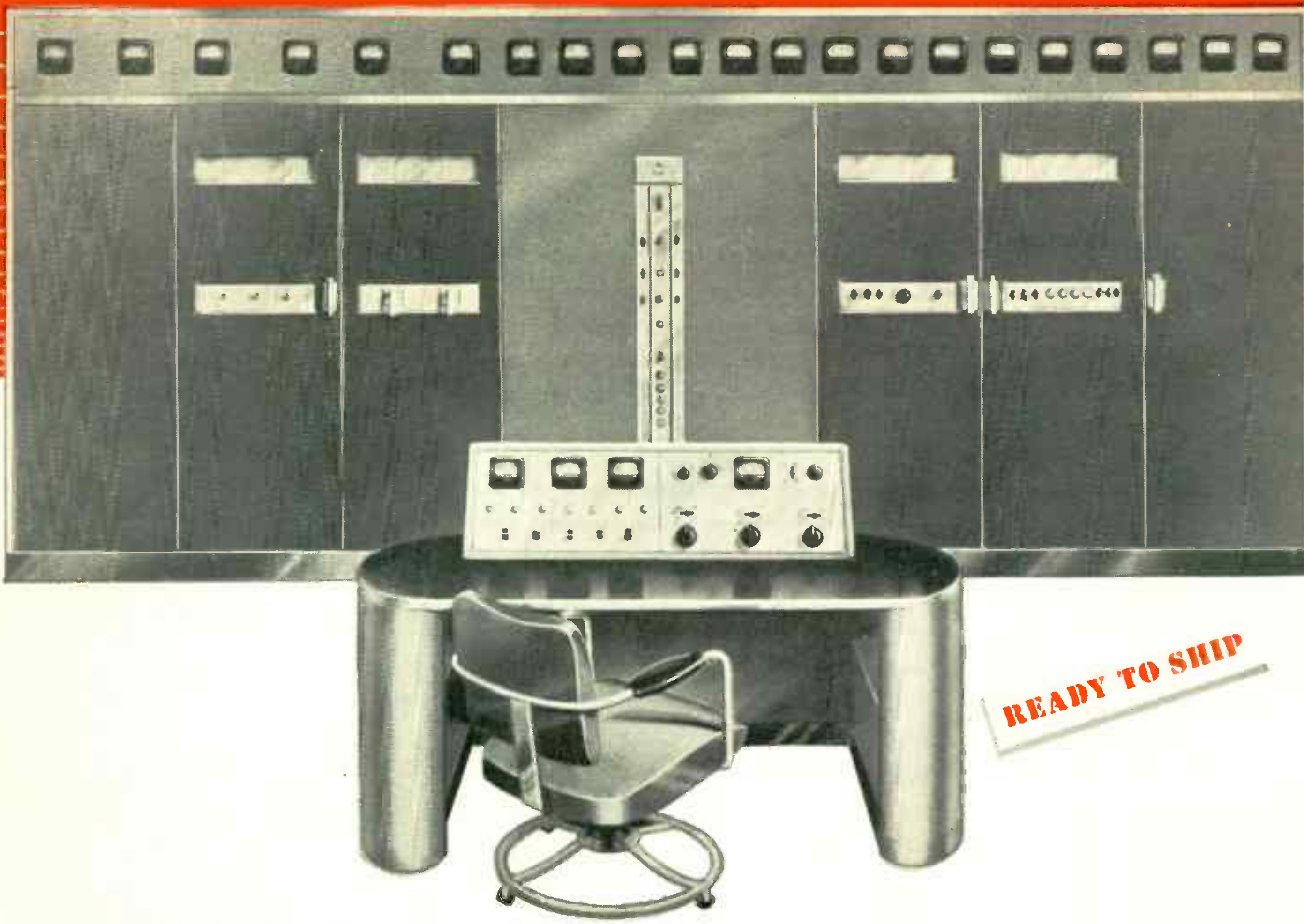
Type BTF-10B

Outstanding for its low running costs, *this 10-kw FM transmitter takes only 22.5 kw to run it.* Grounded-Grid circuits in both drivers and in the final permit the use of small power triodes (7C24's) in all three stages. RCA's "Direct FM" system is used, as in all RCA FM transmitters. All r-f stages are single-ended. High-power stages are motor-tuned. Carrier returns instantaneously after momentary power failure. Only 39 tubes, total, in the entire transmitter (only 23 of these are required for emergency operation). Only 14 different tube types to stock. All air-cooled, the entire transmitter is designed with just *one* high-voltage power supply. Possible savings in running costs of the BTF-10B *—up to $1500 a year!*

READY TO SHIP



...FM Transmitters, FM Antennas



READY TO SHIP

RCA's 50-KW FM TRANSMITTER

Type BTF-50A. One of the easiest-handling high-power transmitters ever designed . . . and as reliable as a powerhouse. Grounded-Grid amplifiers and simplified single-end r-f circuits (class C) insure highly stable operation and easy tuning. Direct FM produces high-fidelity frequency modulation simply and directly (less than 1% output distortion 30-15,000 cps). Total tube complement, 42 tubes. Of these, only 26 can seriously affect the carrier. *Number of different tube types, only 14. One* high-voltage power supply for the entire transmitter.

Type BTF-50A is built for true walk-in. Its unified front-panel design is functionally styled to fit any station layout—makes it economical to set up. Here is the 50-kw FM transmitter that is completely air-cooled—with two blowers operating independently to assure maximum program continuity.

READY TO SHIP

RCA STUDIO CONSOLETTE

Type 76-B5

Latest in the series of RCA Consolettes is the 76-B5. This type performs all the amplifying, monitoring, and control functions of most large and small stations—AM and FM. It has full facilities for simultaneous auditioning and broadcasting for practically any combination of studios, turntables, or remote lines.

— Station Accessories

RCA's Duo-Cone Speaker Type LC-1A

Expressly designed for monitoring FM programs and high-fidelity recordings, this revolutionary new two-cone speaker provides true FM response throughout the range 50 to 15,000 cps! It is free from resonant peaks, harmonics, and transient distortion at all usual volume levels. Cross-over response is remarkably smooth. Controlled "roll-off" is provided for 5 and 10 kc. *Room location of the LC-1A is non-critical.*

The RCA Duo-Cone Speaker is available in three bass-reflex cabinets; finished in two-tone gray, dark walnut, and light mahogany.

RCA PYLON ANTENNAS FOR EVERY FM STATION

Today, RCA FM Pylons are by far the most popular radiators in the nation's FM broadcast stations. They are easy to erect, completely self-supporting, and can be mounted anywhere. RCA Pylons assure you maximum radiation. For example, an 8-section Pylon operated in conjunction with a 50-kw FM transmitter can *deliver an effective radiated power of over 600 kw!*

RCA Isolation Unit

Type BAF-4B

For AM broadcasters who wish to install an RCA FM Pylon atop their present AM tower, and operate AM and FM simultaneously, this unique unit provides complete and efficient isolation of FM and AM signals. Mounts at the base of an insulated broadcast tower.

Data for RCA Pylon Antennas

Standard Pylon. This antenna is designed to meet the requirements of all FM Stations . . . handles up to 50 kw of power. The Standard combines maximum strength and rigidity with minimum weight.

Heavy-Duty Pylon. This is the only FM antenna designed to support the RCA Super-turnstile Television antenna. The Heavy-Duty Pylon is built for locations where winds of hurricane force prevail. It is designed to withstand wind velocities of more than 160 mph when used for FM service alone.

Low-Power Pylon. Here is the ideal low-cost antenna for interim operation and stand-by service. It has the same high gain as other two models, but is available only as a single-section antenna. The Low-Power Pylon handles up to 3 kw.

Type No.	Nominal Power Gain	Sections	Over-all Height (ft.)	Weight (lbs.)
BF-11A/B	1.5	1	13.5	350
BF-12A/B	3.0	2	27	700
BF-14A/B	6.0	4	54	2000
BF-18A/B	12.0	8	108	12497
	HEAVY-DUTY PYLONS			
BF-12E/F	3.0	2	27	4322
BF-14C/D	6.0	4	54	10497
	LOW-POWER PYLONS			
BF-21A/B	1.5	1	13.9	376

FACTS FOR TELEVISION PLANNING

THIS CLEAN-CUT SUMMARY EXPLAINS FACTORS WHICH MUST BE CONSIDERED BY ALL THOSE WHO PLAN TO STEP UP THEIR PROMOTION OF TV SETS—*By* CHARLES PUMPIAN*

THE very rapid growth of television during the first nine months of 1948 indicates that it is only a matter of time before TV becomes a basic and primary advertising medium. Already, in the New York area, some TV advertisers are now reporting greater results per dollar expended for television than in audio broadcasting.

Growth of the TV Audience:

The score as of October 1, 1948 shows greater comparable progress than AM radio experienced in the same period of time. There are now 37 stations operated in 21 market areas. Eighty-seven additional stations have construction permits and are in various stages of building. In addition, there are 303 applications pending with the FCC.

From the standpoint of receiving sets, and this is of prime importance to advertisers, because they invest their advertising dollars to buy circulation coverage, the estimates compiled by RMA show 542,563 sets in use in 19 markets as of October 1:

New York	300,000	St. Louis	9,200
Phila.	62,000	Milwaukee	5,208
Los Angeles	35,000	St. P.-Minn.	4,500
Chicago	31,000	Cincinnati	5,000
Wash.	16,600	Buffalo	4,000
Baltimore	18,530	New Haven	8,000
Boston	12,800	Richmond	3,285
Detroit	12,300	Schenectady	4,500
Clev.-Akron	8,390	S. L. City	750
Toledo	1,500		

Demand for sets is far greater than industry's capacity to meet it, caused primarily by parts shortages. However, this bottleneck is rapidly being eliminated. Philco, with a production of 4,000 sets per week, expects to hit 8,000 by the end of the year, has a production goal of over 10,000 per week in 1949. This company reports that by the end of the year their dollar volume on TV set production will be greater than their AM radio volume.

General Electric predicts a 1949 TV set and equipment volume for the industry of $330,000,000 (at the factory). They estimate that 70% of their radio-television dollar volume in 1949 will come from the sales of its television division.

Here is the present record of TV set ownership, and estimates for the future: 1947—179,000 sets were in use. 1948—870,000 sets anticipated in use by end of year. 1949— 2,500,000 (*Billboard* estimate) 1953—11,500,000 (NBC estimate).

It should be borne in mind that TV set ownership will probably never equal that of AM radio because of auto radios, cheap AM sets, and multiple AM sets in homes, yet the increased number of viewers per set, plus the intensity of viewing will offset AM radio's numerical advantage from an advertising standpoint. For example, Texaco Star Theatre had a sponsor identification of 95.2%

Charles Pumpian: "Here is the TV situation as we see it from the agency view."

in August, a rating never reached by any program in the history of AM. That is why advertisers should be getting in on the ground floor in what we believe is going to be, in a relatively short time, one of the most effective advertising mediums available for many manufacturers.

Support by Sponsors:

The number of advertisers using television has increased substantially since one year ago. For example, *Television Magazine* reports that during August 462 advertisers sponsored programs or spot announcements over 30 TV stations, an increase of 501% over the same month of 1947. In addition, there are some 30 new advertisers currently starting schedules. This includes such advertisers as Royal Typewriter, Van Heusen shirts, Chesterfield cigarettes, Disney hats, Wrigley gum, and others.

The advertisers now using television indicate the wide product appeal of this type of advertising. Thus the 462 advertisers during August included the following businesses: automotive manufacturers, automotive dealers, motor oil and fuel, tires, banks, insurance and loan companies, building materials, cigarettes, men's, women's and children's apparel, watch companies, foods, beer, wine and soft drinks, home appliances and housewares, toilet and drug products, and retail outlets.

Impact on the Audience:

A number of important basic conditions are being revealed about television from the standpoint of its impact on viewers and on their habits. For example, surveys indicate that video set owners stay home more, have more people in, and attend movies less than audio set owners. Owners report that TV is more interesting to them than AM radio, that TV is strong as child entertainment. They report that TV commercials are more pleasing to them than AM radio, that they are more conscious of them, and that they remember sponsors and products more easily and longer. Because of the universal appeal of TV, set ownership is increasingly concentrating in the mass market. TV is not a class medium even at this stage of its development. TV means much as an entertainment medium to the great masses. According to *Time Magazine:* "TV will change the American way of life more than anything since the model T."

The Hazards of Broadcasting:

Television has some serious problems in its industry efforts to develop rapidly. Primarily, the medium is being handicapped by over-enthusiastic promises and hopes of those in the business. Television has generally taken as its directive the famous wartime motto: "We do the difficult today, the impossible takes a little longer."[1] The medium is going through its growing pains.

The networks and TV stations are continuing to lose money. According to Niles Trammel, president of NBC, TV is not and will not be profitable to the stations and networks for maybe six years because of the heavy investments in equipment and the cost of programming which cannot be absorbed quickly in advertising rates. Niles Trammel observed recently that NBC will lose $3,500,000 in 1948 and $4,500,000 in 1949. They expect to break even in 1950. The American Broadcasting Company has recently floated a $9,000,000 common stock issue, the proceeds of which will mainly go to support their television operations.

(*Continued on page 46*)

* Director of Media, Henri, Hurst & McDonald, Inc., 520 North Michigan Avenue, Chicago 11, Ill.

[1] Generally credited to Fred M. Link, president of Link Radio Corporation.

STEPPING-SWITCH OPERATION

PART 2: FOUR BASIC TYPES OF STEPPING-SWITCH CIRCUITS ARE EXPLAINED IN DETAIL, AND PRACTICAL EXAMPLES OF APPLICATION ARE SHOWN — *By* T. L. SIPP*

WHILE there are many operating circuits possible with stepping switches and relays, four will be described because they illustrate practical circuit arrangements which meet general remote control requirements. The form in which the circuits are drawn is borrowed from the telephone industry. Each relay is shown by indicating its coil and associated contacts in vertical alignment. Whenever possible, one side of each relay coil winding is connected to one side of the voltage source. This allows all switching by the contacts to be made from a common potential level. No reference is made in the schematics to a specific voltage for the DC source. This is not critical but, when a choice of voltage is available, preference is generally given to 48 volts as being the optimum for speed of operation without excessive arcing of relay contacts.

Basic Direct-Drive Circuit:

Fig. 4 illustrates one type of circuit using direct-drive switch capable of controlling 10 functions, or closing and opening 5 auxiliary controlled circuits. In addition to the stepping switch, this circuit requires two fast-action relays A and C, two slow-to-release relays B and D, and five auxiliary relays E, of which only one is shown. Operation is initiated by closing the switch SW, which causes the pulsing relay A to operate through the medium of impulse transmission from the normally-closed impulsing contacts of the dial. Relay B is also operated by contacts 2 & 3 of A. The dial, upon restoring, will interrupt the circuit to A, which releases and operates in accordance with the number of interruptions determined by the digit dialed. B, being slow to release, remains operated despite the intermittent opening of its circuit at contacts 2 & 3 of A. During the first interruption by the dial, an impulse is applied to the rotary magnet ROT., and the coil of relay D, via 1 & 2 of A, 2 & 3 of B, and 1 & 2 of C. At this time, slow-to-release relay D operates and the switch advances one step. D, in operating, opens the wiper circuit at its contacts 1 & 2 and closes a circuit to C. C operates and is held operated through its contacts 3 & 4. and 4 & 5 of B. The second and succeeding interruptions cause the rotary magnet ROT. and D to receive impulses over the path of 1 & 2 of A, 2 & 3 of B, and 4 & 5 of D, since 1 & 2 of C are now open. As in the case of B, relay D remains operated during the series of impulses. At the conclusion of dial interruptions, the circuit to the rotary magnet and D are open. D, upon releasing, closes the circuit to one of the windings on an auxiliary relay E, via 4 & 5 of B, 1 & 2 of D, and the wiper.

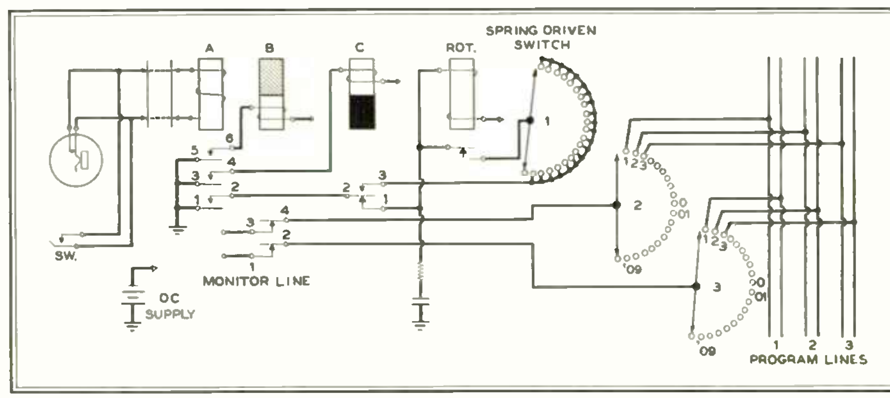


Fig. 5. Basic spring-driven stepping switch circuit controls eighteen lines.

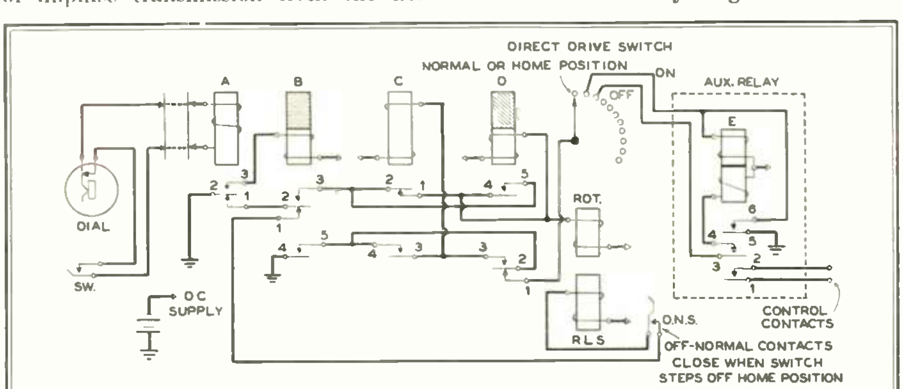


Fig. 4. Basic direct-drive stepping switch is capable of performing ten functions.

Should the wiper be resting on a bank contact associated with the ON lead of E, this relay would operate through its upper winding and remain operated by a circuit through its contacts 5 & 6. If this relay had been closed by a previous selection, and the wiper were resting on a contact connected to the OFF lead, a circuit would be established through its contacts 3 & 4 and the lower winding. With balanced windings on E, and current flowing in both windings so as to produce opposing magnetic flux, this relay will then release. Operating the dial again will cause no effect, since the impulsing circuit to D and the rotary magnet is open at 4 & 5 of D and 1 & 2 of C.

The final operation is the opening of SW, which causes A to release. A, upon releasing, opens the circuit to B, which in turn opens the circuit to the wiper and relay C at its contacts 4 & 5. At the same time, a circuit is closed to the release magnet RLS of the stepping switch, through 1 & 2 of A, 1 & 2 of B, and the switch off-normal contacts. When the switch restores to its home position, the circuit to RLS is automatically opened at the off-normal contacts and the complete equipment is at normal and made ready for another selection.

Basic Spring-Drive Circuit:

A simple circuit employing a spring-driven switch is shown in Fig. 5. For purposes of illustration, the application depicted is one that could be used in small broadcast studios. One or more monitoring positions could be provided with a dial and appropriate bridging amplifier and speaker. The remote equipment is located at a point which is available to the program busses. Dialing of either a 1- or 2-digit number would connect the amplifier across the desired program line. At the conclusion of the audition, momentary closing of switch SW will restore the equipment to normal.

The dial shown in Fig. 5 has normally-open impulsing contacts and therefore provides make impulses in the circuit to A, the pulsing relay. Relay A, when following these impulses, is repeating them to three circuits: to slow-to-release relay

* Engineering Department, C. P. Clare & Company, 4719 Sunnyside Avenue, Chicago 30.

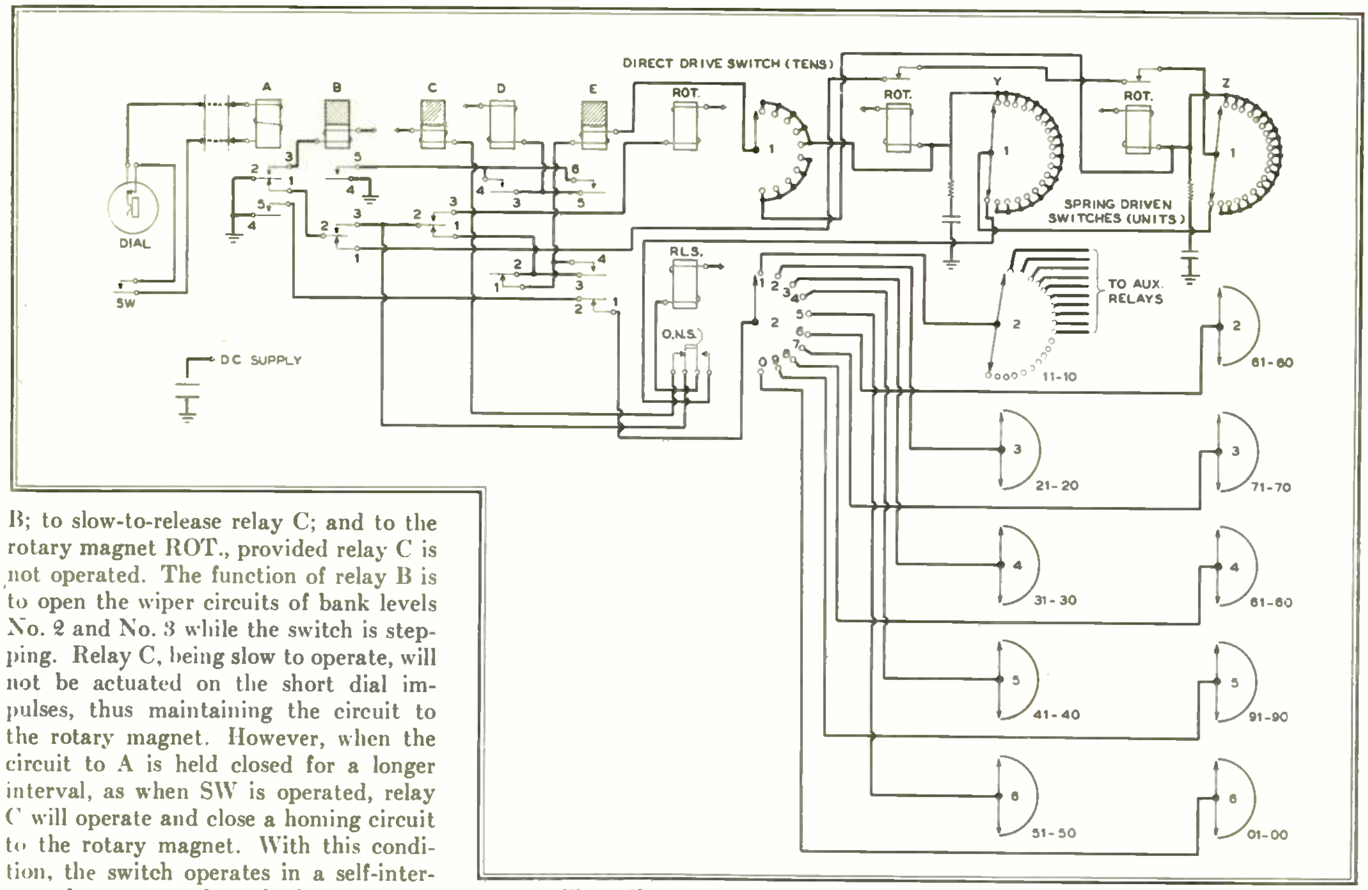


Fig. 6 Up to 100 functions can be controlled by this type of circuit.

B; to slow-to-release relay C; and to the rotary magnet ROT., provided relay C is not operated. The function of relay B is to open the wiper circuits of bank levels No. 2 and No. 3 while the switch is stepping. Relay C, being slow to operate, will not be actuated on the short dial impulses, thus maintaining the circuit to the rotary magnet. However, when the circuit to A is held closed for a longer interval, as when SW is operated, relay C will operate and close a homing circuit to the rotary magnet. With this condition, the switch operates in a self-interrupted manner, through its normally closed contacts, until it reaches the unconnected bank contact representing the home position.

The resistance R and capacitance C are provided to suppress arcing at contacts 1 & 2 of A during impulsing, and of the stepping switch contacts during self-interrupted operation.

Although a 20-position switch is used, only 18 lines are given as the maximum that can be provided. Should the desired program line be connected to a bank position higher than 10, it will be necessary to dial a 2-digit code, since the dial will produce a maximum of only 10 impulses at one pull. Consequently, during the longer interval between groups of impulses, relay B would release and thus close the wiper circuits. Any program on a line connected to bank position 10 would be fed into the amplifier during the interval between dialing the first and second digits. To obviate this condition, the use of 18 lines is based upon no connection to bank contacts No. 10.

Controlling up to 100 Functions: A circuit representing the maximum number of functions obtained by dialing any 2-digit code is given in Fig. 6. By adding one relay and two spring-driven switches to the equipment represented by Fig. 4, not including auxiliary relays, a decimal system capable of controlling 100 functions can be secured.

Operation of Fig. 6 is basically somewhat similar to that described for Fig. 4. The first series of impulses repeated by A, after closing SW, operates the direct-drive switch to select the desired 10's group. The first impulse of the series follows a path through 1 & 2 of A, 2 & 3 of B, and the normally-closed contacts of ONS, to slow-to-release relay C and the rotary magnet. After operation on the first impulse, C provides a path through its contacts 2 & 3 to ROT. and itself for the succeeding impulses of the first series. During the interval between the first and second dialed digits, C releases and can no longer operate during the cycle. The first impulse of the second series follows a path through 1 & 2 of A, 2 & 3 of B, 1 & 2 of C, 1 & 2 of D, through coil E, wiper and a bank contact of level No. 1, to the rotary magnet of the Y or Z spring-driven switch. Slow-to-release relay E operates in series with a rotary magnet. The rotary magnet which operates depends on whether the first digit was greater or less

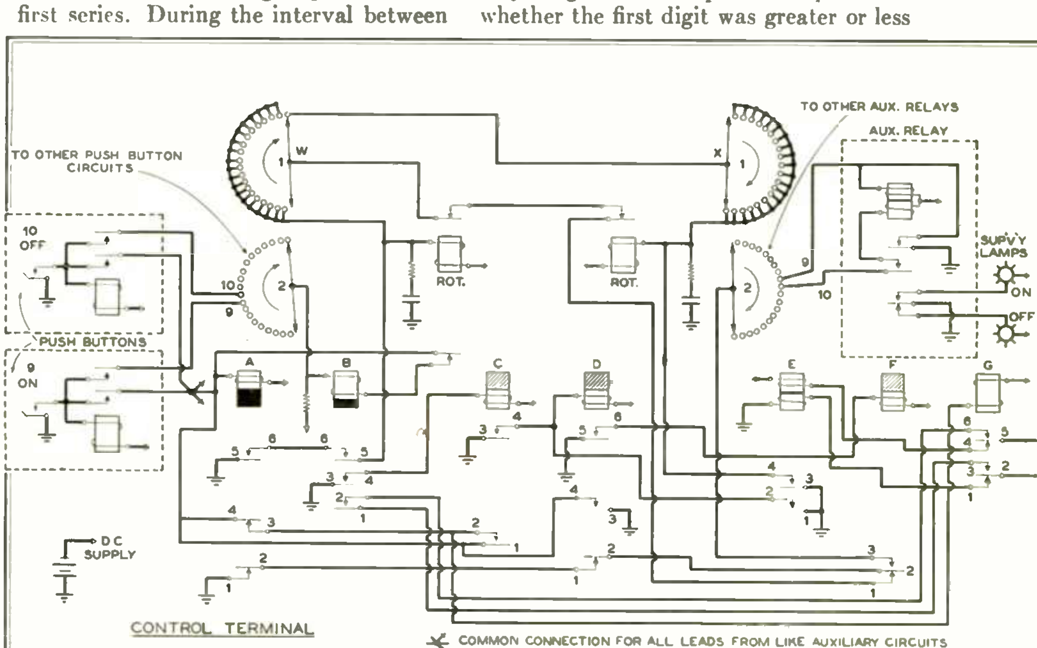


Fig. 7. Where it is necessary to know that the remote controls received the

than 5. Relay E, upon operating, closes a circuit to D, which in turn operates and holds through its contacts 3 & 4 and 4 & 5 of B. E also opens the wiper circuit of the No. 2 level on the direct-drive switch, so that the selected wiper circuit of one of the spring-driven switches will be open during its rotation by the second series of impulses. Succeeding impulses from the second dialed digit take a path the same as the first impulse of this series, except that, since 1 & 2 of D are now open, they must pass through 3 & 4 of E, which is being held operated by the impulse series. At the conclusion of impulsing, E releases, thereby closing a circuit through its contacts 1 & 2 to the selected auxiliary relay. The auxiliary relay which operates corresponds to a given dialed code. If ten of these relays were in the 10's group comprising code numbers 11 to 10, they would respond to numbers 11, 12, 13, etc., up to 10, respectively.

Any further dialing beyond that required for the 2-digit code will have no effect upon the switches, since the impulsing circuit is open at 2 & 3 of C, at 1 & 2 of D, and at 3 & 4 of E. When SW is manually restored, A releases, opening the circuit to B and the wiper circuits of the spring-driven switches. B, upon releasing, opens the circuit to D and closes a circuit through 1 & 2 of A, 1 & 2 of B, interrupter contacts of Y, and interrupter contacts of Z, to the homing wiper and level of switch Z. If Z had been advanced because the dialed code was 61 or a higher number, it would operate in a self-interrupted manner until it reached home. The circuit is then extended through the wiper and home position of Y, to the release magnet of the direct-drive switch, through its closed ONS contacts. If the dialed code had been in the 11 to 50 group, switch Y would home, followed by the restoring of the direct-drive switch.

Signal-Back Operation:

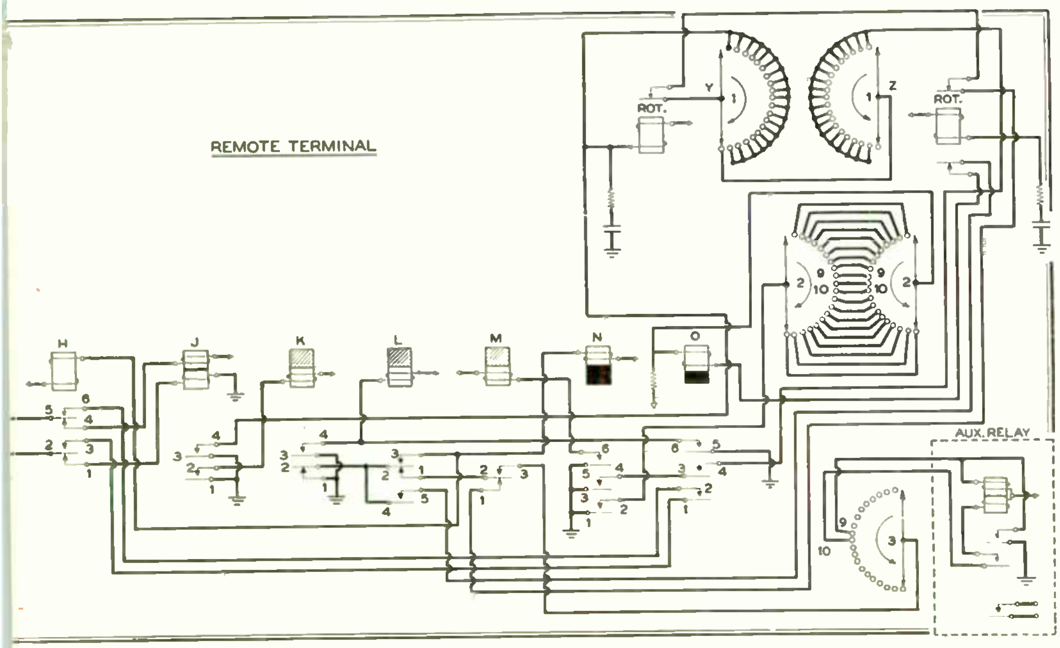
There are certain remote control applications which require an indication at the control point that the remote stepping switch actually reached the desired position. Fig. 7 represents one arrangement for satisfying that requirement. It has two features which are different from the circuits described previously. One is that, instead of using a dial for the selected function, a group of push buttons is provided; one push button being used for each function. The other feature is that an indicating lamp associated with each push button will furnish a signal to the operator only if the remote stepping switch has reached the proper point.

Generally the operation consists of transmitting a single series of impulses to the remote point, the number of which corresponds to a given push button selection. Following this, another series of impulses is generated at the remote point and transmitted back to the control end. These impulses are determined by the position to which the remote switch advanced. The indicating lamp lights only on the basis of impulses received from the remote point.

Referring to the control terminal, Fig. 7, assume the momentary operation of push button No. 9, representing one of the 18 functions. This will cause its associated relay to operate, thus closing circuits to relays A, B, and G, and to bank contact position No. 9 on level No. 2 of switch W. Relay G is a transfer relay and connects impulsing contacts to the transmission circuit. Relay B operates in series with resistance R and closes circuits in turn to C, D, and F, all of which operate in tandem. D, in operating, furnishes a holding circuit through its contacts 3 & 4 to replace that originally supplied by the push button. At this point, A, which is slow to operate, will finally actuate its contacts, closing a circuit to the rotary magnet ROT., as well as opening the original circuit to G, which is now being energized through contacts 1 & 2 of C. The rotary magnet, upon operating, opens the circuit to B. When B releases, it opens the circuit to the rotary magnet, thus allowing the switch to advance and to again close the circuit to B.

This action continues, and is the means for both stepping the switch and forming an impulse generator, through impulsing contacts 1 & 2 on B. Relay B incorporates a small time delay, to provide an impulse rate of 15 to 20 impulses per second. During this time, slow-to-release relays C, D, and F are being held operated. Eventually the wiper of level No. 2 will encounter bank contact No. 9. In so doing, a short is placed across B, preventing its further operation and stopping the operation of switch W. C now releases and opens the circuit to G and D. G releases immediately, but D has a time interval of 0.2 to 0.3 second before it will release. It is during this interval that the remote equipment will start sending back impulses to be received by E. Relay E follows these impulses and re-establishes the circuit to D, holding it operated. E also is causing switch X to advance in accordance with the received impulses. At the cessation of impulses, D will finally release because its circuit is open both at contacts 3 & 4 of C and at 1 & 2 of E. Circuits are now open to the push button relay, relay A, and relay F, all of which release. F, however, being slow to release, provides a time interval during which a circuit is closed to the upper winding of the auxiliary relay. This time, equal to the release time of F, is sufficiently long to allow the auxiliary relay to operate and to hold through its normally open contacts. As soon as F releases, a home circuit is established, allowing switch W to home first, followed by switch X.

Referring to the remote terminal, Fig. 7, a similar sequence of operations takes place, only in the reverse order. Relay J operates, as do relays K, L, and ROT. of Y during the first impulse of the series received. It should be mentioned that the first impulse is considerably longer than succeeding ones, by virtue of slow-to-operate relay A in the control terminal equipment. This provides adequate time for relays K and L to operate in sequence. After this group of impulses, during which switch Y has advanced correspondingly, K releases and, during the release interval provided by L, is closing circuits to transfer relay H, slow-to-operate relay N, and impulse-generating



proper operating impulses, this circuit is used to signal back to the operator.

relay O. The circuit to L is reestablished by O before L can release. As soon as N operates, circuits are closed to M, to the rotary magnet of Z, and to the wiper of level No. 2 on switch Y. Switch Z now advances under the control of O in the same manner as described for switch W and relay B at the control terminal. In so doing, impulses are being transmitted back to the control terminal equipment. When the wiper of level No. 2 on Z reaches the contact No. 9 marked by the wiper and contact of level No 2 on Y, impulsing and switch rotation stop, due to the short appearing across the coil of O. L now releases, followed by H, N, and M. During the interval between the release of L and M, a circuit is closed to the auxiliary relay, which operates and closes the control function contacts. After M releases, a circuit is established to home switches Y and Z in order.

Upon going through the operation of Fig. 7 step by step, the general impression is that an excessive amount of time is required for all of the various operations to occur. Actually, the total time required for maximum rotation of all four stepping switches represented by operating a push button associated with function No. 18, is only slightly more than two seconds.

While wire lines are indicated in these circuits, radio operation can be substituted, of course. The system illustrated in Fig. 7 is of particular value in radio-operated controls where it is essential for the operator to know that the selected function is being performed.

Practical Applications:

One of the many interesting applications of stepping switches for remote control is that used by United Air Lines. In their ground-to-plane communications system, a given ground station operator may have as many as 6 RF channels available. These may include day and night frequencies for two adjacent sectioned areas over which United planes operate, plus channels for local and nationwide coverage. The transmitters and receivers associated with the various channels, normally located several miles from the operating point, are controlled over telephone lines.

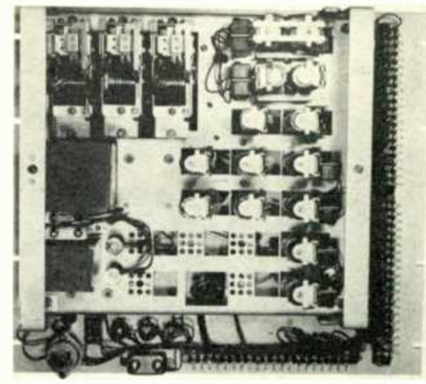
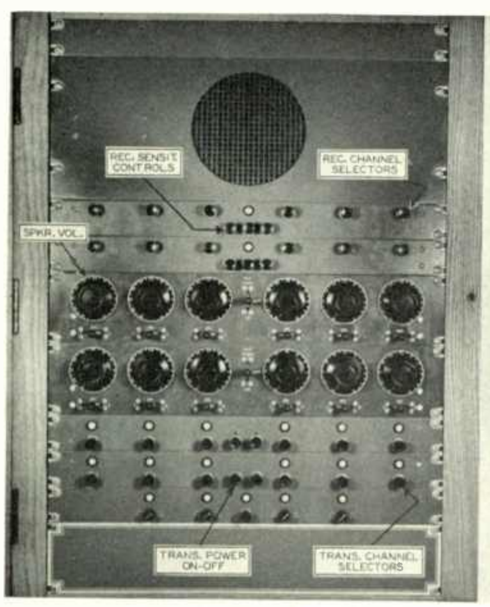


Fig. 10. Dial-operated remote transmitter control. Fig. 11. Rear view.



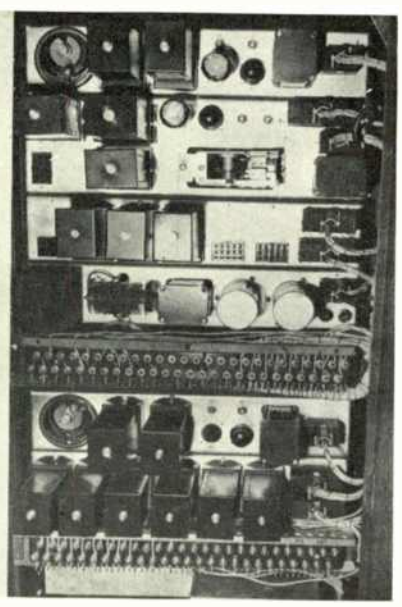


Fig. 8. Teleregister control uses push buttons. Fig. 9. Rear view.

Fig. 8 shows an operator's control console. The various push buttons are used to select the transmitting and receiving channels. In addition, there are three push buttons to select one of three degrees of sensitivity for any receiver. off the power supply associated with a selected transmitting channel by means of two push buttons.

Briefly, these functions are performed by transmitting a given number of 60-cycle impulses over a telephone line. A 20-point spring-driven stepping switch in the control terminal equipment governs the number of pulses transmitted, by rotating until it finds a bank level contact which has been marked through the operation of a relay by a particular push button on the operator's console. At the remote end, a similar stepping switch is advanced by these impulses, through proper pulse-repeating equipment. As soon as this switch ceases rotation, an auxiliary relay operates through the selected bank contact to close the control-function circuits. After transmission of the impulses and operation of auxiliary relays, both stepping switches Furthermore, it is possible to turn on or are homed, or reset, thereby making the equipment ready for another selection.

A portion of this remote control equipment is shown in Fig. 9, and illustrates the stepping switch and relays at a transmitter location. Particular note should be given to the dustproof enclosure and plug-in mounting used by United Air Lines for the relays in this installation.

Another interesting application of stepping switches is that used by the Civil Aeronautics Administration. In this case, the reliability of telephone-type switches is shown to good advantage, since the CAA use their equipment for the remote control of airway radio range transmitters.

One unit, made for the CAA by The Teleregister Corporation, is illustrated in Figs. 10 and 11. A dial on the panel, Fig. 10, generates the impulses which, after transmission over a single-pair telephone line, are translated into control functions in the remote equipment at the transmitter. The dialing of any 2-digit code can control as many as 100 functions, if desired. In the unit pictured, only a fraction of this number is actually used. Operations included are: turning on and off the filaments, plate supply, and modulation associated with either of the two transmitters, plus turning the antenna obstruction lights on or off. An adjunct to this equipment is the provision of telephone handsets at the control and remote ends, which allow voice communication over the telephone control line. When the operator desires to talk over the line, he dials a code number which operates a calling buzzer at the transmitter, thus summoning anyone present.

(*Continued on page 49*)

AUDIO DEVELOPMENTS

DEVOTED TO THE INTERESTS OF THOSE WHO WORK WITH AUDIO FACILITIES — *Edited by* LAWRENCE OLDS*

LOOKING ahead to 1949, it is certain beyond a doubt that audio equipment sales are going to set a new record of dollar volume. This applies to both ends of the broadcast circuit.

First of all, there's the matter of audio facilities for FM stations. Nearly 700 are on the air right now, but most of them are operating on temporary authorization. Before licenses are granted, they will have to clean up their audio equipment from start to finish. This means that odds and ends of assorted junk now in use must be replaced with high-fidelity, low-noise equipment. Fortunately, a considerable number of stations can afford it now, and the others will have to dig down, even though it hurts.

The networks and their larger affiliates will make a considerable investment in recording and play-back apparatus, particularly in the tape category. Reason is that the development of high-quality tape equipment is beginning to revise studio methods and program distribution. Tape has been looked upon as having dubious value, considerably inferior to transcriptions. Now, with fidelity up and noise level down to FM standards, we can expect a definite shift to the European method of recording on tape in advance of air time.

Tape can be edited, programs can be smoothed out, and timing adjusted with precision. Also, copies can be made and distributed just as transcriptions are handled now.

As for reproducing equipment, the public is becoming definitely tone conscious. This, of course, is a slow-moving development, but it's already proving to be a strong trend that adds up to an important market for fine amplifiers, loudspeakers, turntables, tone arms, and dynamic noise-suppressors. At a conservative estimate, 50,000 custom-built home installations will be made in 1949, at prices ranging from $500 to upwards of $1,000 each. Just these super-quality jobs will amount to something over $40,000,000. The nice thing about them is that this sum will be spent for equipment —not furniture.

In addition, it is expected that 75 to 100 schools and colleges will install campus broadcast stations next year. Most of the investment will go into audio facilities, since the transmitters are quite inexpensive. The total for audio equipment won't be impressive as industry figures go, but it will add some $500,000 to '49 sales.

Finally, there's the matter of 16-mm. sound-on-film equipment for movies to be used at TV stations. Figures aren't available at this moment, but all the stations and the studios producing TV films will have to have one or more recorders and the associated processing equipment.

WHILE we are on the subject of audio facilities there's news from one of the equipment manufacturers. Fairchild, always ranked with the top quality producers of recording and playback apparatus, has seemed conspicuously inactive in this field during recent months. Now we have an explanation from Sherman Fairchild himself.

In the past, manufacturing was done at the Fairchild Camera and Instrument Corporation plant at Jamaica, N. Y. This factory, organized to produce precision equipment principally on Government contracts, was not geared to the fast-changing, price-conscious competition of the radio field. Under these conditions, production costs were high, and the constant changes which characterize the radio industry were expensive.

Now, the audio division has been put into the newly-formed Fairchild Recording Equipment Corporation, and set up as a completely independent engineering, manufacturing, and sales organization. Sherman Fairchild is president, Wentworth Fling is operating vice president, and Jay Quinn, formerly of Gray Research, is director of sales and advertising, with John Wolff secretary and treasurer.

Aggressive plans for product research and development are indicated by appointment of Theodore Lindenberg to head up the instrument laboratory, Gordon Mercer in charge of the electronics laboratory, and Dr. D. G. C. Hare as consultant.

New products already announced indicate the activities of the new organization. One is a pickup preamplifier-equalizer which handles vertical, lateral, and micro-groove reproduction. Two or more pickup arms of different makes can be fed into the equalizer. There is also a new turntable with many special features to meet the increasingly complicated requirements of broadcast and production studios, and a recorder for 33.3 and 78 RPM with a variable pitch of 80 to over 300 per inch, so designed that for micro-groove recording the pitch can be reduced during recording to accommodate high-amplitude passages.

Most important, however, is Dr. Hare's work on tape recording equipment. He is best known as the former president of the Deering-Milliken Research Trust. Now Dr. Hare has brought a completely fresh point of view to tape recording. The result is a new type of recorder and playback mechanism that delivers remarkable quality at a tape speed of only 15 ins. per second. Signal-to-noise ratio is rated at 60 db., with a maximum total distortion of 2%. Deliveries will start soon after the first of the year.

Prices on the complete lines will reflect operating economies effected under the new organization setup.

YOU probably remember E. T. Flewelling who made such a stir a few years back with a one-tube super-regenerative design that brought in foreign stations in a way that ran rings around conventional short-wave sets. For some time, he's been living in Ashburnham, Mass., spending much of his time on a new reproducing system. We've been up twice to hear it, and have been equally amazed and puzzled at its performance.

There is nothing in evidence to indicate why apparently conventional and inex-

(*Continued on page 37*)

* North Plain Road, Housatonic, Mass.

PROGRESS IN KLIPSCH SPEAKERS

A FURTHER DISCUSSION OF PERFORMANCE, DESCRIBING SOME NEW DEVELOPMENT WORK AND IMPROVEMENTS RESULTING THEREFROM — *By* PAUL W. KLIPSCH*

SINCE 1940, work has been progressing on corner horn speakers employing wall reflections to mirror the physical speaker, and images to increase the effective size of radiating surfaces. In 1941, the design had crystallized into a woofer of 15 cubic feet, with a maximum dimension of 38½ ins., which would radiate efficiently down to about 50 cycles, or up to 22-ft. wavelengths. By successive redesigns, the 1947 progress included increasing the wavelength to 28 ft. for peak performance, and usable performance to 32 ft.

The most recent advance which involves a conditioning of the driver compliance, has been to obtain peak performance up to 30-ft. wavelengths, with excellent remaining efficiency and reduced distortion at 32- and even 34-ft. wavelengths.

Current production preserves peak efficiency down to the low C-sharp of the pipe organ, with negligible loss at C-flat (32.7 cycles) the lowest pedal note of most pipe organs and about the lowest fundamental of even the largest organs with 32-ft. pipes radiating nominal fundamentals of 64-ft. wavelengths.

The result is that, for the first time, a compact speaker of high efficiency is available for organ reproduction and for original generation of organ tones. Compared to the nearest equivalent, the corner horn is one-fourth the cubical volume of direct radiator systems generally considered adequate, and offers from 5 to 25 times as much conversion efficiency with attendant reduction of harsh quality characterizing low-efficiency systems in the form of various distortions.

The high-frequency system has been the subject of re-valuation to determine the best materials. This has corroborated the choice of the Fiberglass-duck sandwich as being best from the standpoint of freedom from ring, hangover, and absorbtion results as compared to harder and softer materials.

To the improved performance, some face-lifting has been added. Fig. 1 shows the effects of style development in design which has been adopted as a tentative standard, but not with intention to limit variations.

Basic Design:

The original woofer has been described in its various stages of development, the last published data appearing in *FM* AND TELEVISION[1]. That paper showed the basic structure and described the modifications in the horn by which improved loading over a wider range was accomplished. It also described the problems and their solutions pertaining to the companion HF system, and gave a considerable bibliography.

The original woofer comprised a dual taper horn with a nominal cutoff of 47 cycles, and a peak performance at around 50. By using a larger driver, of 15 ins. diameter instead of 12 ins., the dual taper was eliminated. Experiments on the Fairchild unit[2] indicated the possibility of changing the taper rate. The design was altered to a taper rate for nominal 40-cycle transmission, and the dual taper was abandoned. Later, it was discovered that a horn can operate efficiently below its nominal cut-off[3], so development was directed toward taking full advantage of this possibility to extend the low range.

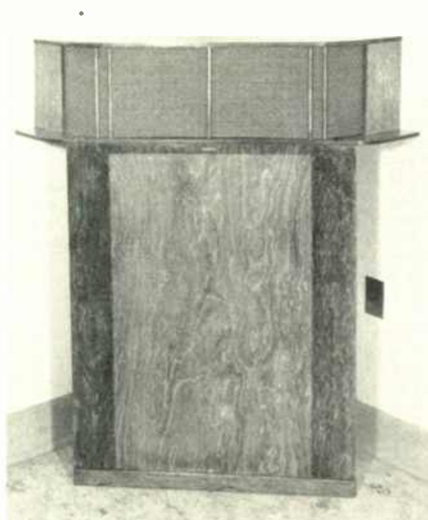


Fig. 1. Basic Klipsch horn designs, to be painted and otherwise concealed in accordance with decorative scheme.

Almost from the very beginning of the corner horn development, the back air chamber was used as a means to 1) eliminate the back wave, and 2) apply a reactive (non-dissipative) back-of-cone impedance to counteract the inertive reactance component of the horn throat impedance. Properly used, the air chamber accomplishes both these functions. Consequently, the load on the diaphragm is largely resistive, the response is smoother, and the frequency range greater.

Compliance Considerations:

The back air chamber acts as a capacitor in the equivalent electrical circuit. The diaphragm suspension compliance also shows as a capacitor in the equivalent circuit. The air chamber and compliance equivalences combine as capacitors in series. Thus, the combined capacitance must be of the correct magnitude, and each must be larger than the resultant.

In general it has been found that commercial drivers, as they are manufactured, are too stiff. The edge compliance can be increased in some cases by suitable treatment. Certain oils and plasticizers are effective in increasing the compliance by a factor of 2 or more.

It has been shown that the back air chamber, to match exactly the reactive component of throat impedance of an infinite horn must be[4]

$$V = 2.9\,AR \qquad (1)$$

where V is the air chamber volume, A is the throat area, and R is the length of horn within which the horn area doubles. If A is in square inches, and R is in inches, then V will be in cubic inches.

Equation (1) presumes the suspension compliance to be virtually infinite, or quite large compared to the air chamber compliance. This condition would be met only with drivers approaching the ideal. This ideal has not been met by any commercial driver tried so far, but it has been possible to obtain up to 2 or 3 times increase in the original compliance, so that treated drivers approach the ideal.

The compliance of the air chamber, designed to conform to the requirement of equation (1) can be determined as follows:

The compliance in centimeters displacement per dyne of force applied to the diaphragm is

$$C = V/A^2\,pc^2$$

where V is the air chamber volume in cubic centimeters, A is the area of the diaphragm in square centimeters, p is the density of air, and c is the velocity of sound in centimeters per second.

For the K-3 woofers, series C and D, the volume is 4,700 cubic inches or 77,000 cubic centimeters. The 15-in. driver has an effective diameter of close to 13 ins., so that $A = 565$ square centimeters. Values of 42 for pc and 34,400 for c give:

$$C = .075 \times 10^{-6} \text{ cm per dyne.}$$

Obviously the suspension compliance (essentially a non-linear quantity) should be large compared to the air chamber, so

* Klipsch and Associates, Hope, Arkansas.

[1] "The Klipsch Sound Reproducer" by P. W. Klipsch, FM and TELEVISION, Sept. 1947. This paper contains a comprehensive bibliography.

[2] Architectural Forum, April, 1943.

[3] "A Note on Acoustic Horns" by P. W. Klipsch, Proc. I.R.E., July 1945.

[4] "A Low Frequency Horn of Small Dimensions" by P. W. Klipsch, Jour. Acous. Soc. Am. Oct. 1941. Note equation (5) of this reference.

that the non-linear motion with its resulting distortion can be minimized. A desirable value for a suspension compliance would be at least twice the value of $.075 \times 10^{-6}$. Drivers as received seldom exceed 0.04×10^{-6} and some run as low as 0.02×10^{-6} or less. Under favorable conditions, the treatment has resulted in driver compliances exceeding 0.13×10^{-6} cm. per dyne.

Care must be taken to prevent the treating oil from migrating by capillary action into the part of the cone which should remain rigid.

Measured Results:

The historical advances can be traced on Fig. 2, in which the voice coil impedances are plotted. Curve A shows the impedance of the 1941 experimental X-3 woofer. Subsequent improvements through the X-3-A-1 and other experiments resulted in the K-3 unit, standardized for initial production in 1946. Curve B depicts the impedance of the K-3. Curve C shows the K-3-B performance. This was the standardization of the tentative T-3-B-1, already reported.[1] Last, there is the curve D, showing the impedance of the K-3-C woofer, with the treated cone suspension.

Now, at last, peak performance is available over the full range and down to within a semitone of the low-C of the pipe organ, with a remaining efficiency at low-C which is perhaps 1 db below peak performance.

Other Advances:

Production of the woofer units, until June 1948, was rather hit and miss. A pilot lot of K-3 units was built in Cincinnati. A few were built in Hope, under contract with a local woodworking concern. Some few others were built under license, again by contract. Lack of personal contact and close supervision precluded any structural advances. With the acquisition of small-scale manufacturing facilities, these lacks were remedied. Starting in June 1948, the production was under the writer's supervision, yea, even under his personal screwdriver. The first result was the revamping of the assembly, in order to offer a clean, unmarred front, amenable to application of furniture finishes. Better control on glues, fastenings, and wood materials show in the finished units. Tests on air-chamber air-tightness show time constants in excess of 3.5 seconds with the throat closed by a dummy, and better than 1.0 second with average drivers. This means that the air chamber reactance is capacitive above about $f = 1/2\, \pi\, T$, where T is the time constant, or for frequencies above about 1/6 cycle per second. This offers a margin of safety below the required 30-cycle performance of the horn.

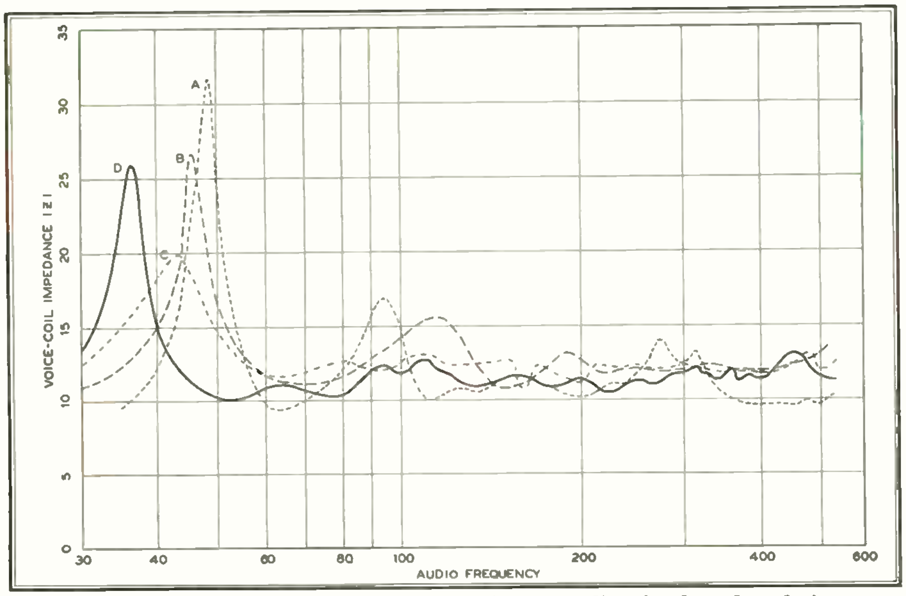


Fig. 2. Showing improved performance in succeeding loudspeaker designs.

Utility models are still being produced, but the styled models are expected to largely replace utility model production except for institutional use. These are in process of standardization, but it is not intended to limit styles to the standard models, but rather to offer reasonable adaptability of standard acoustic elements and, to a lesser extent, standard sub-assemblies and finishes.

The high-frequency component development has not been static. The horn itself went through the expensive hand-contouring stage, and several modifications of form which permitted adaption to a variety of drivers. The latest study was of materials. The standard Fiberglass-duck sandwich laminate was found to be quite dead (nonringing), yet nonabsorbtive. Also, a Fiberglass-cloth and Fiberglass-mat sandwich was tried successfully, but the harder material approaches the liveness of metal. It was feared that any further hardening of the material might result in the ring which has characterized some metal horns. Thus the Fiberglass-duck sandwich has been retained. One might class this study as negative in results, but at least it corroborates the choice of the materials made earlier.

The HF horn remains functionally almost as originally reported.[5] The small cells have been retained as offering the best possible polar characteristics. The radiation angle of 60° by 90° differs by only 3% from the ideal $\pi/2$ solid angle into which the woofer radiates, so that with equal power the sound density over the listening area will be uniform. As both channels maintain close to 50% efficiency, padding of either channel is unnecessary.

Even with the desirable radiation pattern charactistic of this high frequency horn, location of the unit must be logical. It appears that the original choice of speaker placement was fortuitous. The HF horn, located at ear level, assures clean, full, highs over the entire listening region.

Perhaps the major advance has been the introduction of finished units suitable for home use. Technologically, the increased wavelength-handling capacity of the late-model woofers can be appreciated only with a few organ recordings or by users who apply the speaker to electric organ outputs. But the new finish and styling offer the critical listener both ear and eye appeal. Wife-trouble should now arise only from considerations other than appearance!

[5] "A High Quality Loudspeaker of Small Dimensions" by P. W. Klipsch, Jour. Acous. Soc. Am. Jan. 1946. See also ref. 1 above for photographs of late high-frequency horns.

AUDIO DEVELOPMENTS

(Continued from page 35)

pensive equipment should give such superb tone quality. To prove that the same results can be obtained in any home, Ted has made several installations for local friends. He's pleased to have visitors, and to demonstrate the equipment. However, he won't disclose the secrets of the system until it is announced by the company that is engineering the design for commercial production.

It seems as if he's doing everything contrary to conventional methods, yet he gets music from phonograph records such as we have never heard produced by conventional means. He has an interesting way of checking his amplifier-speaker system. He puts a pure sine wave into the amplifier, with a microphone in front of the speaker and connected to an oscilloscope. Then, introducing a second audio frequency at the amplifier, he can see the effects of intermodulation. He explains that one reason for the remarkable quality is that no intermodulation is present. We're sure, however, that that is only part of the story.

HOW TO IMPROVE PROGRAM PICKUPS

STUDIO PRACTICES REQUIRED FOR FM IMPROVE AM, TOO. HERE ARE IDEAS THAT CAN BE EMPLOYED WITH FACILITIES AVAILABLE AT ANY STATION — *By* HAROLD E. ENNES*

MAKE it good. Then make it better. This is the creed of radio engineers. Over a period of twenty-eight years, broadcasting has been made good. With the advent of FM, it can be made very much better. Broadcast equipment has reached the state of design where the noise level is negligible, and the complete spectrum of audible frequencies is available for transmission and reproduction.

Yet it is apparent to all concerned that the techniques of co-ordinating and operating this equipment are as confused and almost as varied as the number of stations and the number of operating personnel at each station.

What has not been so apparent is the fact that this situation can spell the success or failure of a well-designed, well-maintained layout. There is extensive literature covering the theory, design, construction, and repair of the equipment, but the importance of using such equipment properly is just beginning to gain recognition of its true worth.

Microphone Facts & Fancies:

"The microphone is a mechanical extension of the human ear." How often have you heard that one? The fault in this definition lies not so much in its literal meaning as in the implications involved. If it were true, even though you had only one ear, you could walk into a studio and place the microphone at the spot where your one good ear could hear the orchestra, the soloist, the chorus, and the announcer. Only it doesn't work that way in practice. Yet this conception is probably the basic factor in the reasoning of the operator who just sticks up the mike in a studio and proceeds to broadcast the show by riding gain. And there is the more ambitious type who spots a microphone for each section of the orchestra, then one for the soloist and announcer and several for the chorus, and then becomes very indignant when the conductor reports that his musician friends listened to the show and thought someone else had been on the podium.

To understand why a microphone cannot be considered an extension of the human ear, it is necessary to review the fundamental theory. It is an old story, but absolutely essential to understanding the mike from an operational point of view.

Unlike the human hearing system, which is binaural (two-eared), the microphone is monaural (one-eared). It should be emphasized that this is true regardless of the number of microphones used, since the sound is collected into one channel, and reproduced by one loudspeaker, while each of our two ears has a separate channel to the brain. Physically, the difference is that in a monaural system the sense of direction is lost, while reverberation is somewhat more noticeable, making the apparent distance to the sound source seem greater than when listening binaurally. Any operator who has set up a microphone in a particularly live hall has experienced this phenomenon. The conversation between two people anywhere in the hall can be heard quite clearly when listening with two ears, but when listening with headphones connected to an amplifier and microphone, the sounds seem much more distant, while the extraneous noise is high. This brings up an all-important psychological factor closely linked to the physical effect just explained.

DON'T BE A MIKE-MUGGER

That is the first rule given by author Harold Ennes for studio techniques that improve AM programs, and give the startling realism and presence effect that listeners expect of FM, but aren't getting from most broadcast stations.

This is the focusing power exerted unconsciously when listening binaurally, or even with one ear plugged up as much as is possible. The association of the ear with the nervous system and the brain tends to exclude recognition of the extraneous noise, and to focus attention on particular sounds. The microphone, as a mechanical device not associated with any means of concentration, exercises no discrimination between wanted and unwanted sound sources.

A practical example of this difference is to be found in any restaurant where there is dinner music. Despite the high level of ambient noise, you can carry on a conversation or listen to the music, and enjoy doing either one, but not both at the same time. But imagine the result if a microphone were placed on your table for a broadcast! Very little of the music would be heard, and the few strains coming through would sound far, far away. The radio listener would hear a hopeless hodge-podge of voices, noise, and confusion.

First, then, let's do away with the idea that the microphone is an extension of the human ear. This applies equally to microphone techniques for AM and FM. In practice, every effort must be made to utilize the possibilities and limitations of the mike in order to deliver an exact replica of the original program content to the ears of the radio listeners.

Frequently we hear it said that microphone techniques are different for AM and FM. As to this, there are ample grounds for disagreement. Discussions with control-room operators and production men seem to indicate that they do not know how to set up for optimum on FM. Therefore, they adopt the attitude that FM and AM techniques are different and, since the AM audience is larger, AM practices should be favored.

Actually, experience shows that the rule should be: "Precise or sloppy techniques show up more on FM than on AM." In other words, the difference between careful and careless handling of a program is disclosed on AM to only a limited degree, but FM listening shows up the difference very clearly, even with a set of no more than average audio capabilities.

In this connection, there is another point that calls for revision of control-room practice at many stations. It is not unusual to find three speakers in one control room, for the operator may be called upon to keep up with the program on the air, another under rehearsal, and a third being aired by a local competitor. Under such conditions, critical listening by the operator is impossible!

All this leads up to the fact that FM is setting new and very high standards of studio practice. Haphazard program setups that get by on AM may prove to be poison for FM. This is no exaggeration. On the other hand, the employment of high-fidelity methods for FM results in improved quality on AM. This will be explained in detail.

Understanding Response Patterns:

Insofar as program setups are concerned, the foremost characteristic of a broad-

* Engineer, Station WIRE Indianapolis Broadcasting, Inc., Indianapolis, Ind., author of 'Broadcast Operator's Handbook" published by John F. Rider, N. Y. C.

cast microphone is its response pattern. There are several important factors which must be considered when using a microphone pattern to obtain a desired result.

The basic point to keep in mind is that a response pattern as illustrated for a given mike is plotted in a perfectly dead room, to avoid all reflections of sound waves. But when a microphone is set up in a studio room, although the theoretical response pattern does not change, the mike is acted upon by reflections which vary in direction and magnitude according to the shape of the walls and the ceiling, and their ability to absorb or reflect sound waves. This will be made clear by the hypothetical case of a setup involving two sound sources and a bi-directional microphone.

Fig. 1 illustrates the ideal response curve of a bi-directional mike in a completely dead room. Sound sources A and B are of the same intensity and at the same distance from the mike, but B is directly on the zero-response axis. Let us say that each source represents 10 units of sound. Since sound source B will excite both sides of the ribbon equally, no movement of the ribbon will result from this source, and no output voltage will be created in the microphone. Therefore, the total output voltage will be 10 units, and consist only of the impulses received from A. Thus the pattern holds true.

Fig. 2 shows the same setup in a live room. It is still true that B will excite both sides of the ribbon equally resulting in no response to the direct wave, but now we have reflections. Sound will be reflected from the walls back into the sensitive side of the mike and, although reduced in intensity, will add to the 10 units of sound from source A. The difference now between the two sound sources is not only one of intensity, but ratio of reflected to direct sound. Naturally this ratio is greater for sound source B than for source A.

It is, of course, obvious that there is no such thing in broadcasting as a perfectly dead studio. This example is, therefore, rather crude, but serves to illustrate the basic idea of how acoustical treatment influences the polar action upon a microphone. This understanding is imperative from an operational point of view.

While we are on the subject of response patterns, it is well to be sure that it is clear as to just what information they are meant to convey. Fig. 3 shows the polar response pattern of a Western Electric 639 A cardioid, plotted for four different frequencies against the ideal cardioid curve. This shows that there is a narrower response-angle at higher frequencies than at lower ones because high frequencies tend to travel in beams.

The curves at the left in Fig. 3 illustrate, for example, that on 50 cycles the response is down about 5 db at 90° with respect to its response for the same distance at zero degrees. It will also be noted that for 9,000 cycles the response at 90° is down about 6 to 7 db. Also, at 90° the 9,000-cycle response is about 11 db lower than the zero-axis, 50-cycle response.

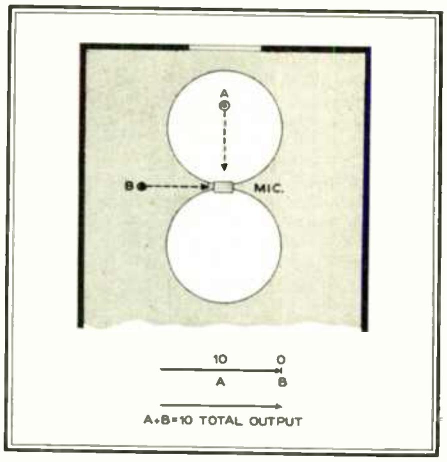


Fig. 1. Bi-directional pattern in dead room

Since, in broadcasting, we are concerned not only with wanted and unwanted sound, but all shades in between, the individual response patterns of a mike prove extremely useful if utilized properly. From this discussion we have

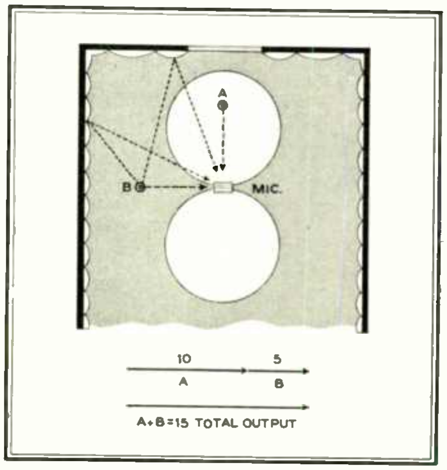


Fig. 2. Results are modified in live studio

four fundamental operating points for the microphone:

1. If a sound source must be moved about the mike, loss of response can be compensated for, if desired, by moving the mike closer to the source.

2. The ratio of reflected to direct sound can be raised in a sufficiently live studio by using greater angles from the zero axis of the mike. This is especially true of bi-directional microphones.

3. The more live the studio, the greater will be this effect.

4. High-frequency sound sources must be more nearly on beam for a given distance to achieve the same intensity of response as lower-frequency sound sources.

To this latter point should be added the note that a bi-directional microphone has a greater deviation in angular response between high and low frequencies. Also, the cardioid or uni-directional instrument has a much wider angle of response at all frequencies than a bi-directional mike.

This is shown at the right in Fig. 3, where the 1,000-cycle curve of an RCA 77 B uni-directional mike (solid curve) is super-imposed on the 1,000-cycle curve of an RCA 44 BX velocity (bi-directional) microphone. It should be observed that at 60° the relative response of the 77 B is down only about 2.5 db, whereas the 44 BX at 60° is down about 6 db. The very great difference at 90° is clearly shown. This is typical of all makes of broadcast microphones when comparing the uni-directional and bi-directional patterns.

Studio Acoustics:

The non-standard acoustical characteristics of broadcast studios are the outstanding factor that has prevented any establishment of definite standards in microphone setups. If there were such a thing as a standard studio, designed to approach as nearly as practicable the ideal condition of sound dispersion, the setup for any particular musical organization would be a simple matter anywhere when once worked out. Naturally, such is not the case. It is probably safe to say that there are no two studios anywhere in the world that are acoustically alike.

Right here, the author feels it advisable to bring out a point so far neglected in the scanty literature on mike technique. This point is that a great number of operators and producers (alas, even in FM) do not have adequately designed and acoustically controlled studios in which to work. This is the most deplorable situation existing in broadcasting, but it is outside the influence of the average operator. All we can do is hope, and then plead, and plead some more until the station owners become cognizant of the extreme importance of modern studio design. It is a sad state of affairs that even some of the most recent FM installations, with completely new studios independent of any AM connection, are neglecting this feature. Most of the good articles appearing thus far on microphone setups have been concerned with well-designed, musically-live studios of the network centers, or the more production-conscious independent owners.

Yet how can an article of this kind be useful to the average operator wanting to do his best in studios of the same design as those built twenty years ago? Since it is the purpose of this paper to present practical information, the writer will attempt to show some definite rules that can be used to meet any acoustical conditions. High-fidelity techniques for a good, modern studio cannot be applied to most of the studios in use around the country. We shall have to plant our feet squarely on the ground and face the situation as it really exists.

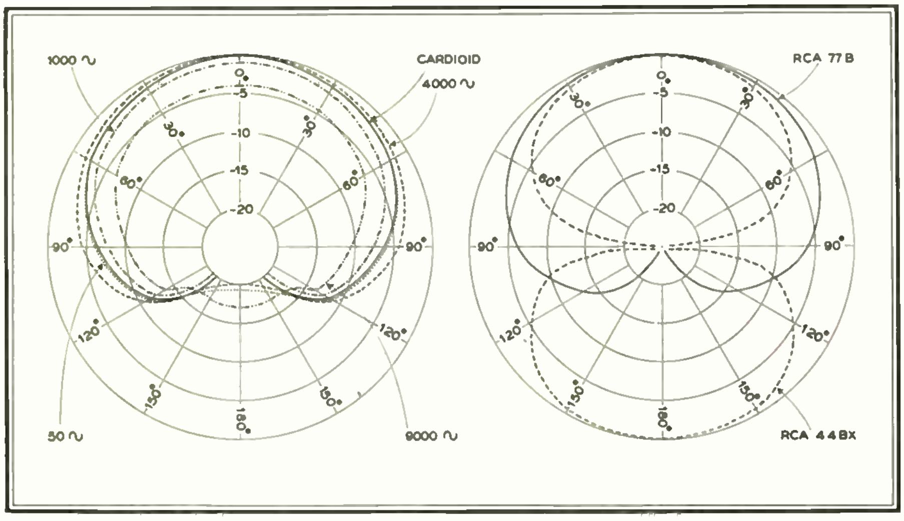


Fig. 3. Left: W. E. Cardiod. Right: Uni-directional and bi-directional RCA types

In the modern studio, the walls are live to musical sounds, but are broken up acoustically in some manner to avoid standing waves, while still achieving a maximum response to diffused, polyphased high-frequency sound. Under those conditions, good tonal brilliance can be obtained with a minimum of microphone and control-board manipulation. This is the type of design we need to really practice proper microphone technique.

The Single Announcer:

The single announcer is the logical starting point for our discussion of mike technique. It must be understood that we are not concerned at present with announcing over a background of music or any form of dramatic presentation. You may ask: "What is there to discuss, then? The announcer just steps up to the mike, or sits down in front of one, and talks!"

You're right. He does. But the fact of an error does not justify it.

Announcing alone occupies a considerable portion of the broadcaster's schedule. Correct voice transmission is so very important to radio because we do not have the sense of sight to help our impressions; the voice is the complete medium of expression. The intake of the breath, the most subtle inflections, the style of delivery, the original voice timbre, all are necessary to the listener. Any or all of them may be severely affected by the announcer's relation to the mike.

Those of us in the technical end of radio must at some time of our careers realize that engineering training does not develop an appreciation of artistic values or sense of showmanship. We are very apt to lose sight of the real reasons behind the keys, faders and perfectly matched impedances of the control system. They are designed this way so that the electrical impulses may correspond to the thunderous crescendos of Wagner's *Die Walküre* or the light, delicate strings of Debussy's *Festivals*. It is with the intangible qualities of human experience, expressed by great artists through the moods of music, that the wires and switches and dials and knobs of the technical department are concerned. As

Fig. 4. Setup for interview in small room

we grow ever more conscious of this, we come to see our work in its true relation to radio's service to the listening audience.

But to get back to the announcer and our starting point in high-fiidelity microphone techniques. Mugging the mike is a strongly entrenched and deeply-rooted habit. But the annonucer must be kept away from the microphone. He will probably object. He may refuse. Some announce desks have microphones permanently mounted on them; and if the announcer moves back he must hold his script in an uncomfortable position, without an arm rest. This is plainly and simply an engineering error. Like fingerprints, there are no two voices exactly alike. For every voice there is a definite relationship to the microphone which allows the most natural and pleasing reproduction.

For voice work alone, 2 ft. is the minimum distance from the face to the microphone that will assure naturalness of that voice! A distance of 2 ft., incidentally, should only be used for the softest voices. Compare this with your own studio operating practice. What is the distance your announcers use? Probably somewhere between 4 and 12 ins. Voice waves at this distance from the mouth and throat cavities do not create electrical impulses that correspond to the natural character of that particular voice.

Do this as an experiment: On rehearsal, set up microphones (in addition to the regular announce mike) 3, 6, and 9 ft. away. Stagger them enough so that no mike will be in front of another. If the regular microphone is immediately in front of the announcer's face, you will have to move it lower or to one side. Don't tell him what you are doing. Just say you are testing mikes. If he is told to start reading at a distance from one microphone and then to move closer, he will subconsciously alter his volume and you will not get a natural check.

Now turn only one microphone on at a time. Start with the farthest mike. Unless you are so conditioned to hearing the mugging voice that you can accept no other, you will find a new experience in naturalness of voice transmission. A distance will be found where the voice begins to sound hollow in a live studio, or thin in a dead one. Use the distance just a shade closer than this point.

In small announce booths, where space is at a premium and where distance would create a barrel effect due to the proximity of the studio wall to the microphone, the mike should be suspended over the announcer's head at a distance of several feet. We are borrowing this technique from television, where the mike must be kept out of the range of the camera, and is often as much as 15 ft. from a performer. It should be borne in mind, however, that the sound in television is only a secondary expression to the picture. In other words, all of the intent and meaning need no tbe embraced in sound, as in audio broadcasting.

This same technique is most convenient when two persons are seated at a table and using a single mike as illustrated in Fig. 4. The table top should be deadened by acoustical treatment or by the use of a heavy cloth cover to prevent reflected sounds from entering the mike.

(To be concluded next month)

for TELEVISION'S exacting applications

Designed for dependable operation up to 450 volts at 85°C. these new Sprague electrolytics are a good match for television's severest capacitor assignments. An extremely high stability characteristic is assured, even after extended shelf life, thanks to a special Sprague processing technique. Greatly increased manufacturing facilities are now available.

Your inquiries concerning these new units are invited.

SPRAGUE ELECTRIC COMPANY • NORTH ADAMS, MASS.

SPRAGUE Capacitors
*Koolohm Resistors

PIONEERS OF ELECTRIC AND ELECTRONIC PROGRESS

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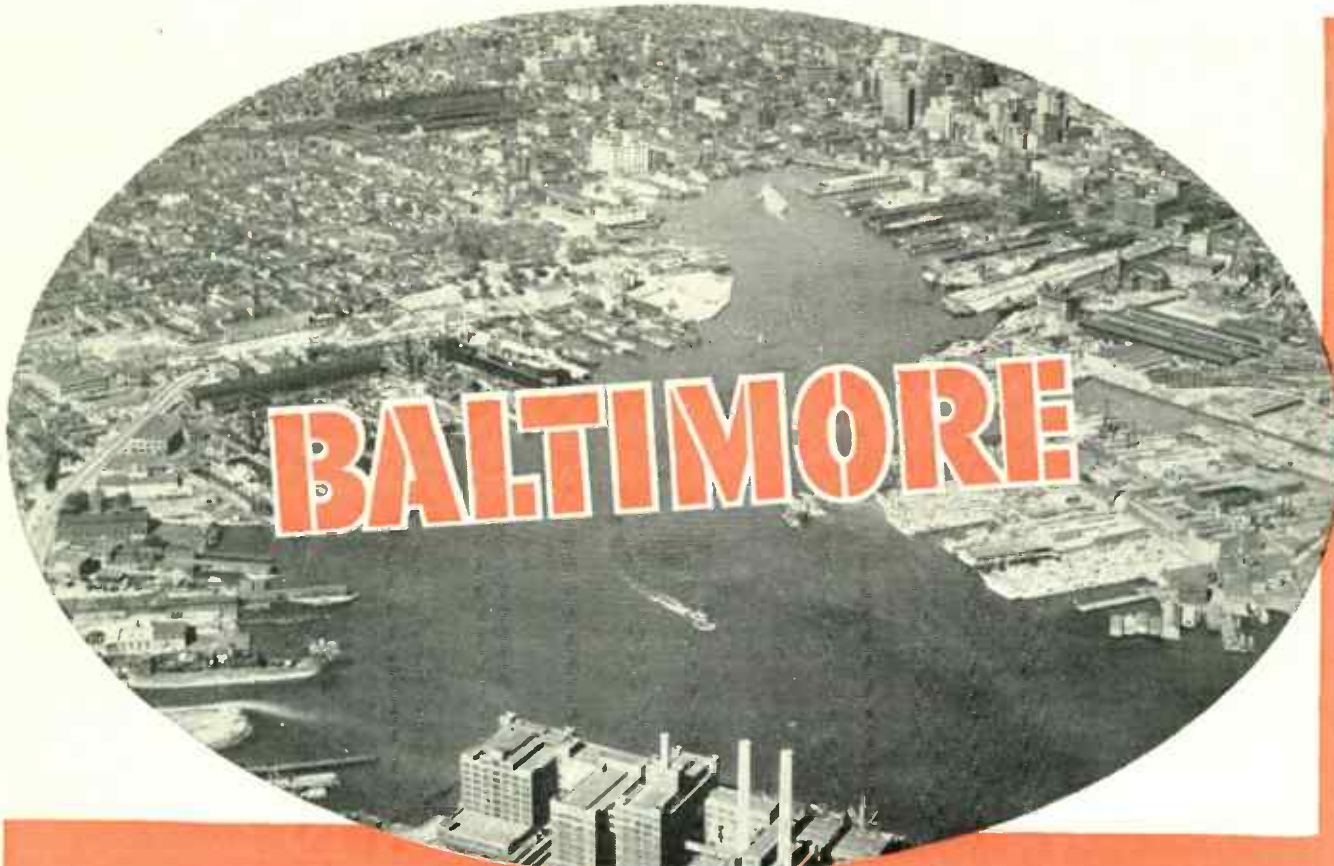


GREAT NEW "RADIO UMBRELLA" SAFEGUARDS CITY OF A MILLION

FEDERAL Equipment is used throughout one of the Largest FM Mobile Radio Networks in the United States

BALTIMORE – pioneer in police radio since 1932 – has replaced its AM system with new Federal FM Mobile Radiotelephone Equipment throughout. Change-over was expertly accomplished without interruption in 24-hour service. And now Baltimore has the advantage of clear, constant and static-free coverage everywhere in the city!

This new network gives split-second police and fire department protection to more than a million people – and covers them like an umbrella. On land and water, 300 square miles of the great seaport of Baltimore are patrolled by 215 mobile radio units. And this network of security swings into action instantly – just dial "O" and ask for "Police Radio" from any telephone.

Communications crossroads for not only the city but the nation are the Radio Rooms in the Police Building in central Baltimore. Switchboards give access to all local telephones. Teletype machines give direct links to 12 states . . . indirect links to all others. Two Federal 250-watt Transmitters – to insure uninterrupted flow of intelligence – are capable of handling MILLIONS of calls a year.

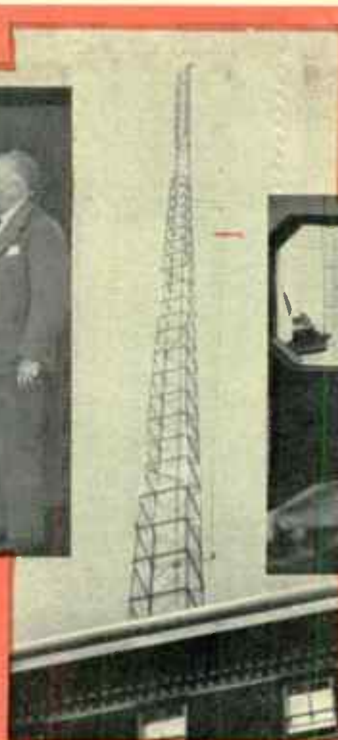
Equipped with Federal Transmitter-Receiver Mobile Units are scout, post-patrol, accident-investigating, vice-squad, detective, inspector and commissioners' cars; impounding trucks, patrol boats and district offices . . . plus fire department units including 10 ambulances and 5 fire boats.

Federal is proud of this model municipal system that is demonstrating the advantages of its Mobile Radio Equipment . . . equally proud of systems engineered for taxi companies, bus lines, pipe lines, utilities, lumber camps and other private accounts. For information, write to Department I-830.

Federal

KEEPING FEDERAL YEARS AHEAD... is IT&T's world-wide research and engineering organization, of which the Federal Telecommunication Laboratories, Nutley, N. J., is a unit.

TWO FEDERAL 250-WATT TRANSMITTERS assure 24-hour service. One is in continuous service—the other stands by in case of emergency. Sgt. J. A. Stoltenberg, Police Radio Engineer (left) and Police Commissioner Hamilton R. Atkinson.



HIGH-GAIN ANTENNA rises 300 feet above ground. The low angle radiation pattern provides maximum signal strength throughout service area and assists in overcoming high noise level of central Baltimore.

RADIO ROOM is soundproof and air conditioned for top efficiency. In foreground are Remote Control Consoles for direction of police and fire department mobile units. Standing by Federal transmitters are R. E. Altoonian, Federal Engineer, (left) and Captain William E. Taylor, head of Baltimore's Communications Division.

Some of the various types of Public Safety vehicles equipped with FEDERAL Mobile Radio Units

Fire Boats

Police Cruisers

Impounding Trucks

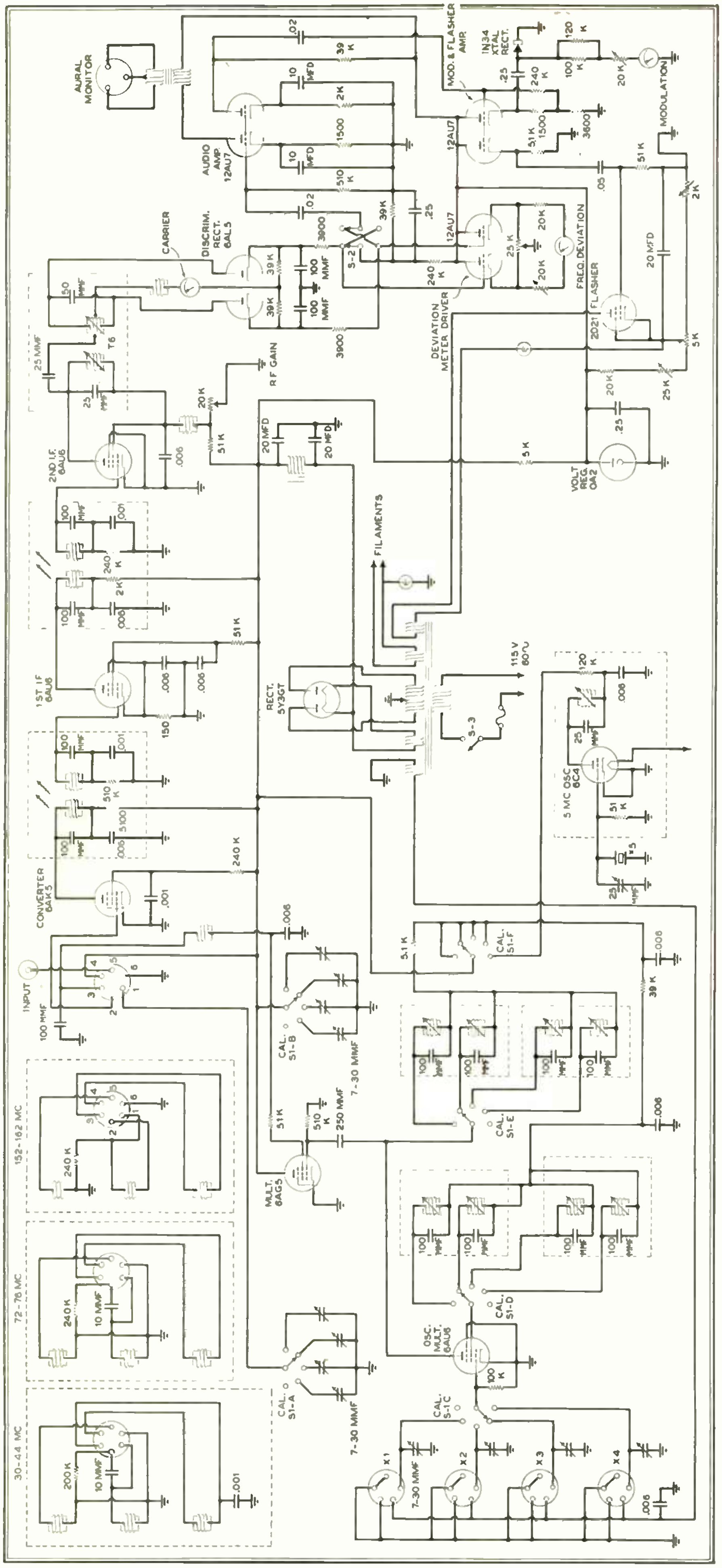
Accident Investigating Cars

Municipal Ambulances

Telephone and Radio Corporation

100 KINGSLAND ROAD, CLIFTON, NEW JERSEY

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp. 67 Broad St., N. Y.



MONITOR

(Continued from page 19)

channel, it is only necessary to shift the panel switch to the mobile frequency. Where interference is experienced with other systems on the same or different frequencies, the monitor can be used to check the performance of their transmitters, also, requiring only a crystal and calibration of the unit to their frequency.

As shown in Fig. 4, there are three different plug-in input transformers to cover 30 to 44, 72 to 76, and 152 to 162 mc. These standard ranges can be modified to meet special requirements. If only one monitoring frequency is specified, or if two to five frequencies are specified in one band, then only one input transformer is used. On the other hand, if the frequencies lie in different bands, the transformer corresponding to the channel-selector switch must be plugged in.

Metering Circuits: Accuracy of the frequency meter is plus or minus .0015% of the signal frequency. This is in accordance with FCC requirements.

The modulation meter is calibrated to show the maximum frequency excursion, in kilocycles, when the variation is sinusoidal. It shows the excursion of modulation sustained for .4 second or more. The response varies less than 1 db for frequencies of 50 to 10,000 cycles.

The deviation meter employs a converter to which are applied voltages from a local crystal oscillator and the received signal. A 6AG5 tube is used for the crystal oscillator, with the screen tuned to the crystal frequency, and the plate tuned to the second harmonic. The output of the converter passes through a broad-band IF amplifier and limiter, to a discriminator transformer and associated diodes. AC and DC voltages across the diode load resistors operate the modulation meter, peak flasher circuit, and frequency deviation meter.

A 6AG5 is used as a doubler, tripler, or quadrupler, depending upon the channel to be checked. Thus the 6AG5 output is the 4th, 6th, or 8th harmonic of the crystal frequency. Fundamental frequency injection is used on frequencies up to 65 mc. and, up to this point, no temperature control is employed for the crystals. Above 65 mc., crystals are temperature-controlled, and half-frequency injection is used above 100 mc. That is, the mixer heterodyne voltage multiplied by 2 is 5 mc. lower than the signal output frequency, or the crystal frequency multiplied by 16 is 5 mc. lower than the signal frequency.

The 5-mc. output from the converter

(Concluded on page 46)

Fig. 4. Schematic of the Doolittle monitor

Sitting before the sound-photo machine in the New York Daily Mirror radio car, John Reidy, the Mirror's chief photographer, advises the Mirror office (extreme left) that a photo is coming through.

The heart of the sound-photo receiving equipment at the office is Sylvania's Glow Modulator Tube, Type R1130B. A pin-point of light emitted by this tube is focused on a sheet of photographic paper attached to a revolving cylinder. As the cylinder revolves, the photograph is faithfully reproduced as it is being broadcast!

N. Y. DAILY MIRROR'S SOUND-PHOTO EQUIPMENT *with Sylvania tubes* HELPS SCOOP THE NEWSPAPER FIELD!

LINK FM SETS — SYLVANIA-tubed, too — transmit on-the-spot photos to paper's home office!

Pioneer in the radio car field, the New York Daily Mirror has made excellent use of its sound-photo apparatus. Equipped with Link Radio Communication units, the Mirror car has been in a position to scoop other newspapers by radioing pictures taken on the spot as soon as they are developed in the mobile photo-lab.

In these units, 36 highest quality Sylvania tubes, ranging from Lock-Ins to standard glass and GT tubes, help insure trouble-free operation of this ultra-modern method of photo-news reporting! For information on Sylvania tubes, see Sylvania Distributors, or write Radio Tube Division, Emporium, Pa.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS

MONITOR

(Continued from page 44)

is passed through an IF amplifier that is nearly flat for 40 kc. on each side, and on to a limiter which further smooths out the band of frequencies passed.

When the frequency-modulated signal enters the discriminator, its instantaneous frequency, being displaced from the 5-mc. point, produces a voltage unbalance between the upper and lower diode resistors, Fig. 4. This upset voltage is negative or positive as the instantaneous value of frequency varies in relation to the center frequency. The currents from both diodes pass through the carrier meter and choke in series with the center tap of the secondary of transformer T6. In this way an indication is obtained of the carrier signal applied to the diode. Finally, the net average voltage from the discriminator is fed to a 12AU7 vacuum tube voltmeter, calibrated in kilocycles deviation.

For the modulation meter, audio voltage developed across the discriminator diodes is fed through a 12AU7. One section of the tube is connected to a transformer, for aural monitoring. The other is used as a resistance-coupled amplifier to feed a 12AU7 double cathode-follower. As Fig. 4 shows, one section of this tube feeds an 1N34 crystal peak rectifier for the peak voltmeter which indicates modulation in kilocycles, while the second section feeds the 2D21 gas-tube flasher circuit.

Switch S1, Fig. 4, has a calibration point marked CAL. on each contact deck. With the switch in this position, plate voltage is applied to a 6C4 oscillator using a 5-mc. crystal. This provides an accurate means for centering the tuning of the discriminator secondary. The monitor is intended for operation in room temperature of 68° F. If the temperature varies greatly from that value, it may be necessary to recenter the discriminator by this calibration method.

Equipment of this type is coming rapidly into wide use by communications systems. In fact, wherever interference conditions are serious, the first step in correcting the trouble is to determine the sources of off-frequency signals and overmodulation by careful monitoring. Field reports indicate that the cost of a precision monitor is soon offset by increased operating efficiency, both as to range and dependability of communications.

TELEVISION PLANNING

(Continued from page 30)

Individual stations continue to operate in the red.

Thus, from a financial standpoint, it is apparent that the stations and networks are making heavy investments which they can only hope to amortize over a period of years. In the meantime, TV stations are looking at the red ink and are now pulling in their horns, making every effort to reduce heavy operating costs until set circulation makes a profitable rate structure possible. Many stations are eliminating morning programming, cutting out live sustaining programs, reducing their talent budgets, and concentrating on evening broadcast hours to reduce overhead.

Not generally known is the fact that the quality of physical transmission of television broadcasts has not been satisfactory. The public has, for the most part, accepted the queer noises and jumpy pictures as a normal part of television, but the FCC has decided that there will be no more approval of building applications for maybe nine months, while the propagation experts review the matter of channel allocations and possible movement of channels to higher frequencies.

While these conditions haven't dulled set demand, they are not conducive to top-quality televising, which is what the advertiser must have for his commercials to pay off, and what the station must have to get viewers to spend more time with their sets instead of using commercial time as a break for a drink or to relax the intensity of watching the screen.

Until we can have coast-to-coast facilities for simultaneous transmission of programs, which has been the cornerstone of AM radio success, television progress will be slowed up because programming cost on TV is too heavy to pay for limited networks or spot broadcasting of high-quality programs.

At the Sun Valley convention of NBC affiliates last September, it was generally agreed that coast-to-coast TV is some time off, mainly because of the huge cost for cables involved. It is estimated that one year's coast-to-coast programming would cost the four networks about $40,000,000 for cable charges alone. This is too heavy a drain on the working funds of the nets.

Thus it appears likely that TV will be developed in present basic markets where sales and population are most concentrated and where TV is already getting a foothold.

Regardless of the rapid progress television has been making, audio broadcasting has not been standing still. Since 1940 there has been a 62% increase in the number of AM sets. There are 73,000,000 sets in 37,600,000 radio families today. In addition, nearly 2,500,000 FM sets have been bought since January, 1947. Total billings by audio stations continue to hold up, but there is some worry evidenced by networks and individual stations as to the future trend as TV gets a stronger hold on family listening habits.

(Concluded on page 49)

TV MARKETS

(Continued from page 25)

NEW JERSEY

ATLANTIC CITY					
A-H	Atlantic City Tele. Bcstg. Co.	8	1	1	500
A-H	Neptune Bcstg. Corp.	8	1	500w	415
A-H	Press-Union Pub. Co.	8	1	500w	378
TRENTON					
A	Trent Bcstg. Corp.	8	1	500w	252

NEW YORK

ALBANY					
A-H	Hudson Valley Bcstg. Co.	7	2.4	1.2	1171
A-H	Meredith Champlain Tele.	9	12	6	864
A-H	Patroon Bcstg. Co.	9	29.6	14.8	1007
A-H	The Press Co.	2	15.1	7.6	353
A-H	Van Curler Bcstg. Co.	9	8	5	1061
BUFFALO					
A-H	Bcstg. Foundation, Inc.	9	30.8	16.2	388
A-H	Buffalo Courier Express	7	25.6	27.2	487
A-H	New England Tele. Co.	9	20	10	552
A-H	WGR Bcstg. Corp.	9	30.4	15.2	472
CORNING					
A	Corning Leader, Inc.	9	650w	660w	595
ELMIRA					
A	Elmira Star Gazette, Inc.	9	2.9	1.4	704
ITHACA					
A	Cornell University	4	13.6	6.8	847
NIAGARA FALLS					
A-H	Niagara Falls Gazette	9	23.1	11.6	423
ROCHESTER					
A-H	Meredith Pub. Co.	11	37.6	18.8	465
A-H	WARC, Inc.	11	36.1	18.	534
A-H	WHEC, Inc.	2	22.4	11.2	386
TROY					
A-H	Troy Bcstg. Co.	9	10	6.8	924
A-H	Troy Record Co.	11	31.1	15.5	824

NORTH CAROLINA

CHARLOTTE					
A-H	Inter-City Adv. Co.	11	2.8	1.4	460
A-H	Radio Station WSOC, Inc.	9	25.5	12.8	443
A-H	Surety Bcstg. Co.	9	27.8	14	442
GREENSBORO					
A	Greensboro Bcstg. Co. WTLE	10	2.8	1.1	397
HIGH POINT					
A	Radio Station WMFR, Inc.	12	1	.7	379
RALEIGH					
A	WPTF Radio Co.	5	16.6	8.3	621

OHIO

AKRON					
A-H	Allen T. Simmons	11	28.3	14.2	372
A-H	Summit Radio Corp.	11	31	16.4	310
BELLAIRE					
A-H	Tri-City Bcstg. Co.	12	27	13.5	538
CANTON					
A	Bursh-Moore Newspapers	7	24	12.6	442
CINCINNATI					
A-H	Allen B. Du Mont	2	31.2	33.7	522
CLEVELAND					
A-H	Cleveland Bcstg., Inc.	2	15.5	7.8	636
A-H	Allen B. Du Mont	2	14.9	7.5	786
A-H	United Bcstg. Co.	7	32	16	774
A-H	WGAR Bcstg. Co.	7	11	6.6	568
A-H	WJW, Inc.	2	15.3	7.9	595
TOLEDO					
A-H	Maumee Valley Bcstg. Co.	11	17.7	8.8	520
A-H	Toledo Blade Co.	10	31.8	17	439
YOUNGSTOWN					
A-H	Mansfield Radio Co.	13	20	10	512
A-H	Vindicator Printing Co.	13	23.6	26.2	700
A-H	WKBN Bcstg. Corp.	13	23.4	11.7	509

OKLAHOMA

OKLAHOMA CITY					
A	KOMA, Inc.	5	17.3	8.6	490
A	Mid-South Tele. Bcstg. Co.	5	16.6	8.3	482
A	Okla. City Tele. Co.	9	29.5	14.7	462
A	Southwestern Pub. Co.	9	29.5	14.9	525
TULSA					
A-H	Public Radio Corp.	10	26.9	13.5	369
A-H	Tulsa Bcstg. Co.	8	18.5	9.2	263
A-H	Tulsa Tele. Co.	10	18.3	9.1	498
A-H	Southwestern Pub. Co.	8	24.1	12.7	520
A-H	Southwestern Sales Corp.	8	31	15.3	399

OREGON

PORTLAND					
A	KOIN, Inc.	8	22.2	11.7	1401
A	KPOJ, Inc.	12	2.8	1.4	1037
A	Edward Lasker	10	30	15	2768
A	Oregonian Pub. Co.	6	10	11.2	984
A	Westinghouse Radio Sta.	10	8.5	4.2	974

PENNSYLVANIA

ALLENTOWN					
A-H	Lehigh Valley Bcstg. Co.	8	440w	324w	727
A-H	Penn-Allen Bcstg. Co.	8	376w	188w	773
A-H	Tri-City Telecasters, Inc.	8	700w	500w	626
ALTOONA					
A	Central Pa. Corp.	9	3.1	1.5	1095
A	Gable Bcstg. Co.	9	7	3.5	1048
BETHLEHEM					
A-H	Philco Tele. Bcstg. Corp.	8	2.6	1.6	829
EASTON					
A-H	Eastan Pub. Ca.	8	450w	450w	753
ERIE					
A	Presque Isle Bcstg. Ca.	3	1	.8	431
HARRISBURG					
A-H	Harold O. Bishop	8			
A-H	WHP, Inc.	8			
HAZELTON					
A	Hazletan Bcstg. Co.	2	210w	105w	677
MEADVILLE					
A	Meadville Bcstg. Svc.	13	2.5	1.2	580
PHILADELPHIA					
A-H	Daily News Tele. Co.	12	19.4	9.7	403
A-H	Pa. Bcstg. Co.	12	28.8	14.4	488
PITTSBURGH					
A-H	Allegheny Bcstg. Corp.	8	30.8	16.2	489
A-H	Matta Bcstg. Co.	10	27.6	13.8	546
A-H	Pittsburgh Radio Supply	10	26.6	13.3	444
A-H	United Bcstg. Corp.	10	31	15.5	265
A-H	WCAE, Inc.	10	23	12	804
A-H	Westinghouse Radio Sta.	6	24.9	24.9	670
A-H	WWSW, Inc.	10	23.8	11.9	721
READING					
A-H	Eastern Radio Corp.	5	630w	330w	632
A-H	Hawley Bcstg. Co.	5	400w	338w	739
SCRANTON					
A	Appalachian Co.	7	2.8	1.5	841
WILKES-BARRE					
A-H	Louis G. Baltimore	11	4.5	2.5	948
A-H	Wyoming Valley Bcstg. Ca.	11	8	8	230
WILLIAMSPORT					
A	Central Pa. Corp.	13	3.6	1.8	1291
A	WRAK, Inc.	13	3.1	1.6	558
YORK					
A-H	Helm Coal Co.	8	700w	488w	549
A-H	Susquehanna Bcstg. Co.	8	775w	388w	558

RHODE ISLAND

PROVIDENCE					
A-H	Cherry & Webb Bcstg. Co.	13	23.1	24.8	616

SOUTH CAROLINA

GREENVILLE					
A	Greenville News-Piedmont	10	27.8	13.9	1187

TENNESSEE

MEMPHIS					
A	Bluff City Bcstg. Co.	5	14.4	7.2	380
A	Mid-South Tele. Bcstg. Co.	9	19.2	13.7	513
A	WMPS, Inc.	9	25.8	12.9	420
A	WREC Bcstg. Service	7	24	12	435
NASHVILLE					
A	Capitol Bcstg. Co.	9	28.6	14.3	290
A	WLAC Bcstg. Service	7	16	14.2	746
A	WSIX Bcstg. Station	5	17.1	7.4	744

TEXAS

AMARILLO					
A	Amarillo Tele. Co.	5	1.8	825w	461
AUSTIN					
A	Austin Tele. Co.	8	4.2	2.1	455
BEAUMONT					
A	Lufkin Amusement Co.	10	28.4	14.2	485
CORPUS CHRISTI					
A	Corpus Christi Tele. Co.	6	19.7	9.8	417
DALLAS					
A-H	A. H. Belo Corp.	12	30	16	420
A-H	Texas Television	10	30.2	16	415
A-H	City of Dallas	10	24.9	12.4	564
A-H	Variety Bcstg. Co.	2	16.5	8.3	507
FORT WORTH					
A	Tele. Enterprises	10	25.2	12.6	504
HOUSTON					
A-H	Harris Cy. Bcstg. Co.	5	18.2	9.6	459
A-H	Texas Tele. Co.	7	19.2	19.2	498
A-H	Houston Post Co.	4	14.5	7.2	426
A-H	KTRH Bcstg. Co.	5	17.9	8.9	454
A-H	Shamrock Bcstg. Co.	7	30.4	15.2	502
SAN ANTONIO					
A	Express Pub. Co.	7	26.2	13.1	342
A	Walmac Co.	9	22.7	11.4	587
A	Mission Bcstg. Co.	12	21.9	10.9	463
WACO					
A	Waco Tele. Co.	6	2.3	1.1	353
WICHITA FALLS					
A	Wichita Falls Tele. Co.	8	2.7	1.4	460

UTAH

SALT LAKE CITY					
A	Edward Lasker	7	30	15	919
A	Salt Lake City Bcstg. Co.	7	50	25.4	372
A	Utah Bcstg. Co.	2	15.4	7.7	38

VIRGINIA

NEWPORT NEWS					
A	Hampton Roads Bcstg. Corp.	7	23.9	12.6	416
NORFOLK					
A	Commonwealth Bcstg. Corp.	13	19.4	19.4	409
A	Tidewater Tele. Co.	11	2.8	1.4	177
A	WTAR Radio Corp.	4	24.2	12.1	367
RICHMOND					
A-H	Larus & Bro. Co.	10	23.5	11.7	500
A-H	Lee Bcstg. Co.	10	27.3	13.6	348
A-H	Richmond Radio Corp.	3	17.1	8.6	362
A-H	Southern Bcstrs., Inc.	8	18.5	19.3	546

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TV MARKETS

(Continued from page 48)

WASHINGTON

SEATTLE					
A-H	Fisher's Blend Station	2	16.7	8.3	513
A-H	KING Bcstg. Co.	7	28.1	14.1	1584
A-H	Edward Lasker	7	20	15	3200
A-H	Queen City Bcstg. Co.	11	30.4	15.3	1426
A-H	Totem Bcstrs., Inc.	7	26	13.8	1260
A-H	20th Century-Fox of Wash.	11	26.9	13.4	749
TACOMA					
A	Tele. Tacoma, Inc.	4	12	6	291

WEST VIRGINIA

CHARLESTON					
A	Charleston Tele., Inc.	7	26.5	14	568
A	Charleston Bcstg. Co.	13	27.2	13.6	582
WHEELING					
A-H	W. Va. Bcstg. Corp.	12	32.5	17.1	598

WISCONSIN

MADISON					
A-H	Badger Bcstg. Co.	9	3	1.4	337
A-H	Radio Wisconsin, Inc.	9	26.8	13.4	515
MILWAUKEE					
A-H	Hearst Radio, Inc.	10	28	15	439
A-H	Milwaukee Bcstg. Co.	6	28	14	479
A-H	WEXT, Inc.	6	16.8	8.8	408
A-H	Wisconsin Bcstg. Sys., Inc.	8	26	13	482

TELEVISION PLANNING

(Continued from page 46)

Television is bound to cut in not only on AM but on other media, because it basically incorporates important features of all other media. This should give TV a real advantage in attracting the advertising dollar if it can, at its substantially higher cost, produce sales at a lower cost. We believe that TV is going to be an important adjunct to other established media because it supplements their values and should intensify their combined use. TV will intensify audio advertising, and there is no reason why advertisers cannot combine both video and audio in their advertising plans.

There is one important value in TV's threat to other media. Because it is a virile, new advertising medium, it is going to spark other media to better performance competitively. This is good for all advertising.

STEPPING SWITCHES

(Continued from page 34)

Although differing in circuit details, the equipment shown in Fig. 11 converts line impulses into control functions by a method basically similar to the 2-digit system illustrated in Fig. 6. For the 10's switch, the Teleregister equipment utilizes a spring-driven switch instead of the direct-drive type in Fig. 6.

Special Control Systems: From the examples given, it is obvious that endless variations of these basic circuits can be worked out. By transmitting different audio frequencies, and using corresponding filters at the receiving end, additional selective functions can be controlled.

Reversing the usual method of operation, each function of a remote radio installation can be checked at intervals set by a time clock, and its condition reported to a signal-light board controlled

(Continued on page 50)

STEPPING SWITCHES

(*Continued from page 49*)

by stepping switches at the headquarters office.

In fact, engineers skilled in stepping-switch circuitry can devise means for controlling and reporting back any number of functions, to any degree required.

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Even When It's "Hotter Than The Hinges—"

Mallory Capacitors Will Maintain Their Rated Capacity

You don't expect a radio set to heat up above 150°F. but it's good to know that, should the temperature rise for any reason, Mallory Capacitors will operate at 185°F.

It's good to know Mallory Capacitors hold their capacity while in use—as shown by the table below. It's good to know that they do not lose their capacity under high temperature operation, on the shelf, or in sets that are idle. The carefully guarded purity of materials and protection against contamination during manufacture permit them to withstand long periods of inactivity without reaging.

Mallory turns out capacitors by the millions—but in spite of this volume production, Mallory checks and tests so that you will get the quality you expect from every Mallory Capacitor. Look to Mallory for Capacitors, Vibrators and Volume Controls that will have all the top qualities of performance plus ease of installation and the assurance of customer satisfaction.

No better proof could be offered than the test results below . . .

THE MALLORY "GOOD SERVICE FOR GOOD BUSINESS" PLAN

will increase business and profits in your shop.

A unique follow-up file makes it easy to keep customers.

You tie in with Mallory acceptance to develop new business—ask your distributor about it.

2,000 HOURS OF OPERATION

An actual test of Mallory capacitors operated in an oven at 185°F. and 450 volts DC. plus 10 volts of 120 cycle ripple, showed them still going strong and with increased capacity at the end of 2,000 hours. Typical results:

At Start of Test		*After 2,000 Hours*	
Capacity	*Resistance*	*Capacity*	*Resistance*
20.9 mfd	6.16 ohms	23.5 mfd	6.5 ohms
20.1 mfd	6.5 ohms	23.4 mfd	6.55 ohms

BUY MALLORY ASSURED QUALITY AT REGULAR PRICE LEVELS

P. R. MALLORY & CO., Inc.

MALLORY

CAPACITORS . . . CONTROLS . . . VIBRATORS . . .
SWITCHES . . . RESISTORS . . . RECTIFIERS . . .
VIBRAPACK* POWER SUPPLIES . . . FILTERS

*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

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