Price 25 Cents June '50

FM—TV RADIO COMMUNICATION

★ ★ Edited by ★ ★
Milton B. Sleeper

MORE FM PROFITS FROM
Controlled Commercials

FEATURED IN THIS ISSUE:
Portfolio of High-Fidelity Custom Installations

10th Year of Service to Management and Engineering

VARIACS

for HIGH Power

WITH the Type 50-A or Type 50-B VARIAC quite large currents for high power operation can be handled safely and conveniently. The **Type 50-A** VARIAC is rated at 5 kva; its rated output current is 40 amperes, with a maximum of 45; its output voltage is continuously adjustable from zero to a maximum of either 115 or 135 volts from a 115-volt line. **Price: $140**

The **Type-50-B,** designed for 230-volt input, may be used on a 115-volt line. With 230 volts input it is rated at 7 kva with a rated current of 20 amperes and a maximum of 31. With 115 volts across one-half of the winding the ratings are reduced to one-half of these values. The output voltages are either zero to 270 or zero to 230 volts. **Price: $140**

Two **Type 50-A's** ganged, with their windings in parallel and with a suitable choke, are rated at 10 kva with rated and maximum currents of 80 and 90 amperes respectively. The ganged assembly is the **Type 50-AG2. Price: $310. Type 50-P1 Choke: $10**

Two Type 50-B's, when similarly used on 230 volts are rated at 14 kva with 40 and 62 ampere current ratings. This assembly is the **Type 50-BG2. Price: $310. Type 50-P1 Choke: $10**

With two or three Type 50 VARIACS a number of three-phase connections are possible. Various powers up to 25 kva can be handled.

These larger VARIACS are proving indispensable in hundreds of uses where the economical operation, convenient rotary control, excellent regulation and high efficiency of the VARIAC are desired to vary continuously the voltage on any high-power a-c operated machine or device.

MAY WE SEND YOU A COPY OF THE "VARIAC BULLETIN"?

GENERAL RADIO COMPANY Cambridge 39, Massachusetts

90 West St., New York 6 920 S. Michigan Ave., Chicago 5 1000 N. Seward St., Los Angeles 38

ZENITH DEALER PHIL GETH SAYS:

"Zenith is more than a profit builder – It's the top traffic builder in my business!"

Yes, thousands of dealers agree with *Mr. Phil Geth, Zenith dealer at 207 East 93rd St., Brooklyn, New York!* When it comes to building traffic there's no better way than with Zenith*. For Zenith's long list of "Famous Firsts" have a happy habit of capturing a customer's fancy—and sending him into the nearest Zenith dealer's store. These "Famous Firsts" not only help you sell Zenith, but also boost profits on your complete line of merchandise. And because your sales records rise or fall in direct proportion to the traffic you draw, it'll pay you to feature these crowd-pulling "Famous Firsts" in your store. Display, demonstrate and sell Zenith for bigger-than-ever profits the year around!

Zenith "The Von Buren" TV-Radio-Phonograph . . . 105 sq. in. Giant Circle Screen . . . 3-way automatic record playing of all sizes . . . all speeds . . . FM-AM radio. Genuine Mahogany veneer "Queen Anne" cabinet.

$489.95† *(plus Federal Excise Tax)*

Look at the Record! ZENITH "Foremost Firsts"

in Radio

First All-Metal Chassis. Zenith was first with a genuine all-metal chassis and today still leads the industry in this important engineering feature.

First Single Knab Tuning. It took a lot of fussing with a lot of knobs to tune a radio until Zenith gave America single knob tuning.

First Super-Efficient Built-in AM and FM Antennas. Zenith antenna developments include the famous Wavemagnet* . . . the detachable Wavemagnet . . . and the built-in Light-Line FM antenna.

First and Only Record Reproduction with Cobra* Tone Arm. No other tone arm reproduces tones as the Cobra does! It plays records of all speeds, all types of grooves, with a single long-life stylus.

First Super-Sensitive FM. Zenith is first with this revolutionary FM reception, operating efficiently on signals too weak to be heard on many ordinary FM sets. Provides reception from more stations in most locations.

*Reg. U. S. Pat. Off.

in Television

First with the Giant Circle Screen. Zenith was first to offer the largest possible picture in relation to tube size. Now with Picture Control for a choice of circular or rectangular type picture!

First in Tuning Ease. Zenith's famous Turret Tuner with one knob automatic tuning has been a feature of every Zenith Television receiver. No more fiddling with many knobs!

First with Built-In Provisions for Receiving Ultra-High Frequencies. The Zenith Turret Tuner was first with built-in provision for receiving the proposed ultra-high frequencies on present standards without a converter.

First with the "Black Magic" Blaxide Picture Tube. Zenith was first to give you startling new life-like picture quality without annoying reflections, glare or blur, even in normally lighted rooms! Medical authorities recommend this way to view television!

Zenith "The Lincoln" Television Console . . . . 165 sq. in. Giant Circle Screen . . . sensational "Super Range" Chassis . . . new "Reflection-Proof" feature . . . "Black" picture tube. Genuine Mahogany Veneer Cabinet.

$359.95† *(plus Federal Excise Tax)*

New Zenith "Hollywood" Console Radio-Phonograph. New 3-speed Cobra automatic changer . . . new Super-Sensitive FM and Long-Distance* AM. Modern blonde cabinet of imported Gold Coast Afara.

$289.95†

New Zenith "Century" Table Radio-Phonograph. New 3-speed Cobra Automatic Changer. Famous Long-Distance AM radio. Genuine Mahogany or Walnut cabinet.

$119.95†

FIRST FROM ZENITH

The great features . . . the great values

These "Famous Firsts" and the quality *built into* every Zenith are your positive assurance that the profits you make on Zenith sales are profits you can keep. They aren't dissipated in excessive service, rebates and other costly attempts to pacify dissatisfied customers.

†Suggested retail price. Price subject to change without notice. West Coast and far South price slightly higher.

ZENITH *LONG DISTANCE RADIO and TELEVISION

THE ROYALTY OF RADIO AND TELEVISION

NOW! ONE FULL WATT ANTENNA POWER

littlefone

Increased Range Portable FM Radiotelephone

PJZ–4	PJZ–14
25–50 MC	152–174 MC
*PJZ–2	*PJZ–12

Complete, self-contained 2-way radio station, weighing only 14 lbs. . . . with output of *one full watt!* Has 10-tube FM transmitter and ultra-sensitive 12-tube receiver in one compact, crystal controlled unit . . . ready for immediate 2-way operation. Powered by Wet Rechargeable Batteries. Gives 8 hours continuous service between charges which can be made from car battery or 115 Volts AC.

The *littlefone* complies with FCC regulations for low power industrial radio service. Gives remarkable coverage between units or when used with a fixed station or mobile equipment. Opens vast new opportunities for the effective use of 2-way radio communications. Enables constant contact between and with men in the field. Provides new efficiency and flexibility in field operations of emergency radio. public services. transportation. and industry. Available in *hand carry* and *back pack* models. Easy to carry. Simple to operate. Thoroughly dependable.

Dry Bottery Operation is Optional

"SQUELCH" is Available on All Models

Models PJZ-4 and PJZ-14
one-watt *littlefone:*
11" x 8¼" x 3¼"
weight, only 14 lbs.

* Models PJZ-2 and PJZ-12
half-watt *littlefone:*
8¾" x 8¼" x 3¼"
weight, only 10 lbs.

Doolittle RADIO, INC.

Builders of Precision Radio Communication Equipment

7421 S. LOOMIS BLVD. CHICAGO 36, ILLINOIS

FM-TV

Formerly, *FM* MAGAZINE, and *FM* RADIO-ELECTRONICS

VOL. 10 JUNE, 1950 NO. 6

CONTENTS

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Published by: FM COMPANY

Publication Office: 264 Main St., Gt. Barrington, Mass. Tel. Gt. Barrington 500

Chicago Office: Louis Reinig, 176 W. Adams St. Tel. Andover 3-5585

FM-TV Magazine is issued on the 10th of each month.

Subscriptions: Should be addressed to 264 Main St., Great Barrington, Mass.

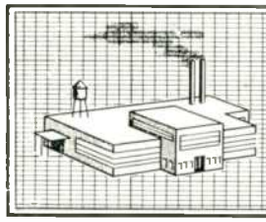
Single copies 25c—Subscription rate: $6.00 for three years, $3.00 for one year in the U. S. A.—Canada, add 50c per year postage—foreign, add $1.00 per year postage.

Contributions will be neither acknowledged nor returned unless accompanied by adequate postage, packing, and directions, nor will *FM-TV* Magazine be responsible for their safe handling in its office or in transit.

Entered as second-class matter August 22, 1946, at the Post Office, Great Barrington, Mass., under the Act of March 3, 1879. Additional entry at the Post Office, Boston, Mass. Printed in the U. S. A.

CPA AUDIT

CIRCULATION AUDITED BY
HENRY R. SYKES,
CERTIFIED PUBLIC ACCOUNTANT
SYKES, GIDDINGS & JOHNSON
PITTSFIELD, MASSACHUSETTS



Set Production

PRODUCTION of TV receivers during the five-week month of March set an all-time record of 525,277, according to the RMA report. These continued gains are giving rise to the speculation as to when TV will take over completely from audio broadcasting. However, FM and AM production figures do not indicate that such a shift has set in.

Surprisingly, audio receiver production, both AM and FM, are climbing, too, and in the first quarter of 1950 both have substantially exceeded the average monthly production of '49.

One clue to the TV situation can be found in the complaints being voiced by the tavern-keepers. "People used to go to taverns to drink beer. Now they have television sets, so they stay home. Maybe they still drink beer, but they aren't buying it from us." So you can add the taverns to the list of places where fewer people go now because they have television at home, and the package stores to the TV benefit list.

It is reassuring, however, to find that TV is not gaining at the expense of audio broadcasting. As *Printer's Ink* pointed out recently, surveys show that the number of audio listeners is increasing in some TV areas!

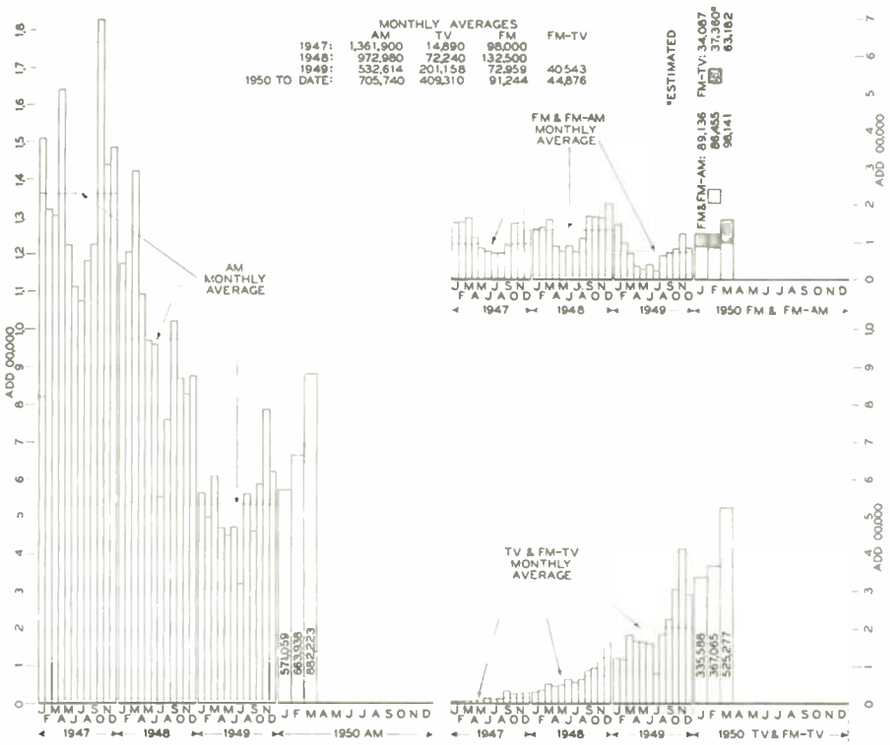
This is certainly confirmed by our Production Barometer. FM sets climbed to 98,141, plus a very large but unrecorded number of chassis for custom installations, and AM sets totalled 882,223, of which about 65% were portable and automobile types.

Picture tubes registered a further shift to larger sizes in March. Of those sold to manufacturers, 37% were 14 ins. and larger, and 98% were 12 ins. or more in size. Sales to manufacturers in March amounted to 642,986, up 115,797 over February, and slightly above first-quarter sales of 1949.

March sales of receiving tubes set an all time record of 33,663,494, exceeding February by 8,797,948. This was more than double March, 1949. First-quarter total was 80,801,064, compared to 40,658,043 for the same period in '49.

The breakdown in March showed 26,274,558 tubes sold for new receivers, 6,102,167 for replacements, 1,204,765 for export, and 82,004 going to Government agencies.

Dollar value was $15,588,979. All types of cathode-ray tubes sold in March, including oscillograph and camera pickup types, came to 676,523 units valued at 816,539,346.



TV, FM, and AM Set Production Barometer, prepared from RMA figures

THIS MONTH'S COVER

The use of supersonic signals to emphasize or eliminate commercials is enabling FM broadcasters to perform a variety of services that AM stations cannot duplicate. For example, music can be furnished to competing store chains, but only the appropriate commercials are heard over the speakers in each store. Reaction of home listeners to the music programs and moderate commercials has been favorable. This month's cover shows one of the Jewell stores in Chicago where Multipulse receivers and supersonic controls are used for point-of-sale promotion.

SPOT NEWS NOTES

ITEMS AND COMMENTS, PERSONAL AND OTHERWISE, ABOUT PEOPLE AND COMPANIES CONCERNED WITH RADIO COMMUNICATIONS

FCC Shift:

Effective May 17, Cyril M. Braum was named Chief of the Television Broadcast Division, succeeding Curtis B. Plummer, who is now Chief Engineer of the Commission. Simultaneously, the FM and AM Broadcast Divisions were merged into a new Aural Broadcast Division, headed by James E. Barr, former Chief of the AM Broadcast Division.

Color Tube Patent:

Has been issued to Du Mont Laboratories, covering an invention by Henry Kasperowicz of that company. Using a screen with dots of fluorescent material producing red, blue, and green colors, this tube can be used in any field, dot, or line sequential system.

Glenn H. Browning:

The honorary degree of Doctor of Science will be conferred upon the president of Browning Laboratories by his alma mater, Cornell College, Mt. Vernon, Ia., on June 12.

Something New Added:

Committee meetings during RMA Convention at Chicago, as listed in a press release dated May 12, include an 8:00 P. M. session of the SEX Executive Committee, with A. N. Curtiss as chairman. We don't know what the initials mean, but they probably relate to previewing the floor show which Les Muter has organized for the RMA banquet, following an address by FCC Chairman Coy.

Small Oscilloscope:

A new wide-band Pocketscope, model S-14-B, has been released by Waterman Products, Inc., 2445 Emerald Street, Philadelphia 25. Performance of this unit has been improved greatly, and its small size makes it convenient for many uses in adjusting and servicing audio and TV equipment.

Stomach-Warmer:

We've had a number of inquiries asking: How did you get the cats to pose on the radio set while you took the May cover photograph? It was easy. They spend a lot of time on the 646-B. When it's turned on, the gentle heat of the metal case makes it a pleasant place for them to warm their stomachs. Maximum seating capacity is three cats, if they all lie still. There was one trick to taking this picture: Nu Nu and Duke had been well fed with liver. Photographer was Charles Fowler, our business manager.

No. 1 Messerupper:

CBS has a most remarkable record of success in having its own way, to the disadvantage of others, or stirring up trouble wherever its policies are not permitted to prevail. This record goes back to the shift in FM frequencies, the uniform market coverage plan, and grouping FM frequencies at one section of receiver dials, to its present participation in color TV. Now, unable to prevail in the management of NAB, it has resigned from the broadcasters' trade association.

Robert J. Cannon:

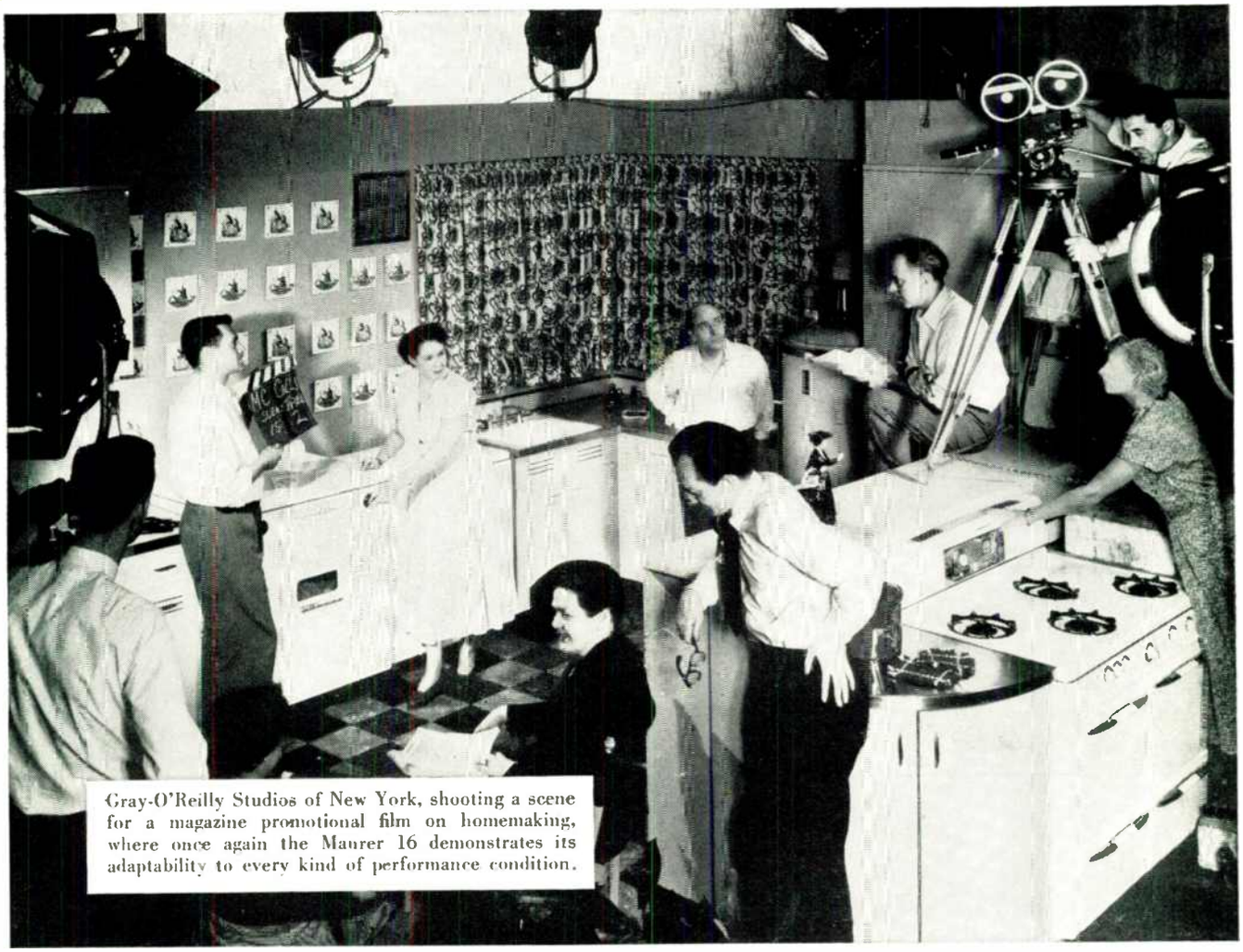
Elected president and treasurer of Cannon Electric Development Company, Los Angeles. He succeeds his father, James H. Cannon, who passed away recently. The new president has been active in the Company since 1934, and has served as vice president and general manager since 1942.

Data on Components:

A great number and variety of items are

(Continued on page 8)

Maurer VERSATILITY on the job!



Gray-O'Reilly Studios of New York, shooting a scene for a magazine promotional film on homemaking, where once again the Maurer 16 demonstrates its adaptability to every kind of performance condition.

Whatever the locale . . . the steaming heat of a tropic jungle, or the spotless test kitchen of a leading woman's magazine . . . you can count on the Maurer 16 mm. camera to deliver the same superb results.

This versatility in performance stems from absolutely precise registration of every frame, insured by the exclusive Maurer intermittent movement. It stems, too, from Maurer flexibility and ease of operation . . . and from a reputation for dependability based on the industry's highest, most advanced standards.

Facts such as these explain why so many top-flight cameramen have come to rely on MAURER equipment, and the 16 mm. camera, the only 16 designed for professional use.

For details on the many *exclusive* Maurer features, write: Dept. G

The Model F Prime Recording Optical System and Galvanometer is a light modulating unit for recording sound photographically upon standard film. This system requires no special servicing or spare parts (other than recording lamp). Detailed instructions for mounting in your recorder are included.

J. A. Maurer, INC.
37-01 31st Street, Long Island City 1, N. Y.
850 South Robertson Blvd., Los Angeles 35, California

16mm maurer

CABLE ADDRESS: JAMAURER

SPOT NEWS NOTES

(Continued from page 6)

described in a new bulletin available from Alden Products Company, Brockton, Mass.

Railroad Radio:

Missouri Pacific will spend $100,000 for end-to-end radio on 26 trains. The order was placed with Motorola.

Norman E. Wunderlich:

Has been elected vice president and general manager of Link Radio, in charge of all company activities. He formerly headed Motorola's communications division until he joined Federal. In 1948 he returned to Chicago where, for the last year, he has been in charge of Link's midwest office.

RF Coils and Chokes:

Shallcross Manufacturing Company, Collingdale, Pa., is now producing a wide range of high-Q chokes and slug-tuned transformers, all made to customers' specifications.

Introducing Speakers:

Listening to so many speeches of introduction at so many meetings, luncheons and dinners, we are surprised that so few toastmasters and chairmen are acquainted with the correct form for use on such occasions. Some of the speeches we have heard are just plain awful. Others are positively embarrassing to the man who is introduced. The proper contents and form of a speech of introduction are set forth simply and concisely in Prof. R. C. Borden's book "Public Speaking as Listeners Like It," published by Harper & Brothers, 49 E. 33rd Street, New York, at $1.50.

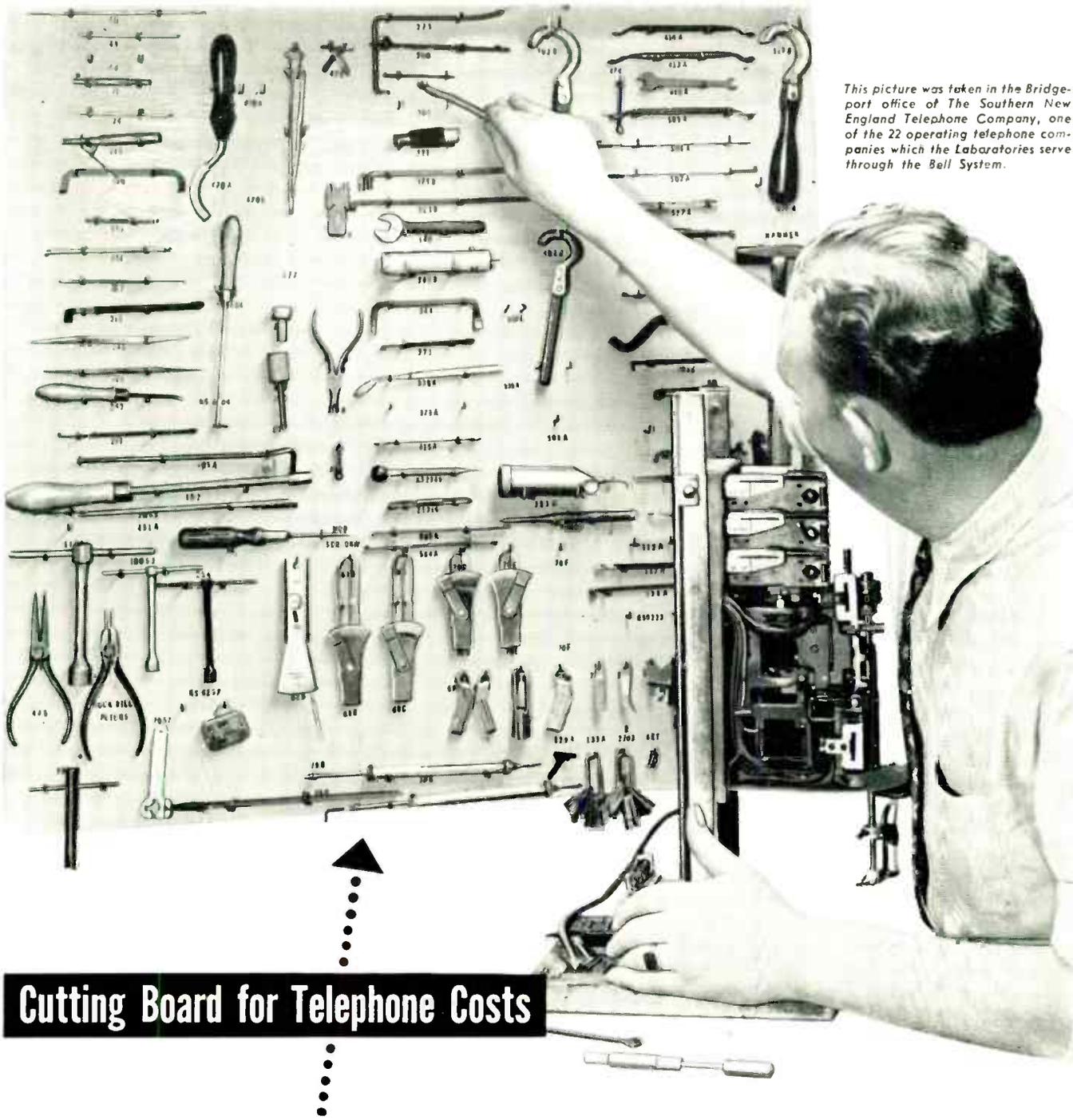
FM Set Sales:

Zenith reports FM sales running currently at 2½ times the volume of corresponding periods last year. Most popular model is priced at $79.95. Second in number sold is the $49.95 model, with the $59.95 type in third place, and the $39.95 straight FM in fourth place. Browning Laboratories reports a still greater increase this year over '49, with its straight FM chassis outselling the combined number of FM-AM units.

The Public Agreed:

Opinion poll taken on transitcasting at Tacoma, Wash., showed 96.7 per cent of riders favored this service, 1.2 per cent had no opinion, and 2.1 per cent were opposed. Said Max Bice of KTNT: "This was the largest number of people who ever agreed on anything the transit company has done!"

(Continued on page 10)



This picture was taken in the Bridgeport office of The Southern New England Telephone Company, one of the 22 operating telephone companies which the Laboratories serve through the Bell System.

Cutting Board for Telephone Costs

Few of these tools have sharp edges. But they are powerful cost cutters. Whenever a telephone craftsman reaches for one, he finds the right tool ready to his hand. There's no time wasted trying to do a complicated job with makeshift equipment.

Most telephone tools are highly specialized. 90% of dial system tools were designed by Bell Laboratories. Each saves time in maintenance, installation or construction.

There are tools with lights and mirrors to work deep within relay bays; tools to brush, burnish and polish; tools that vacuum clean — even a tool to weld on new contact points without dismantling a relay. There are gauges to time dial speeds, others to check spring tension. Some look like a dentist's instruments. Some you have never seen.

Keeping the telephone tool kit abreast of improvements is a continuing job for Bell Telephone Laboratories. It's another example of how the Laboratories help keep the value of your telephone service high, the cost low.

BELL TELEPHONE LABORATORIES

WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE BIG IN VALUE AND LOW IN COST

Professional Directory

SPOT NEWS NOTES

(Continued from page 8)

Howard T. Souther:

Has joined Electro-Voice, Inc., Buchanan, Mich., as manager of the speaker division. He will have charge of developing the new line of E-V high-fidelity speakers. Mr. Souther was formerly vice president of Stephens Manufacturing Company.

TV Studio Equipment:

A line of equipment designed for producing commercials and special optical effects in wide variety at nominal cost is illustrated in a bulletin just released by Gray Research & Development Company, 16 Arbor Street, Hartford 1, Conn.

Theodore H. Belden:

Appointed communications engineer for Motorola, to handle the Maine, New Hampshire, and Vermont territory.

WHO to Have 400 Kw. on FM:

Clear channel station at Des Moines will offset loss of coverage due to interference on AM by increasing FM power to 400 kw. next July.

Coil Weight Calculator:

The weight of a coil of steel strip can be determined almost instantly by the use of a disc calculator available without charge from Littell Machine Company, 4421 Ravenswood Avenue, Chicago 13. Given the inner and outer coil diameters and the width, the calculator shows the weight in pounds.

Color on Phonevision:

The answer is: Yes. Phonevision will work on any color system just as well as it does on monochrome transmission.

1949 Reference Index:

Fourth volume of the Electronic Engineering Master Index is now ready. It lists 8,500 articles and 4,000 patents under 600 headings, declassified reports on German and Japanese research, translations of Russian scientific literature, and U. S. and foreign text-books. Price is $17.50. Published by Electronics Research Publishing Company, 480 Canal Street, New York 13.

FM-TV Compatability:

FM and TV were described as physically and economically compatible by Robin Compton of WOIC-TV in his NAB address on the economics of television. Minimum operating cost is achieved by having transmitters at the same site and using the same tower for both antennas, while remote AM "tower farms" require extra personnel and expensive mainte-

(Continued on page 38)

Special Services Directory

PHONEVISION: HOW IT WORKS

THE METHOD OF OPERATION OF ZENITH'S SYSTEM WHEREBY FEES ARE CHARGEABLE FOR SPECIAL TELEVISION PROGRAMS, PART 1 — *By* ERWIN ROSCHKE*

PHONEVISION is a subscription system for television, used to provide high-quality, non-sponsored programs to subscribers on a fee basis. The system, developed by Zenith Radio Corporation, has been field-tested successfully in the Chicago area for the past three years. The purpose of this paper is to present the basic operating principles and design considerations of the Phonevision system, by which secrecy can be incorporated into any desired television transmission so that the modified signal from a conventional transmitter can be received as an intelligible picture only on a receiver supplied with a correcting signal by means of some type of auxiliary control circuit.

This secondary control link can be a twisted pair of wires, an electric power line, or an ordinary telephone line. The only requirement is that its use can be controlled at some point remote from the television receiver.

The purpose of a coded or secret television transmission is to make possible the broadcasting of special types of program material, which are not normally available to television stations because of excessive costs involved. Controlled distribution of the decoding signal makes it possible to charge for these special programs. In effect, it provides a box office for such programs.

Our method of incorporating secrecy or privacy in a video signal is to modify the original signal by producing a deliberate change in the phase relation of video to horizontal synchronizing signals. A key signal is sent to the television receiver via a second path when this change is to occur, so that a correction can be made for it.

In the system under discussion the video information is shifted erratically with respect to the horizontal synchronizing pulses. The shift introduced amounts to a small percentage of the horizontal sweep period. The picture is transmitted in either of two modes, in one of which the video information is normally phased with respect to the horizontal synchronizing pulses. In the other mode, a phase shift is introduced between the video and horizontal sync pulses. Changes from mode to mode are made at a random subfield rate. For example, for three or four fields the picture may be transmitted with a phase shift between video and synchronizing signals, followed by two fields with normal phase relationship. This mode-changing is entirely random, and is determined by a noise source so as to give secrecy to the system. The resulting picture with this type of transmission is one in which the image moves back and forth horizontally at a slow irregular rate, producing an annoying blurred effect.

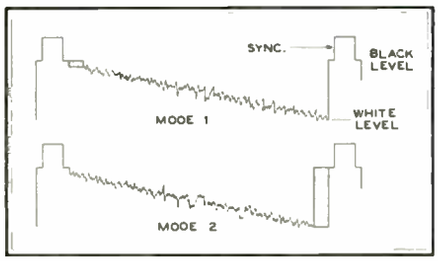


Fig. 2. Video shift changes the DC level

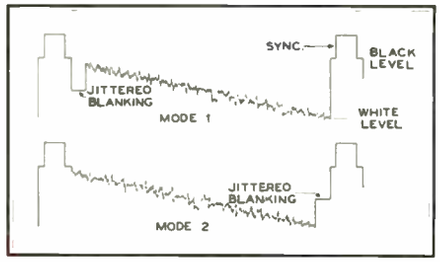


Fig. 3. Jittering holds correct DC level

The change of mode is accomplished during the vertical blanking period, thereby giving all circuits adequate time to stabilize. Accompanying one of the two modes of transmission is a key signal, consisting of a tone at any frequency substantially higher than the field frequency. This key signal is sent via a secondary link to Phonevision receiver.

At the receiver, the key information is used to trigger circuits which compensate for the phase shift introduced between video and horizontal sync pulses. Therefore, when the video is shifted with respect to the horizontal sync pulses, the start of the horizontal sweep in the receiver is correspondingly changed. Absence of the key signal indicates normal phase between the video and the horizontal sync pulses.

While a system can be made to operate in which the phase-shift is compensated for instantaneously on reception of the key signal, it seems more desirable to send the key from the transmitter a considerable time before its use is demanded at the receiver. In this way, small variations in the time-delay of the secondary control link can be neglected. An additional advantage is the limited bandwidth needed to transmit the key signal. This is important where the control link is to be used simultaneously for other services, such as transmission of speech.

*Phonevision Development Engineer, Zenith Radio Corp., 6001 Dickens Ave., Chicago 39, Ill.

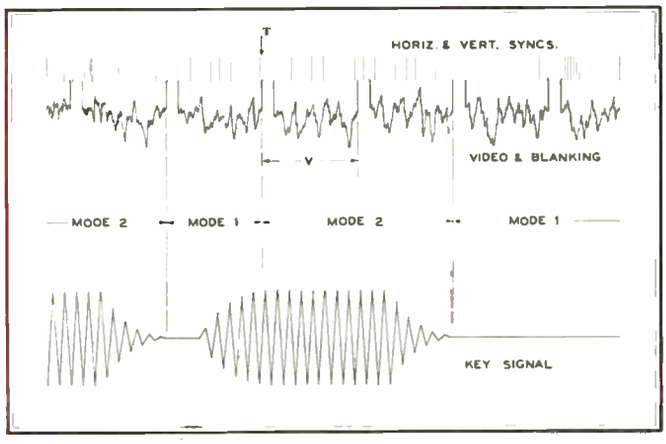


Fig. 1. Phase relationship of key signal to mode transitions

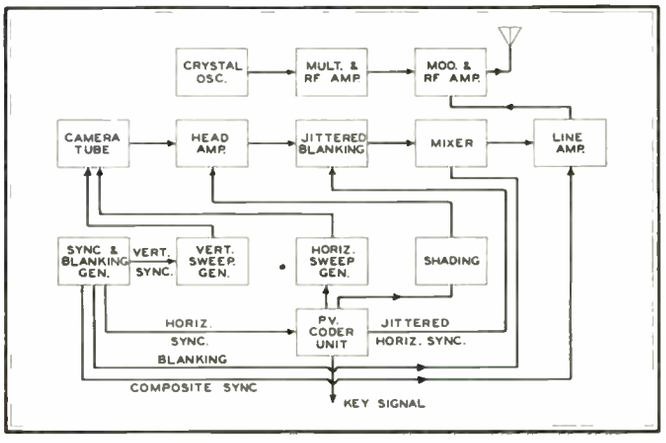


Fig. 4. Transmitter alterations necessary for Phonevision use

The system we are now using sends the key from the transmitter about 1/60th of a second, or one field, before it is actually used at the receiver. This is shown in Fig. 1. If the transition from one mode to another is to be made at T, the key signal is initiated almost a full field period preceding T. Circuits with adequate Q can be used in the key-generating equipment at the transmitter, so that the key signal builds up to full amplitude at approximately ¾ of a field period. In the receiver, a pulse derived from the vertical sweep circuit is combined with the key information so that the first vertical pulse present with the key, or the first vertical pulse in the absence of the key, initiates the transition between modes. Because of the length of time permitted for the key signal to reach full amplitude, the bandwidth required to pass this signal is only about 120 cycles. The highest possible keying rate is 30 times per second, and the lowest rate is adjusted to 10 per second or less.

Because of the varying phase of the video signal with respect to the blanking signal, there could be introduced low frequency components which would not normally be present in the video signal. How these low frequencies might be introduced can be understood by considering a waveform for a picture consisting of subject matter which is white on the right and black on the left, Fig. 2. In one mode, mixing of the video with the blanking signal will remove a portion of the video containing black information. In the other mode, a white portion of the signal will be removed. Study of Fig. 2 will make it evident immediately that this results in the introduction of low-frequency components. Correct transmission of such a signal would put an added burden on the studio amplifier, mixers, and transmitter. Special precautions would be required also to assure adequate low-frequency response in the receiver. Insertion of a jittering horizontal blanking in combination with the fixed blanking signal, Fig. 3, prevents the generation of these low frequencies, since video information of both modes is then identical. The jittered blanking is set at some intermediate gray level to give best results.

Those portions of the shading generator which are associated with horizontal shading are initiated by the same horizontal sync pulses which actuate the horizontal sweep in the pick-up tube. In the case of Phonevision, the coded horizontal sync pulse which causes the time displacement in video signal is fed also to the shading generator, so that the horizontal shading signal is shifted in phase with the video. In this way, any flicker which would be introduced because of video shift is eliminated at the start.

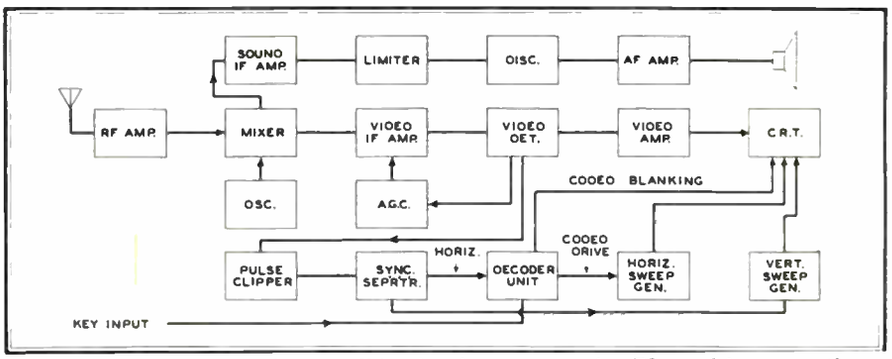


Fig. 6. Only slight receiver modification is necessary for Phonevision operation

The Phonevision Transmitter:

The circuits required to convert an ordinary TV transmitter to one capable of transmitting Phonevision pictures will now be considered. As shown in the block diagram, Fig. 4, a typical transmitter consists of an oscillator stage, RF amplifiers, multipliers, and a modulator. The heart of the studio gear is the synchronizing signal generator in which the sync pulses, both horizontal and vertical, and the blanking pulses are generated. Vertical sync pulses are applied to the vertical sweep circuits directly, with no change in this part of the circuit. However, the horizontal sync pulses, instead of being fed directly into the horizontal sweep-forming circuits, now pass through a coder unit which forms jittered synchronizing pulses. The camera tube output is fed into a head amplifier, where mixing of video signals with the shading signal is accomplished. The head amplifier feeds the jittered blanking unit, after which the signal passes to the mixer where steady blanking is added.

At this point, control over contrast and background setting is provided. The synchronizing and blanking generator supplies the composite sync signal to the video amplifier, where the video signal from the camera tube, plus the blanking signals, are mixed with the composite sync wave-form. This composite video signal is then fed to the modulator. The coder generates also the key signal, which is applied to the control link and distributed to Phonevision subscribers.

Fig. 5 is a block diagram of the coder unit for the system described. This unit can be broken down conveniently into four main sections, as indicated by the dashed lines. In the first section is the random key generator, by which positive secrecy is obtained in the system. The input to this part of the unit is the normal vertical drive, which is fed through an isolation stage and a phase control circuit to a blocking oscillator. Combined with the vertical pulse is the output of a noise generator. The combination of these two signals results in a pulse from the blocking oscillator occur-

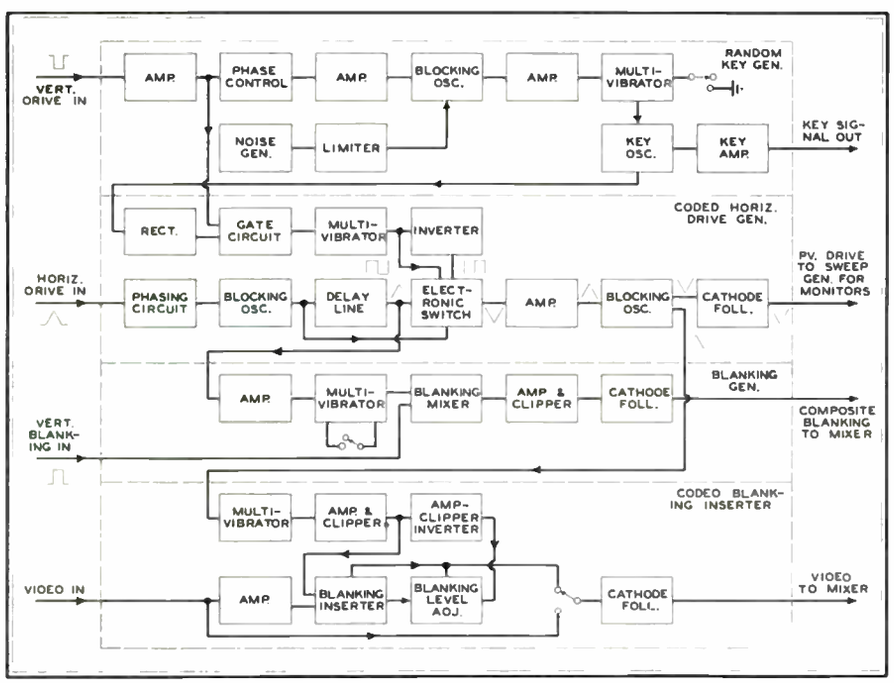


Fig. 5. Circuit components of the Phonevision coder unit, used at the transmitter

(Continued on page 48)

RCA TRI-COLOR PICTURE TUBES

EXPLAINING HOW THREE COLORS ARE OBTAINED USING DIRECT-VIEW KINESCOPES, AND THE RECEIVER CIRCUITS WHICH ARE EMPLOYED WITH THEM*

THE color television receivers demonstrated for the FCC incorporated two forms of the RCA tri-color kinescope, each of which employed the same type of direct-view color screen. In one of the tubes, three electron guns are used, the electron beams of which pass through the same tube neck and the same deflection yoke to strike the color screen. In the other, a single electron gun is used, again with a single deflection yoke. Both are fabricated in 16-in. metal cones, and produce pictures approximately 9 ins. by 12 ins. in size.

The direct-view color screen is composed of an orderly array of small, closely-spaced, aluminized phosphor dots, arranged in triangular groups. Each group comprises a green-emitting dot, a red-emitting dot, and a blue-emitting dot. In the laboratory sample tubes used in the demonstrations, there are 351,000 such dots, 117,000 of each color. The screen is viewed in the same manner as a conventional black-and-white direct-view kinescope.

The 3-gun Kinescope:

The manner in which the color screen produces a color picture is best understood by considering the operation of the three-gun tri-color kinescope first. An apertured mask is interposed between the three guns and the dot-phosphor screen in such a manner that the electrons from any one gun can strike only a single-color phosphor, no matter which part of the raster is being scanned.

The mask is a sheet of metal separated from the phosphor screen, and contains 117,000 holes, or one hole for each of the tri-color dot groups. This hole is so registered with its associated dot group that the difference in the angle of approach of the three oncoming beams determines the color. Thus, three color signals applied to the three guns produce independent pictures in the three primary colors, the pictures appearing to the eye to be superimposed because of the close spacing of the phosphor dots.

Insofar as the color effects are concerned, the three-gun tri-color kinescope can be utilized in a receiver in much the same manner as three single-color kinescopes except, of course, that no optical superposing or registration means are necessary, and deflection power need be provided for only one deflection yoke.

One of the new research-type receivers employs the three-gun tri-color kinescope and high-level sampling.[1] This single-kinescope receiver utilizes 46 tubes, and consists essentially of a 27-tube black-and-white television receiver to which have been added 19 tubes for color synchronization, sampling, and power.

The Single-gun Kinescope:

Operation of the single-gun kinescope is analogous to the operation of the three-gun tri-color kinescope, in that the beam from the single gun is rotated magnetically so that, in effect, it occupies in time sequence the three positions of the guns in the three-gun kinescope. Thus, when the beam is in a position corresponding to the green gun of the three-gun kinescope, it excites only the green phosphor dots and is at this particular time modulated only by the green component of the video signal. A short time later, the beam has been rotated to a position corresponding to the red gun of the three-gun kinescope, and is modulated by the red component of the video signal to excite the red phosphor dots. A third position produces the blue picture similarly. Sampling is provided automatically by rotating the beam synchronously at the sampling frequency.

The research receiver employing the single-gun tri-color kinescope utilizes 37 tubes, and consists essentially of a 27-tube black-and-white television receiver to which have been added 10 tubes for color synchronization, beam rotation, and additional power supplies.

Receiver for the 3-gun Kinescope:

Fig. 1 is a block diagram of the circuit arrangement employed in the receiver utilizing the three-gun tri-color kinescope. Video signals from a conventional black-and-white television receiver are applied simultaneously to the three internally-connected control grids of the three-gun kinescope. Another signal, derived from the video amplifier, is used to actuate an automatic color-phasing and sampling synchronizing circuit. This produces a local 3.58-mc. sampling wave, which is applied through an amplifier tube and appropriate delay lines to three gating tubes. These in turn supply three sampling pulses, differing in phase by 120 degrees, to the three cathodes of the kinescope. Thus, each gun is turned on in time sequence corresponding to the original sampling process at the transmitter, and the beam current from each gun excites its phosphor color at the proper time.

The tuning arrangement in the plate circuit of the 3.58-mc. sampling-signal amplifier, Fig. 1, permits fine adjustment of the overall color-phasing. However, proper color-phasing is determined essen-

(Continued on page 36)

[1]See "How RCA's Color Television Works," *FM-TV* Magazine, October, 1949.

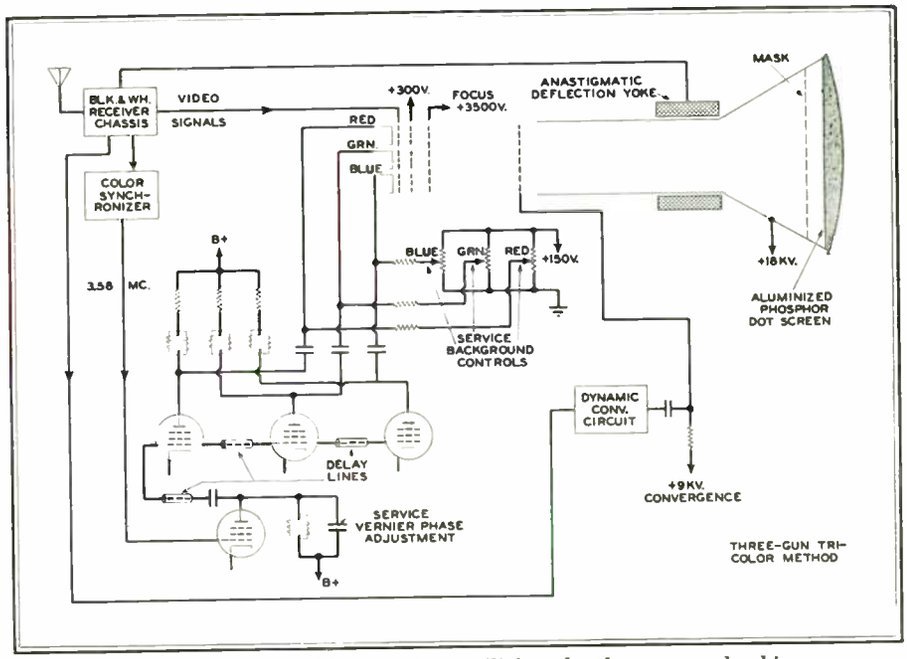


Fig. 1. Circuits employed in a receiver utilizing the three-gun color kinescope

*From a report filed with the FCC by RCA Laboratories Division on April 4, 1950.

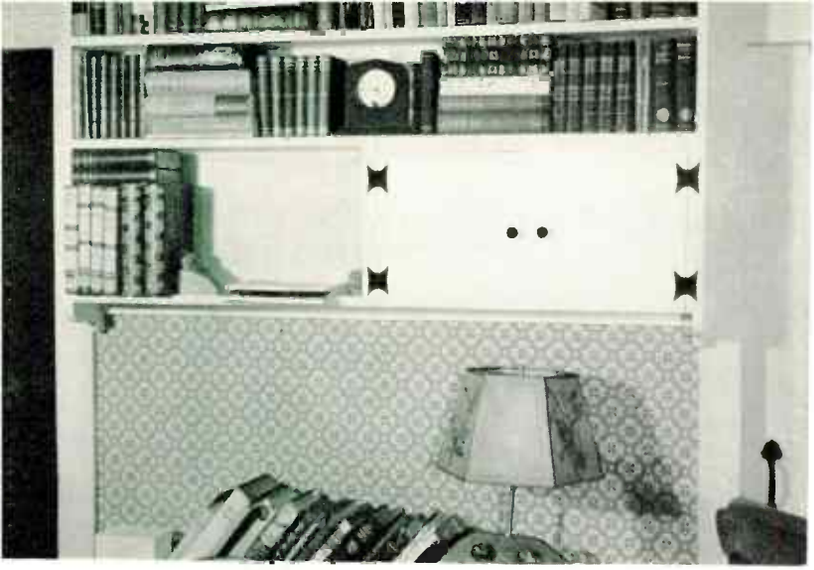


FIG. 1, ABOVE: AN FM-AM TUNER, HIDDEN BY THE DOORS ADDED TO THIS BOOK SHELF, CONNECTS TO A SPEAKER BEHIND THE SHELVES IN FIG. 2, BELOW.

FIG. 3, RIGHT: A MORE FORMAL CABINET CARRIES THE SPEAKER ABOVE, WITH THE TUNER, AMPLIFIER, TURNTABLES, AND TWO RECORD COMPARTMENTS BELOW.

FIG. 4, LEFT ABOVE, AND FIG. 5, RIGHT: BUILT-IN TV RECEIVERS COMBINED WITH HIGH-FIDELITY RADIO AND PHONOGRAPH EQUIPMENT. GRILLES CONCEAL THE SPEAKERS.

FIGS. 6 & 7, BELOW: TWO VIEWS OF AN INSTALLATION DIVIDED INTO FOUR SECTIONS. THERE ARE TWO AUTOMATIC CHANGERS, PULL-UP SHELF FOR A TURNTABLE AND THREE PICKUPS, AND AN FM-AM RADIO AND AMPLIFIER. SPEAKER IS MOUNTED SEPARATELY.

FIGS. 8 AND 9, ABOVE: THIS BUILT-IN CABINET CONTAINS A TV RECEIVER, FM-AM TUNER, TWO RECORD-PLAYERS, AND RECORD STORAGE SPACE. THE LOUD-SPEAKER IS MOUNTED ABOVE. NOTE THE EFFECT WHEN DOORS ARE CLOSED

FIGS. 10 AND 11, BELOW: A COMPLETE HIGH-FIDELITY SYSTEM WAS BUILT INTO THIS ANTIQUE CABINET. THE UPPER PART WAS ENCLOSED WITH GRILLE CLOTH TO HIDE THE SPEAKER. THE EQUIPMENT WAS ASSEMBLED ON LOWER SHELVES

MUSIC FOR LISTENING PLEASURE

A Portfolio of Ideas Which Illustrate the Latest Techniques of Custom Radio-Phonograph Designers, and the Growing Demand for High-Fidelity Reproduction in American Homes—*By* Milton B. Sleeper.

TODAY, the operation of Government and industry in the United States is guided by statistics. We have come to assume that if anything is of importance, information about it is available somewhere on punched cards. And, for a small charge, you can get the details by having the cards fed into nimble sorting machines that can quickly run up the answer, whether it's the number of registered cattle east of the Mississippi, with sub-totals for each breed, or your probable life span after age 42 if you were to be born in 1976.

Some People Are Different: However, statistics involving large numbers are seldom as interesting as the less-known facts about smaller groups which depart from the broad-scale pattern.

For example, you can find out how many of what type radio sets and phonographs go into American homes each year. But there are many installations being made now that do not appear in industry statistics. Neither can they be seen in store windows, or pictured in magazine advertising. Yet they are much more interesting than conventional factory-built models.

These are the custom-built, high fidelity installations that are to be found in an increasing number of beautiful homes, occupied by people of discriminating taste.

According to industry statistics, these radio-phonograph installations do not exist because they are not included in the monthly production records. Since there is no way to count them, manufacturers of conventional sets look at the annual sales figures on table models, consoles, and auto sets and say: "The public does not want high-fidelity instruments." At one of the FCC hearings, CBS expressed the same opinion, quoting results of tests which, because of the way they were conducted, seemed to indicate that

FIG. 12, LEFT: AN INTERESTING WAY TO MOUNT A LOUDSPEAKER FOR GOOD ACOUSTICAL RESULTS, WITHOUT ENCROACHING ON USEFUL FLOOR SPACE. DOORS ON THE CORNER CABINET HIDE THE SPEAKER GRILLE WHEN THE AUDIO SYSTEM IS NOT BEING OPERATED

FIG. 13, ABOVE: THIS RADIO-PHONOGRAPH IS CONNECTED TO THE SPEAKERS SHOWN IN FIGS. 12 AND 15. NOTE THE EFFECTIVE YET UNOBTRUSIVE DESIGN OF THIS BUILT-IN CABINET, COMBINED WITH THE SHELVES FOR RECORD ALBUMS AT THE RIGHT SIDE

people don't want to listen to frequencies above 5,000 cycles.

Be that as it may, the purpose of this discussion is not to consider the average listeners or the homes that make up the statistics, but the exceptional ones that don't.

And that brings up the questions: what are high-fidelity installations, who wants them, and why should they be custom-built?

What Is High-Fidelity?

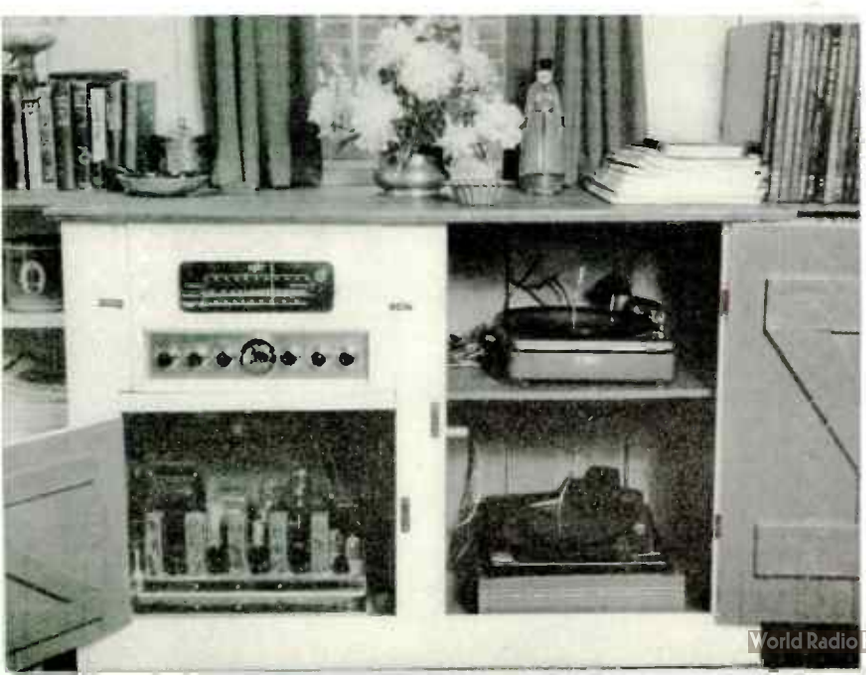
Ideally, a high-fidelity installation provides exact reproduction of the original speech and music heard at the broadcast or recording studio. This calls for undistorted reproduction of the entire audio frequency range, with at least proportionate volume from the softest to the loudest passages.

Actually, the performance of such an installation is limited by outside factors such as the use of 5,000-cycle net work lines, background noise on AM, disc recording facilities, and needle-scratch. Only on live-talent FM reception and tape recordings can the full capabilities of high-fidelity instruments be realized at the present time. However, much progress has been made, and much more can be expected in the refinement of disc recording and playback techniques.

It might seem that there would be very little advantage in the use of audio equipment that is more perfect than the quality of the speech and music fed into it. That is not the case, however. The average factory-built radio-phonograph has relatively narrow audio response and dynamic range, and introduces a considerable amount of distortion. These faults act to emphasize the faults of radio reception and recordings to a grievous extent. The only way they can be mini-

FIG. 14, BELOW: INTERIOR OF THE EQUIPMENT CABINET ILLUSTRATED IN FIG. 13. THE FM-AM TUNER IS ABOVE, AT A CONVENIENT HEIGHT FOR THE CONTROLS. AMPLE VENTILATION IS ALLOWED IN THE AMPLIFIER SECTION

FIG. 15, RIGHT: ANOTHER WAY TO PROVIDE A CORNER MOUNTING FOR A LOUDSPEAKER. THE LOWER SHELVES OF THIS CHINA CABINET WERE REMOVED TO ACCOMMODATE THE BAFFLE. SEPARATE VOLUME CONTROL IS PROVIDED



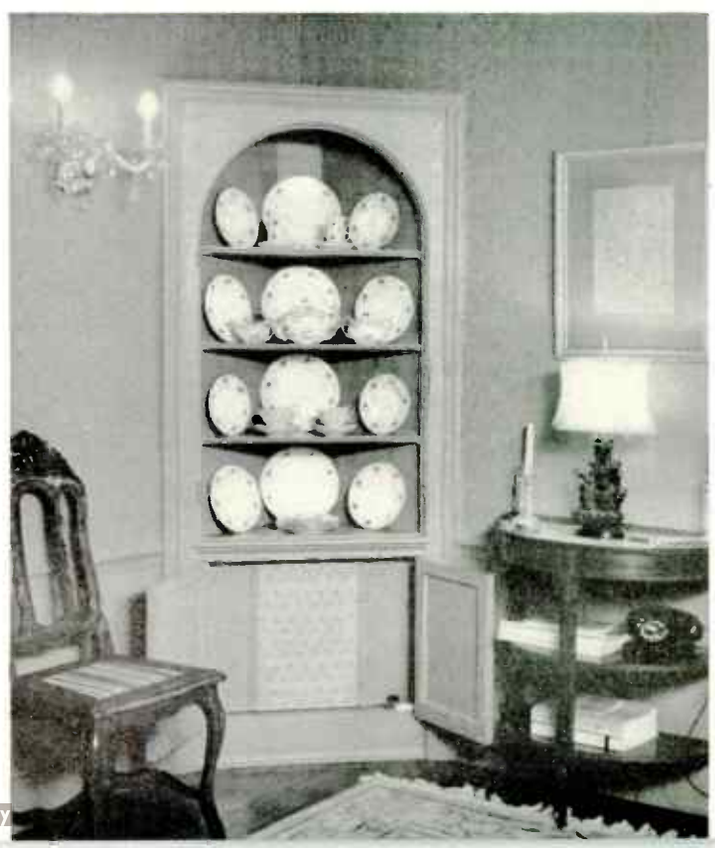


FIG. 16, ABOVE: ONE OF THE ADVANTAGES IN SEPARATING THE SPEAKER FROM THE OTHER EQUIPMENT IS THAT THE RADIO AND PHONOGRAPH CAN BE ADJUSTED TO BETTER ADVANTAGE. THIS GIVES THE PROPER PERSPECTIVE WHEN THE VOLUME IS CHANGED

FIG. 17, RIGHT: CLOSE-UP OF THE ANTIQUE CABINET SHOWN IN FIG. 16. A NEW FRONT PANEL OF MATCHING WOOD WAS BUILT IN FOR MOUNTING THE FM AND AM TUNERS AND AMPLIFIER CONTROLS, WITH SPACE BELOW IN ORDER TO ACCOMMODATE THE ALBUMS

mized is to employ radio and phonograph reproducing equipment that is virtually faultless.

Who Wants High-Fidelity?

This brings us to the second question: Obviously, people who are not aware of the difference between the quality of reproduction from commercial radios and phonographs and that delivered by high-fidelity installations have no preference for the latter. Many people are tone-deaf. The juke box and the telephone represent standards of quality in the reproduction of music and speech to a large number of listeners. And those who have never heard a high-fidelity system have no idea that such an improvement in listening pleasure is possible.

But those who know music as students, or from frequent attendance at recitals, concerts, and the opera hear as much difference between an ordinary radio-phonograph combination and a high-fidelity system as an art collector sees between a printed picture and an original painting.

The musical education of children is another factor in family preference for high-fidelity installations. Particularly since the war, parents have come to recognize that it is just as important for their children to hear the very finest reproduction of the best radio and phonograph music as it is for them to have the finest instruments and the most capable teachers.

Numerically, the group of high-fidelity devotees is substantial, and its steady increase is consistent with the growing appreciation of music in this country. This interest is being fostered also by audio experts who are now specializing in the design of custom installations, and by manufacturers of fine components.

FIG. 18, LEFT: AN OLD CHEST WAS USED FOR THIS RADIO-PHONOGRAPH COMBINATION. HORIZONTAL PANELS, BUILT IN AT THREE LEVELS, HOLD THE TUNER, TURNTABLE, AND AMPLIFIER. A LIGHT ILLUMINATES THE RECORDS

FIG. 19, BELOW: HERE AT THE LEFT IS THE SPEAKER OPERATED FROM THE EQUIPMENT ILLUSTRATED IN FIG. 18. THIS STANDARD, FACTORY-BUILT ENCLOSURE, OF VERY CONSERVATIVE DESIGN, MAKES AN ATTRACTIVE PIECE

FIG. 20, ABOVE: A LARGE SPEAKER ENCLOSURE IS SOMETIMES AWKWARD TO LOCATE IN A LIVING ROOM. HERE IT IS PLACED INCONSPICUOUSLY AT THE RIGHT OF THE PIANO, WHERE AN EXCELLENT DIFFUSION EFFECT IS ACHIEVED

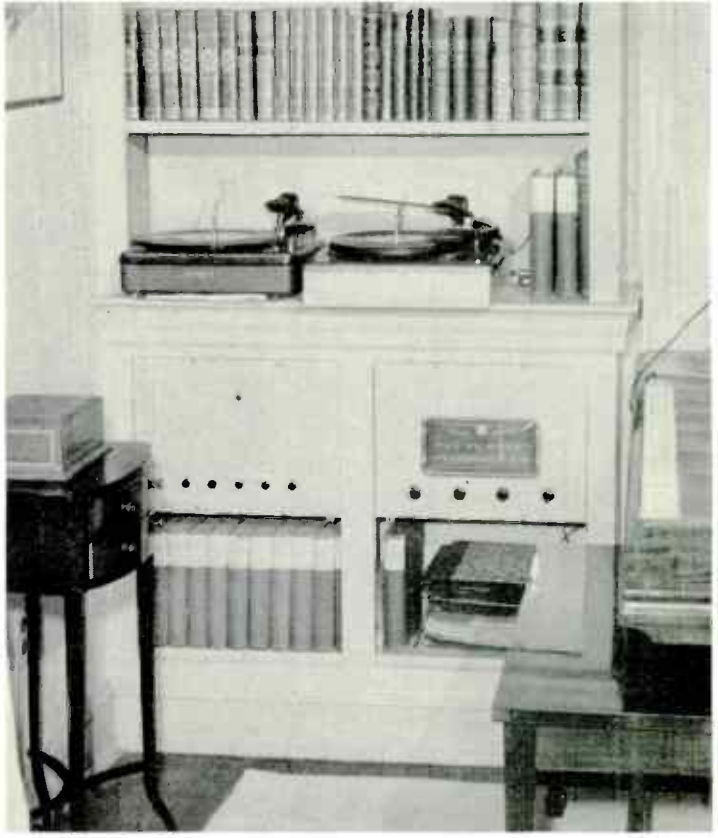


FIG. 21, RIGHT: A CABINET CONTAINING THIS EQUIPMENT AND THE SPEAKER WOULD BE OF AWKWARD PROPORTIONS. SEPARATING THEM AS SHOWN HERE SOLVES THE SPACE AND CABINET PROBLEMS IN AN ATTRACTIVE FASHION

Why Custom Installations?

So we come to the third question: Why must high-fidelity installations be custom-built? The reason is simply that such equipment, like a residence pipe organ, can't be put up in a small, standard package, or cabinet. To do so would destroy the tone quality of a radio-phonograph or a pipe organ.

Both must be planned, first of all, to meet the acoustic conditions and space limitations of the room where the installation is to be made. In the case of a radio-phonograph system, the optimum location and mounting of the loudspeaker must be determined before the type of speaker is chosen. Then the correct amplifier can be selected.

Only when that much has been accomplished can the details as to the radio tuner, turntable, pickup, noise-suppressor, and equalizer be settled, and the mechanical arrangement of these units be worked out.

There is no simple, standard way to assemble these various units to meet the diversified conditions and requirements encountered. These installations are made for people who are as meticulous about the furnishings and decoration of their homes as they are critical of audio quality. They want the equipment to be inconspicuous or perhaps out of sight completely when it is not in use. This calls for various kinds of speaker mountings, and the arrangement of the apparatus in furniture pieces, cabinets, closets, or storage walls. Since this is all special work, each system must be tailored to suit each home and each owner.

Typical Installations:

High-fidelity installations range in cost from $300 to $2,000 or more. If no

FIG. 22, LEFT: THIS IS AN EXAMPLE OF A SITUATION ENCOUNTERED FREQUENTLY IN HIGH-FIDELITY INSTALLATIONS. THE OWNER WANTED TO CONCEAL THE RECORD-CHANGER AND AMPLIFIER IN A CABINET USED AS PART OF THE LIVING ROOM FURNISHINGS

FIG. 23, BELOW: HERE THE ONLY ELECTRICAL EQUIPMENT IN EVIDENCE IS THE SMALL FM TUNER AT THE LEFT OF THE CABINET. AM RECEPTION WAS NOT REQUIRED. THE GRILLE WHICH CAN BE SEEN BELOW THE BOOKCASE SHELVES CONCEALS THE LOUDSPEAKER

FIG. 24, LEFT: THE RELATIVELY INEXPENSIVE AND SIMPLE ARRANGEMENT ILLUSTRATED HERE CONSISTS OF AN AUTOMATIC TURNTABLE, FM-AM RECEIVER, AND A SPEAKER MOUNTED BEHIND A GRILLE EXTENDING OVER THE SHELVES

FIG. 25, VIEWED ACROSS THE ROOM, THIS INSTALLATION IS MOST INCONSPICUOUS. THE EFFECT WAS ACHIEVED BY PUTTING ROWS OF BOOK BACKS IN FRONT OF THE GRILLE, EXCEPT WHERE THE SPEAKER OPENING IS LOCATED

cabinet-work is necessary, it is possible to plan a custom radio-phonograph that will cost less and yet outperform factory-built console models. It all depends upon the owner's ideas of what he wants, and the skill of the engineer who plans and installs the equipment.

The accompanying illustrations present examples of the work of two specialists in custom-built systems. Figs. 1 to 7 show installations made by Philip C. Kelsey, 21 Whitfield Street, Guilford, Conn. Those shown in Figs. 8 to 27 represent the work of William Shrader, president of Shrader Manufacturing Company, 2803 M Street, N.W., Washington D. C.

These photographs were selected to illustrate a wide range of designs in different types of homes, from relatively simple equipment, as in Figs. 1 and 2 and 24 and 25, to elaborate systems shown in Figs. 6 and 7, and 12 to 15. Three installations include television receivers.

It is obvious that no radio set manufacturer could design a line of production models that would suit the diversified requirements represented here. However, the demand for tuners, amplifiers, turntables, speakers, and other high-fidelity equipment has grown to such a volume as to afford the economy of quantity production, and to absorb the cost of the research that has made high-fidelity reproduction possible.

The truth is that the number of homes where such installations are to be found is now so large that statistics would be impressive if they were available. Specifically, they would show what a mistake it is to say that the American people don't want high-fidelity. Rather, it should be said that relatively few people have had the opportunity to hear fine reproduction from expertly-designed, custom-built systems.

FIG. 26, LEFT: IN THIS LIVING ROOM, THE SPEAKER IS AT SOME DISTANCE FROM THE OTHER EQUIPMENT WHERE IT CAN BE HEARD TO BEST ADVANTAGE, WHILE THE RADIO RECEIVER, CHANGER, AND THE RECORD ALBUMS ARE AT THE MOST ACCESSIBLE LOCATION

FIG. 27, RIGHT: THIS CABINET WAS BUILT IN TWO SEPARATE SECTIONS, WITH DOORS TO CONCEAL THE EQUIPMENT WHEN IT IS NOT IN USE. TWO AUTOMATIC TURNTABLES ARE USED TO HANDLE LONG-PLAYING AND STANDARD RECORDS IN THE SIMPLEST MANNER

WHAT'S NEW THIS MONTH

THE APPLICATION OF COMMON CARRIER APPARATUS DESIGN PHILOSOPHY TO RADIO EQUIPMENT—AM NETWORKING PRACTICES MAY NOT WORK OUT FOR TV

A significant definition of radio design policies and practices was enunciated in an address[1] before the Communications Section of the Association of American Railroads by James D. McLean, manager of Philco's industrial division. He said:

"Now, we found in our experience in building equipment — carrier equipment and terminal equipment for Western Union and some of the other telephone and telegraph companies — that there were three basic philosophies that apply to the construction of radio equipment. One is the home-appliance approach, the philosophy that is used when you build a television set. Second is the commercial approach, the philosophy you use in building FM mobile equipment. The third category, and it is the most important one, is the common-carrier approach, as we call it for lack of a better name.

"In the common-carrier approach, it is necessary to use extreme care in the design of equipment to provide for simplicity of operation and maintenance, and extra-long life . . . These three factors also contribute to the solution of the basic economic problem which faces these new communications systems. Fewer tubes, fewer parts, simpler equipment, reduction in size and complexity, all mean that the equipment is less costly to construct, to operate, and to maintain. All of these things contribute to the basic economic problem of getting the cost-per-mile of radio equipment down to the point where it is practical for general use. . . .

"Long life is, of course, most important because the dependability of microwave equipment is going to be judged on its dependability in comparison with wire lines, and wire lines are quite dependable except in extreme cases of bad weather and storms. We must surpass wire lines in dependability and long life, and it can be done. We must keep the size small. We all agree that you can't maintain complicated equipment in the field. You must be able to replace defective units and bring them back to the central laboratory or workshop, and fix them there. Units must be small, light-weight, and easily handled by workmen so that they can be put in a truck and brought back without the use of special equipment."

The introduction of common-carrier design philosophy represents a new stage in the expansion of radio communications. It may have an influence on mobile equipment, which is becoming the subject of increasing criticism. The design and components in some mobile units today are not much in advance of home radio receivers. Price competition and the practice of requiring competitive bids are given as the reason, but one might suspect that cheap designs are being used as a substitute for the quality of salesmanship required to promote the advantages of superior equipment.

THAT the idea of adapting AM network operation to television may be an over-simplification is indicated by the following comment from an experienced AM executive who, over a period of several years, has been engaged in television broadcasting:

Most TV investors are coming from the AM field. Naturally, they try to reason out their TV requirements on the basis of their AM experience. This is likely to lead to false conclusions, because there are basic reasons why AM precedents will not apply to TV.

Here are some of the assertions, made freely and frequently, based on the assumption that AM practice will follow in TV as a matter of course. Also, presented for careful consideration, are some opposite views:

1. *Networks will be as important in TV as in AM:* If networks survive in TV, the economic picture will have to change more radically than it is possible to envision now. If the network take is 70% with 30% going to the station, as is the case now in AM, just try to figure out how a TV station can operate profitably even at double the AM rate. It is currently expected that TV rates will reach that level when the TV audience achieves AM saturation, although that time is a few years off.

But there isn't a chance that TV networks can operate on the AM basis because of TV distribution costs. Something in the order of 8% of the AM gross take goes to telephone distribution expense. The same setup for TV would absorb 48% of the gross.

When AT & T organized the first wire network system in 1922, that was the only means of distributing acceptable programs to stations outside New York City. Radio relays and telegraph lines operated by other companies were hopelessly poor. Phonograph records were made then by blasting soundtracks into masters through inverted megaphones. Had there been tape recording facilities in 1925 of 1950 quality, there never would have been a network system.

Film distribution of TV programs got off to a bad start, but it seems quite certain that, within two years, film will prove to be the best means of distributing high-grade programs. So it isn't safe to make assumption No. 1.

2. *Networks are necessary to assure immediate distribution for big events:* This is only true of major sports and catastrophies. Most of these are of only local or regional interest. Almost all programs being networked now for both TV and AM would be better for editing and canning as film and tape.

TV stations seem to need networks for sales and low-cost operation, but their program quality would be improved immediately if stations bought as free agents from a group of competing film distributors. The management of TV stations has been woefully inadequate in the national field, and has let the networks take most, or all, of their revenue.

3. *Networks are needed to produce high grade programs:* It is probable that the networks will end up as TV film program producers because the movie industry apparently will never recover from the lavish talent, production, and executive costs established during years of sixty-million cash customers a week. So networks and independent producers will probably turn out good film programs for TV at costs on which the movie industry would starve. But it won't be economically possible for stations to take a large bulk of sponsored TV programs on the old 70%-to-network basis.

Realistic pricing for sponsored programs would be more like 15% for selling, whether done by the station, representative, or ex-network, and 15% to the advertising or other production agency. Reliance on networks alone is merely inviting the mental bankruptcy which has afflicted the AM field. We have just witnessed the acquisition of a large part of one network's creative contributions of the last quarter of a century by another. Now try to name a program created by the loser to fill these gaps. If it is up to the present creative powers of the nets, the big TV talent of 1975 will be Berle and Howdy Doody.

(Continued on page 40)

[1] "Microwave Radio Relay As Applicable to Railroad Operations" by J. D. McLean and W. H. Forster. *Proceedings of the Association of American Railroads, Communications Section,* Sept. 1949. Offices of the AAR are at 30 Vesey Street, New York 7, N. Y.

NEWS PICTURES

Fig. 1—Part of expansion plans for RCA Home Instruments Division is this television picture-tube plant recently dedicated at Marion, Ind. Program includes also expansion of facilities at Canonsburg, Pa. and Bloomington, Ind.

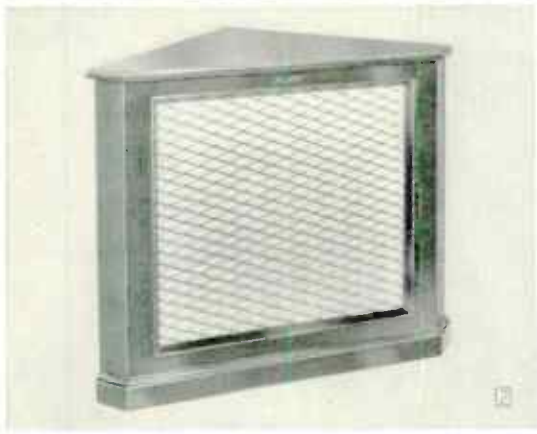


Fig. 2—This is the newest Stephens corner cabinet, the model 418 Tru-Sonic speaker system. It incorporates 2 PM speakers and an 800-cycle horn and driver system.

Fig. 3—Motorola's new 2-way mobile radio units, designed for adjacent channel operation, are available in either the under-dash model, left, or for trunk-mounting, as at right.

Fig. 4—Polarad Electronics Corp. presents this portable television wave-form monitor, model TO-1, designed for general waveform analysis and video amplitude measurements.

Fig. 5—Accuracy of ±0.001% is obtained with this crystal calibrator, model 111, by Measurements Corp., Boonton, N. J. It provides a test signal for frequency calibration of equipment operating between 250 kc. and 1,000 mc.

Fig. 6—This phase-modulator tube is a development of Stanford Research Institute. It is used in an experimental UHF transmitter at Long Beach, Calif. which employs, for the first time in television, phase-to-amplitude modulation. System combines two phase-modulated signals to produce AM video.

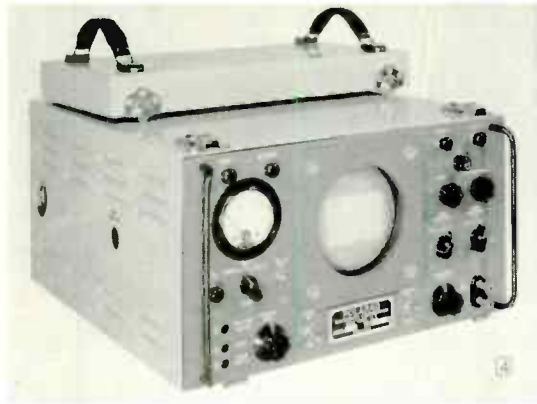


Fig. 7—Operator's hands are never in the danger area when using the Pres-Vac safety feeder, which employs compressed air and a venturi tube to feed small parts to a press.

Fig. 8—General Radio's slotted line and coaxial elements, series 874, provide for convenient, accurate measurement of impedance, standing-waves, voltage, and power at UHF. Just above the slotted line is a crystal diode modulator, type 1,000-P6, used to combine a video source with any TV-frequency RF source to make a test signal generator for TV receivers.

Fig. 9—New idea in TV receiver design is Unit-ized construction by Setchell-Carlson, Inc. Chassis is composed of 8 plug-in units, instantly removable for replacement or repair.

Fig. 10—Here is a new addition to the Meissner line of AM-FM tuners, model 9A. Designed for use in consoles, it is complete with audio section, phono input, phono switching, and power outlet for turntable motor.

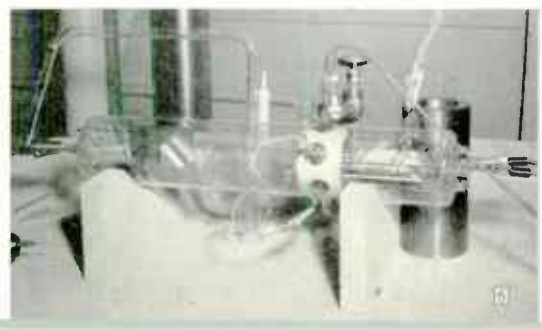
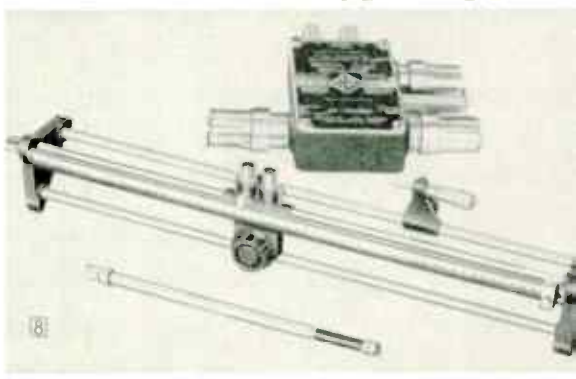
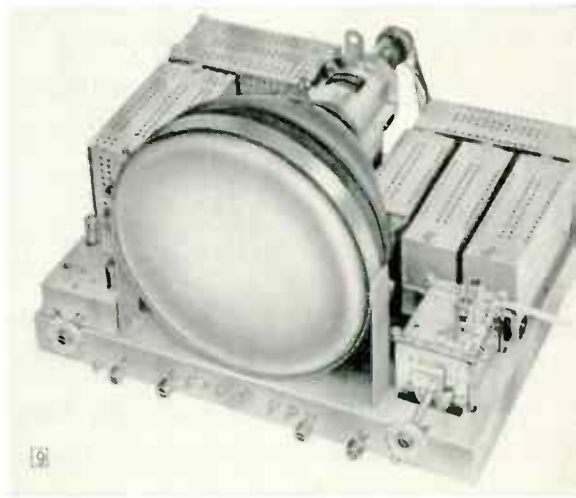
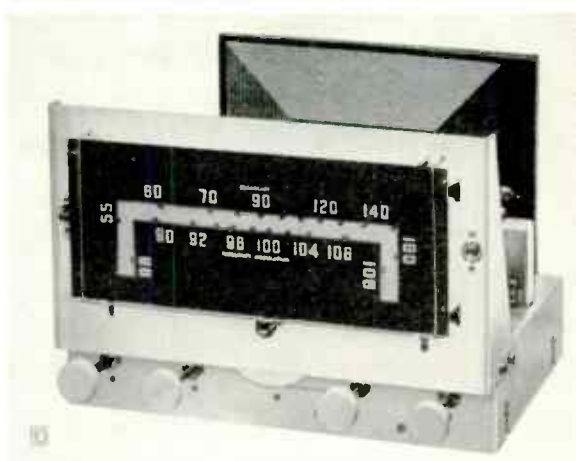
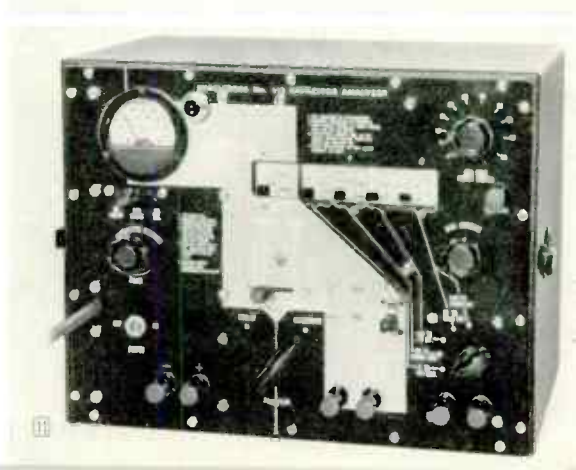


Fig. 11—This laboratory-type capacitor analyzer determines capacitance from 5 mmf to 12,000 mfd., insulation resistance from 1.1 to 12,000 megohms, and leakage current, dielectric strength, and power factor. Shalleross Mfg. Co.









PLANNING RELAY INSTALLATIONS

HOW THE OPTIMUM COMBINATION OF ALL VARIABLE FACTORS FOR MICROWAVE RELAY SYSTEMS CAN BE DETERMINED BY THESE CHARTS — *By* ROY F. ALLISON

DISTANCE and equipment costs are the primary considerations in planning microwave systems. The line-of-sight range of a system can be calculated with considerable accuracy, given the operating frequency, bandwidth, antenna input power, the type and dimensions of the antennas, and the required operating characteristics. However, determination of the optimum combination of these variable factors, in order to arrive at the lowest cost, involves a lengthy series of calculations.

To show the effects of these variables on line-of-sight range, the accompanying charts have been prepared for different frequencies, with parabolic antennas of 40 to 120 in. diameter, bandwidths of 1 and 10 mc., and input powers of 0.1, 1.0, and 10 watts.

The charts were prepared from formulas which are commonly used for determining the range of microwave systems. [1, 2, 3, 4.]

As is explained subsequently in this text, factors were introduced to cover receiver noise, signal-to-noise ratio, fading, and the FM improvement factor.

A study of these charts will aid in deciding whether, for a given distance, the additional cost of a tower to carry the wind load of a large parabola will be less than the difference in cost between microwave transmitters of 0.1 and 10 watts, for example. Similarly, requirements and equipment costs can be compared for one long hop and two short ones.

In making up the charts, values for variables were chosen to encompass most cases likely to be encountered in coverage and power calculations. Relatively simple corrections can be made for unusual cases, indicated as follows:

Antennas:

All calculations were made for parabolic antennas of the same size at both transmitting and receiving points. Fig. 1 is a view of a typical parabola, manufactured by Workshop Associates in all the sizes for which computations were made. For other types of antennas, the range values can be adjusted according to the square roots of the relative power gain ratios. The power gain of a parabolic antenna can be calculated from the following equation, which was used in preparing the charts:

$$\text{Gain} = 2.649 \times 10^{-5} f^2 r^2,$$

where f = frequency in mc.

r = radius of reflector in feet.

This value should be squared, in order to obtain the power gain of two antennas, as used in computations for the charts. The resultant figure should be divided into the power gain of the actual antennas used, and the square root of the quotient taken. This figure should be multiplied by the distance shown on the graph to obtain the actual range which can be expected.

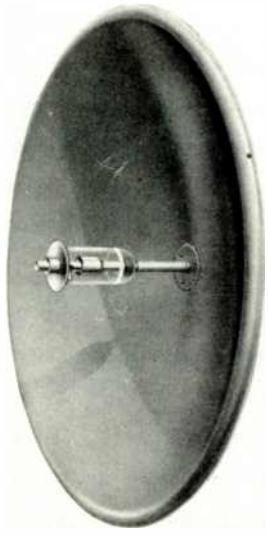


Fig. 1. Note enclosed dipole on parabola

Transmitter Power:

Here also, adjustments can be made for powers other than those given. Distances shown for a given power should be multiplied by the square root of the ratio of actual power to power indicated in the charts.

Bandwidth and Noise Factor:

The total noise generated by the receiver input circuits is of great importance in coverage calculations. It is dependent on both the system bandwidth and the receiver noise factor, since thermal noise power is determined by bandwidth, and the resultant figure is multiplied by the noise factor to obtain a total noise figure.

Corrections for differences in bandwidth are made by dividing distances shown by the square root of the ratio of desired bandwidth to that indicated in the charts.

Liberal allowances have been made for noise factors, as shown on the charts. It is believed that these most nearly represent the performance capabilities of modern equipment. However, adjustments can be made easily by dividing distances shown by a factor obtained in the following way: Subtract the noise factor shown on the chart from the actual noise factor, in decibels. Divide by two, and convert to a power ratio to obtain the desired correction factor.

Signal-to-Noise Ratio:

Adjustments for signal-to-noise ratios other than those given are made in the same manner as for noise factors. A handy rule-of-thumb when working with decibels is this: 6 db represents a power ratio of 4. At twice any distance from a transmitter only one-fourth the power is received. For a decrease in signal-to-noise ratio of 6 db, only one-fourth the signal power is required. Therefore, a 6-db decrease in allowable signal-to-noise ratio results in effectively doubling the distance with the same power. In the same way, a 6-db increase in signal-to-noise ratio results in halving the distance.

FM Improvement Factor:

The improvement factor in signal-to-noise ratio due to FM operation was included in all calculations. The usual practice in communications equipment is to make peak frequency deviation equal to the highest modulating frequency, which together determine the improvement factor. [2, 4.] This results in a value of 4.8 db, which was used in all cases. If AM or pulse modulation is used in a system, distances shown must be divided by 1.74 for the same bandwidth.

Fading Factor:

Fading increases in severity with both frequency and distance. It was not possible, in making calculations, to introduce corrections in fading allowances according to both factors. Relatively little is known about fading effects, and it is difficult to predict accurately the severity likely to be encountered under varying conditions. As shown on each graph, allowances of 15 to 20 db were made, depending on the frequency. It is recommended, however, that for distances over

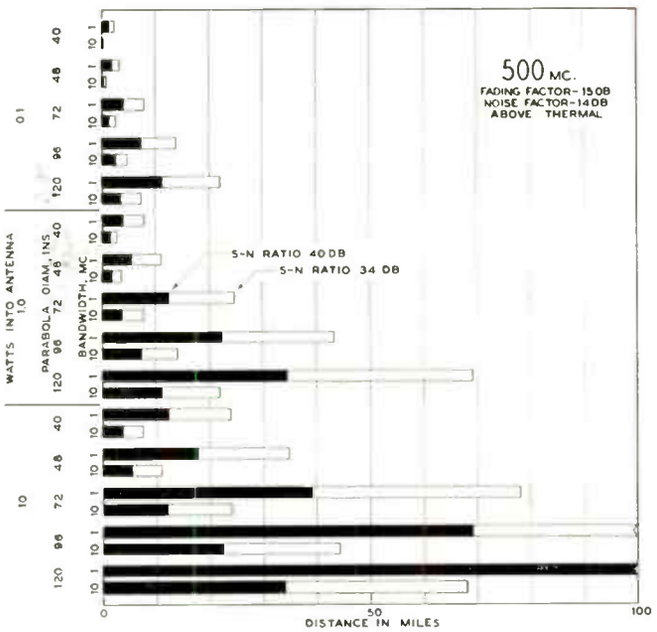
(Continued on page 42)

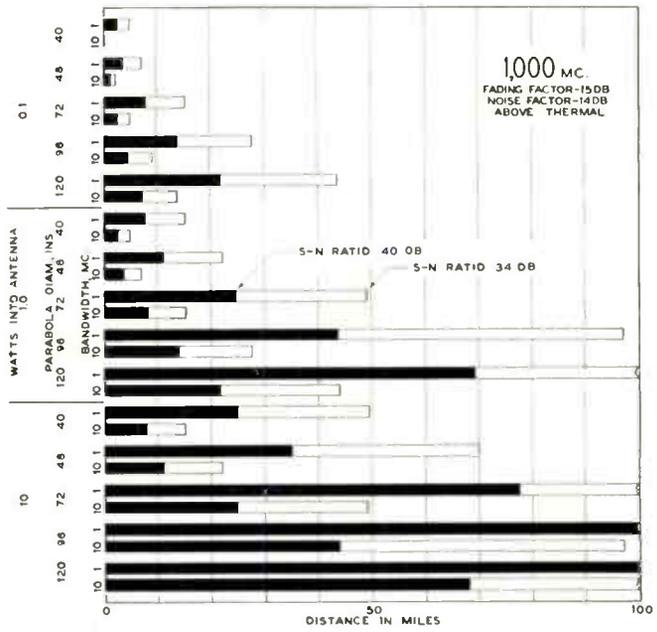
[1] H. T. Friis, "A Note on a Simple Transmission Formula," *Proceedings of I. R. E.*, May, 1946.

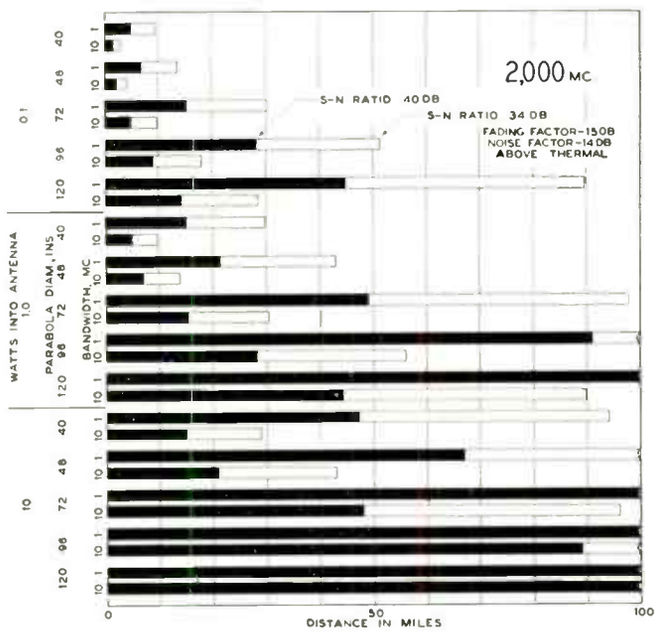
[2] Murray G. Crosby, "Frequency Modulation Noise Characteristics," *Proceedings of I. R. E.*, April, 1937.

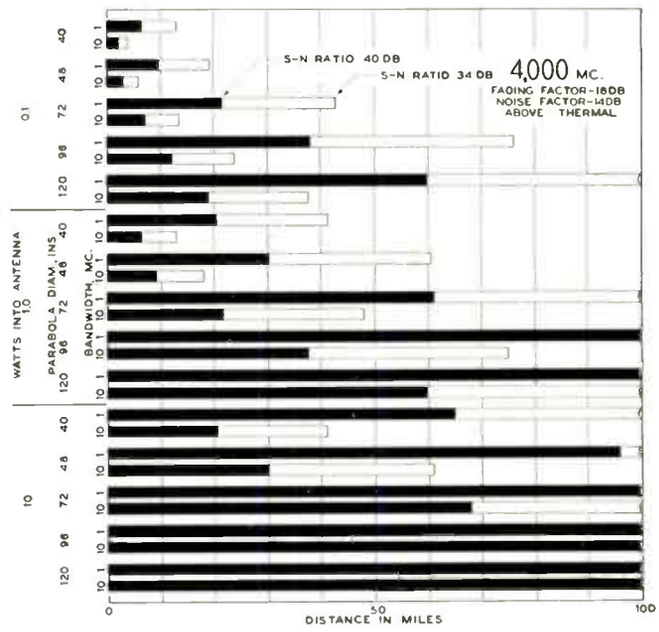
[3] C. W. Hansell, "Radio Relay Systems Development by RCA," *Proceedings of I. R. E.*, March, 1945.

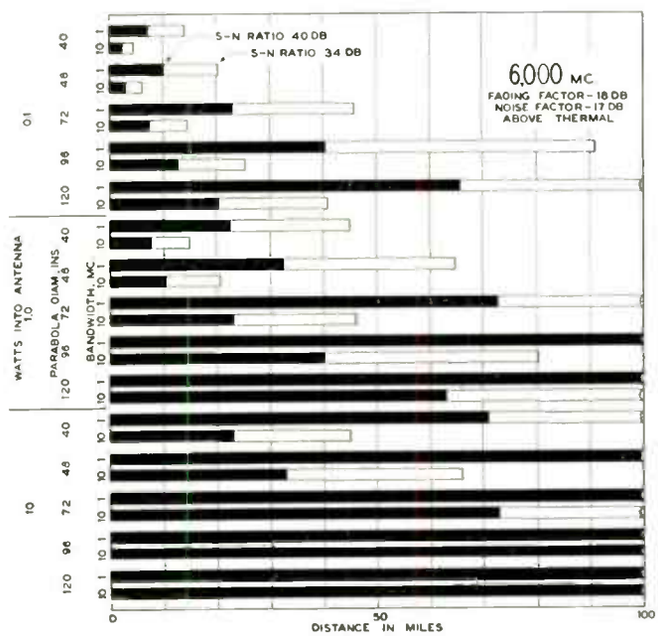
[4] A. L. Hammerschmidt, "Free-Space Microwave Transmission," *RCA Review*, March, 1948.

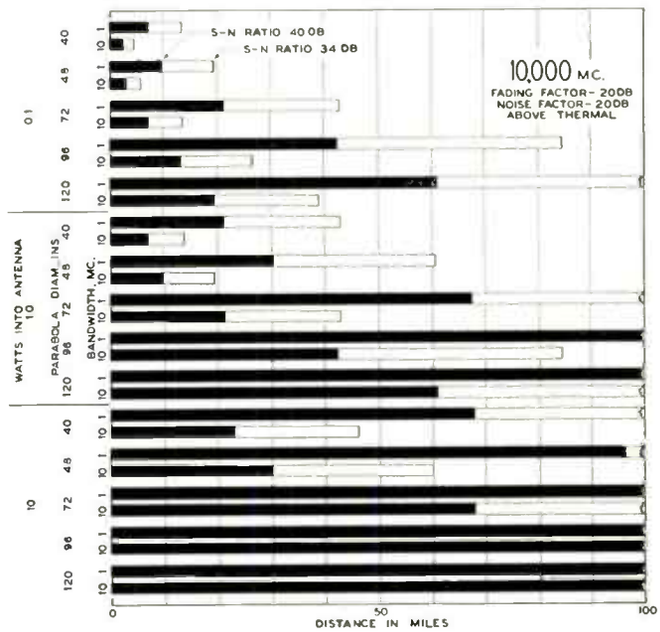








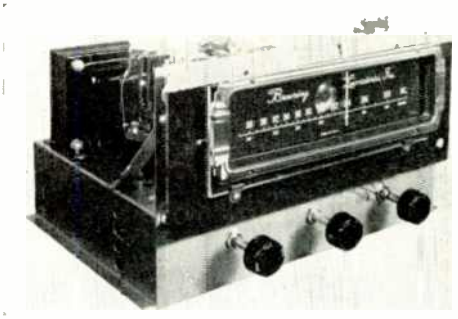




BROWNING TUNERS ASSURE MAXIMUM PER

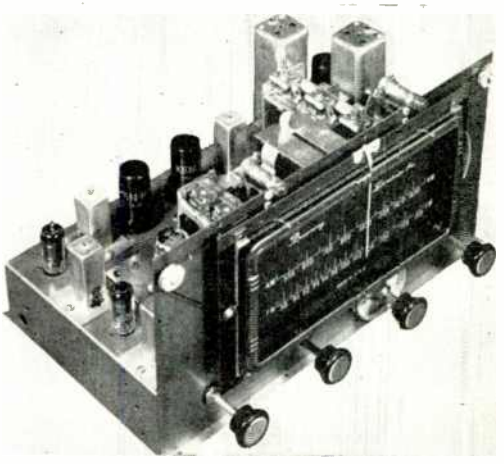
BROWNING RV-10 FM TUNER

High-sensitivity FM reception can be added easily to any AM receiver. The moderately-priced BROWNING RV-10 tuner is designed for that purpose. A tuned RF stage with an Armstrong dual limiter and discriminator produce complete noise limiting with signals of less than 10 microvolts. This is the same FM section as in the RJ-12A and RJ-20. Controls: phono switch, radio-phono volume, and tuning. Tubes: three 6AU6, one 7F8, two 6SJ7, one 6H6, one 5Y3 rectifier, and 6AL7 tuning eye. As illustrated, or on a 19-inch rack panel.



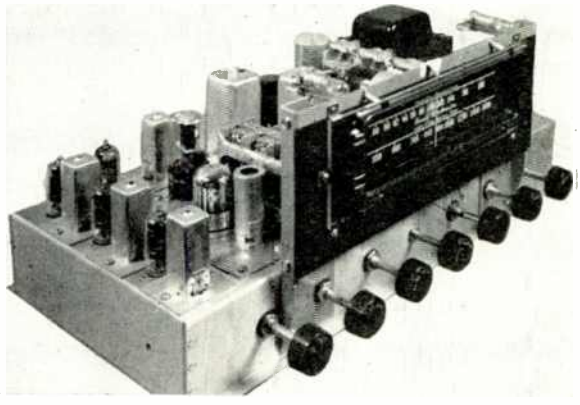
BROWNING RJ-12A FM-AM TUNER

This model combines high-sensitivity FM reception from an Armstrong circuit that limits noise completely on signals of less than 10 microvolts, with the best reception of AM broadcasting. FM and AM circuits are completely separate. FM audio response is flat within 1½ db from 20 to 15,000 cycles. No drift after 2-minute warming. AM is flat within 3 db from 20 to 6,600 cycles. Front phono switch and combined radio-phono volume control. Tubes: three 6AU6, one 7F8, one 6SK7, one 6SG7, two 6SJ7, one 6H6, one 6SA7, one 1N34 detector, one 6AL7 tuning eye. Operates from separate PF12 power supply with one 5Y3GT. As illustrated, or on a 19-in. rack panel.



BROWNING RJ-20 FM-AM TUNER

The RJ-20 is intended particularly for those who require superlative reproduction quality on both radio and records. Armstrong circuits, incorporating every refinement, deliver the full promise of FM's interference-free performance with maximum receiving range. Variable IF bandwidth allows AM selectivity adjustment from 4 to 9 kc. A 2-stage audio system is built in to provide separate treble and bass boost up to 20 db for record reproduction. Tubes: Five 6AU6, one 7F8, one 6SG7, one 6SA7, one 6SK7, two 6AL5, one 6NS7, 6AL7 tuning eye, 5Y3GT rectifier. As illustrated, or on a 19-in. rack panel.



WHERE TO BUY BROWNING HIGH-SENSITIVITY FM and FM-AM TUNERS

Partial list of distributors who will be pleased to supply you with BROWNING tuners best suited to your particular requirements

Alaska

Anchorage
Alaska Radio Supply
P. O. Box B4

Alabama

Birmingham
Ack Radio Supply Co.
223 N. 22nd St.
Clary Co., Inc.
2024 Fourth Ave., N.

Arizona

Tucson
Elliott Electronics
418 N. Fourth Ave.

Arkansas

Fort Smith
Wise Radio Supply
1001 Towson Ave.
Little Rock
Southern Radio Supply
1419 Main St.
Texarkana
Lavender Radio Sup.
522 E. 4th St.

California

Burbank
Valley Elect. Sup. Co.
1302 N. Magnolia Blvd.
Fresno
De Jarnatt Wholesale
1260 Van Ness Ave.
Long Beach
Dean Co., Fred S.
969 American Ave.
Scott Radio Supply Co.
266 Alamitos Ave.
Los Angeles
Henry Radio
11240 W. Olympic Blvd.
Kierulff & Co.
820 W. Olympic Blvd.
Radio Products Sales
1501 S. Hill St.
Radio Specialties Co.
1956 S. Figueroa St.
Univ. Radio Supply
1729 S. Los Angeles St.
Oakland
Brill Co., W. D.
198 10th St.
Wenger Co., E. C.
1450 Harrison St.
Pasadena
Dow Radio, Inc.
1759 E. Colorado St.
Sacramento
Kemp Co., E. M.
1115 "R" St.
San Bernardino
Bagley Co., George H.
1216 "D" St.
San Diego
Coast Electric Co.
744 G St.
San Francisco
R. M. Beck Co.
90 9th St.
Brown Co., C. C.
61 9th St.
Cox Distributing Co.
259B Lombard St.
San Francisco Radio
1280-84 Market St.
Zack Radio Supply Co.
1426 Market St.
Santa Barbara
Channel Radio Supply
434 State St.

Colorado

Denver
Sound Service
446 Broadway

Connecticut

Hartford
Hatry & Young, Inc.
203 Ann St.
Moses Radio Elec. Co.
54 Flower St.
New Britain
United Radio Supp y
53 E. Main St.
New Haven
Brown Co., Thomas H.
15-25 Whiting St.
New London
Hatry & Young
428 Bank St.
Waterbury
Bond Radio Supply Co.
439 W. Main St.

Delaware

Wilmington
Radio Electric Serv.
219 W. 8th St.
Wilmington Elec. Spec.
405 Delaware Ave.

District of Columbia

Washington
Capitol Radio Whlslrs.
2120 14th St., N. W.
Elect. Wholesalers
2010 14th St., N. W.
Kenyon Radio Sup. Co.
2214 14th St., N. W.
Sun Radio & Service
938 F St., N. W.

Florida

Miami
Walder Radio & Appl.
1809 N. E. 2nd Ave.
Pensacola
Grice Radio & Elect.
358-360 E. Wright St.
St. Petersburg
Cooper Radio Co.
648 Second Ave., S.
Sarasota
Morley Radio Electric
944 Main St.

FORMANCE FROM CUSTOM INSTALLATIONS

Tampa
Kinkade Radio Supply
402-04 W. Fortune St.
Thurow Distributors
134-36 S. Tampa St.

Georgia

Atlanta
Concord Radio Corp.
265 Peachtree St.
Specialty Distrib. Co.
425 Peachtree St., N. E.
Savannah
Specialty Distrib. Co.
223 E. Broughton St.

Idaho

Boise
Craddock's Radio Sup.
1522 State St.

Illinois

Chicago
Allied Radio Corp.
833 W. Jackson Bvd.
Concord Radio Corp.
901 W. Jackson Bvd.
Newark Electric Co.
323 W. Madison St.
Walker-Jimieson, Inc.
311 S. Western Bvd.
Mt. Carmel
Wabash Radio Distrib.
702 Plum St.
Rockford
Mid-West Associated
506 Walnut St.

Indiana

Angola
Lakeland Radio Sup.
525 S. West St.
Fort Wayne
Pembleton Labs.
236 E. Columbia St.
Warren Radio Co.
720 Clinton Ave.
Indianapolis
Van Sickle Radio Sup.
102 S. Penn. St.
Lafayette
Lafayette Radio Sup.
408 North St.
Terre Haute
Archer & Evinger
312 E. Wayne St.

Iowa

Cedar Rapids
Gifford & Brown, Inc.
Des Moines
Gifford & Brown, Inc.
1216-18 W. Grand Ave.
Waterloo
Gifford & Brown, Inc.

Kansas

Wichita
Amateur Radio Equip.
1215 E. Douglas St.

Kentucky

Lexington
Radio Equipment Co.
480 Skain St.
Louisville
Burks & Company
911 W. Broadway
Universal Radio Sup.
533 S. 7th St.
Owensboro
Central Electronics
203 W. 4th St.

Louisiana

New Orleans
Columbia Radio & Sup.
3940 3rd St.
Shuler Supply Co.
415 Dryades St.
Southern Radio Sup.
1900 Tulane Ave.
Walther Bros. Co.
714-20 Howard Ave.

Maine

Portland
Radio Service Lab.

Maryland

Baltimore
Radio Electric Service
5 N. Howard St.
Wholesale Radio Parts
311 W. Baltimore St.
Hagerstown
Zimmerman Whlslrs.
114 E. Washington St.

Massachusetts

Boston
Demambro Radio Sup.
1111 Commonwealth
Hatry & Young
42-44 Cornhill
Herman Co., Inc.
885 Boylston St.
Mayer Co., A. W.
895 Boylston St.
Radio Shack Corp.
167 Washington St.
Radio Wire Television
110 Federal St.
Brockton
Ware Radio Supply Co.
913 Centre St.
Cambridge
Electrical Sup. Corp.
1739 Mass. Ave.
New Bedford
Beckman Co.
11-35 Commercial St.
Pittsfield
Pittsfield Radio Co.
41 West St.
Springfield
Cushing, T. Frank
349 Worthington St.
Hatry & Young
169 Spring St.
Springfield Radio Co.
405 Dwight St.
Springfield Sound Co.
147 Dwight st.
Worcester
Demambro Radio Sup.
729 Main St.
Radio Maintenance
19-25 Central St.

Michigan

Ann Arbor
Purchase Radio & Cam.
605 Church St.
Wedemeyer Elect. Sup.
213-17 N. Fourth Ave.
Battle Creek
Electronic Sup. Corp.
185 W. Michigan Ave.
Detroit
Duffy & Co., Inc.
2040 Grand River Ave.
K. L. A. Laboratories
7422 Woodward Ave.
Radio Specialties Co.
456 Charlotte St.

Minnesota

Duluth
Popkey Company
206 E. First St.
Minneapolis
Bonn Co., Lew
1211 LaSalle Ave.
Northwest R. & E. Sup.
52 S. 12th St.
Stark's, Inc.
71 S. 12th St.
St. Paul
Bonn Co., Lew

Mississippi

Jackson
Cabell Electric Co.
422 S. Farish St.

Missouri

Butler
Henry Radio Shop
211 N. Main St.
Cape Girardeau
Suedekum & Sons
620 Good Hope Ave.
Joplin
Brotherson Co.
515 N. Byers Ave.
Kansas City
Burstein-Applebee Co.
1012-14 McGee St.
St. Louis
Ashe Radio Co.
1123-25 Pine St.
Van Sickle Radio Co.
1113 Pine St.
Springfield
Reed Radio Supply

Montana

Billings
Electronic Supply Co.
214 11th St., W.

Nebraska

Lincoln
Hicks Radio Co.
1420-22 O St.
Omaha
Radio Equipment Co.
2822 Farnam St.

Nevada

Reno
Kemp Co., E. M.

New Hampshire

Concord
Evans Radio
10 Hills Ave.
Dover
American Radio Corp.
510 Central Ave.
Manchester
Radio Service Lab.
1191 Elm St.

New Jersey

Camden
Radio Electric Service
513-15 Cooper St.
Jersey City
Nidisco-Jersey City
713 Newark Ave.
Newark
Continental Sales Co.
195 Central Ave.
Electronic Marketers
415 Halsey St.
Krich-Radisco, Inc.
422-432 Elizabeth Ave.
Lippman & Co.
246 Central Ave.
Radio Wire Television
24 Central Ave.
Phillipsburg
Williams, Carl B.
154 S. Main St.
Trenton
Allen & Hurley
25 S. Warren St.

New York

Albany
Ft. Orange Radio Dist.
642-644 Broadway
Taylor Co.
465 Central Ave.
Amsterdam
Adirondack Radio Sup.
32 Guy Park Ave.
Brooklyn
Benray Distrib. Co.
485 Coney Island Ave.
Peerless Electronics
76 Willoughby St.
Stan-Burn Radio & Elec.
558 Coney Island Ave.
Buffalo
Dymac, Inc.
2329-31 Main St.
Genesee Radio & Parts
205 E. Genesee St.
Radio Equipment Corp.
147-51 Genesee St.
Hempstead, L. I.
Davis Electronics
204 Main St.
Standard Parts Corp.
235 Main St.
Ithaca
Stallman of Ithaca
127-31 S. Tioga St.
Jamaica, L. I.
Harrison Radio Corp.
Norman Radio Distrib.
94-29 Merrick Rd.
Peerless Radio Distrib.
92-32 Merrick Rd.
Mt. Vernon
Davis Radio Distrib.
66-70 E. Third St.
New York
Arrow Electronics
82 Cortlandt St.
Dalis, Inc., H. L.
17 Union Sq.
Federated Purchaser
80 Park Pl.
Fischer Distrib. Co.
118 Duane St.
Harrison Radio Corp.
12 West Broadway
Harvey Radio Co., Inc.
103 W. 43rd St.
Leonard Radio, Inc.
69 Cortlandt St.
Milo Radio & Elect.
200 Greenwich St.
Newark Electric Co.
115 W. 45th St.
Radio Wire Telev.
100 6th Ave.
Radionic Equip. Co.
170 Nassau St.
Sun Radio & Elect.
122-24 Duane St.
Terminal Radio Corp.
85 Cortlandt St.
Rochester
Hunter Electronics
233 East Ave.
Rochester Radio Sup.
118 St. Paul St.
Schenectady
Schwartz & Son
710-12 Broadway
Syracuse
Broome Distrib. Co.
100 Tully St.
Rochester Radio Sup.
Troy
Trojan Radio Co., Inc.
426 River St.
White Plains
West. Elect. Supply
420 Mamaroneck Ave.

North Carolina

Asheville
Freck Radio & Supply
38-40 Biltmore Ave.
Charlotte
Shaw Distributing Co.
205 W. 1st St.
Raleigh
Car Radio Equipment
105 E. Martin St.
Winston-Salem
Dalton-Hege Rad. Sup.
342 Brookstown Ave.

Ohio

Akron
Olson Radio Warehse.
73 E. Mill St.
Sun Radio Co.
110 E. Market St.
Canton
Burroughs Radio Co.
711 2nd St., N. W.
Cincinnati
Hughes-Peter, Inc.
Schuster Electric Co.
321 Sycamore St.
Steinberg's, Inc.
633 and 637 Walnut St.
United Radio, Inc.
1314 Vine St.
Cleveland
Northern Ohio Labs.
2073 W. 85th St.
Olson Radio Warehouse
2020 Euclid Ave.
Pioneer Radio Supply
2115 Prospect Ave.
Progress Radio Supply
415 Huron Rd.
Winteradio, Inc.
1468 W. 25th St.
Columbus
Hughes-Peters, Inc.
111-17 E. Long St.
Thompson Radio Sup.
107 E. Long St.
Dayton
Hughes-Peters, Inc.
Srepco, Inc.
135 E. 2nd St.
Elyria
El-A-Co.
121 Lodi St.
Lima
Warren Radio Co.
Toledo
H. & W. Auto Acc.
26 N. 11th St.
Warren Radio Co.
1320 Madison Ave.
Youngstown
Ross Radio Co.
325 W. Federal St.
Zanesville
Thompson Radio Sup.
135 S. Sixth St.

Oklahoma

Oklahoma City
Electronic Supply
212 N. W. 10th St.
Tulsa
Radio, Inc.
1000 S. Main St.

Oregon

Eugene
United Radio Supply
Portland
Bargelt Supply
1131 S. W. Wash. St.
Harper-Meggee, Inc.
Northwest Radio Sup.
717 S. W. Ankeny St.
Portland Radio Supply
1300 W. Burnside St.
Seattle Radio Supply
United Radio Supply
22 N. W. Ninth Ave.

Pennsylvania

Allentown
Radio Electric Serv.
1042 Hamilton St.
Bethlehem
Buss Radio Electric
59-63 E. Broad St.
Erie
Duncombe Co.
1011 W. 8th St.
Warren Radio Co.
12th & State Sts.
Philadelphia
A. C. Radio Supply Co.
1539 W. Passyunk Ave.
Almo Radio Co.
509 Arch St.
Consolidated Radio Co.
612 Arch St.
Herbach & Rademan
522 Market St.
Neuber, Herbert K.
1307 Race St.
Radio Electric Serv.
701 Arch St.
Pittsburgh
Cameradio Co.
963 Liberty Ave.
Tydings Co.
632 Grant St.
Reading
Barbey Co., Inc.
55-57 Penn St.
Scranton
Pursell, Fred P.
548-50 Wyoming Ave.

Rhode Island

Providence
Dandreta & Co.
129 Regent Ave.
Demambro Radio Sup.
Edwards Co., W. H.
94 Broadway

South Carolina

Columbia
Dixie Radio Supply
1715-17 Main St.

Tennessee

Chattanooga
Specialty Distrib. Co.
Kingsport
Radio Electric Supply
210 Cherokee St.
Knoxville
Chemcity Radio & Elec.
12 S. Emory Park
Roden Electrical Supply
808 N. Central St.
Memphis
Bluff City Distribut.
905 Union Ave.
Lavender Radio Supply
1012 Union Ave.
Nashville
Braid Electric Co.
107 Eleventh Ave., S.

Texas

Abilene
R. & R. Electronic Co.
1074 N. 3rd St.
Austin
Hargis Co.
706 W. 6th St.
Beaumont
Montague Radio Distr.
220 Willow St.
Straus-Frank Co.
Corpus Christi
Straus-Frank Co.
Wicks-Devilbiss Co.
516 S. Staple St.
Dallas
Ra-Tel, Inc
2123 Cedar Springs
Wilkinson Bros.
2406-08 Ross Ave.
Fort Worth
Ft. Worth Radio Sup.
1201 Commerce St.
Galveston
Straus-Frank Co.
Houston
Gulf Coast Elect.
1110 Winbern St.
Hall, Inc.
1306 Clay Ave.
Houston Radio Supply
1321 LaBranch St.
Sound Sales & Eng.
1614 Fannin St.
Lubbock
R. & R. Supply Co.
704-06 Main St
San Antonio
Straus-Frank Co.
301-07 S. Flores St.
Waco
Hargis Company, Inc.
1305 Austin Ave.
Wichita Falls
Mooney Radio Supply
1104 Grace St.

Utah

Salt Lake City
Standard Supply Co.
531 S. State St.

Virginia

Norfolk
Radio Supply Co.
711 Granby St.
Richmond
Radio Supply Co.
Roanoke
Leonard Electr. Supply
106 Second St., S. W.

Washington

Seattle
Harper-Meggee, Inc.
960 Republican St.
Seattle Radio Supply
2117 Second Ave.
Western Electr. Supply
2609 First Ave.
Zobrist Co., Inc.
2121 Westlake Ave.
Spokane
Harper-Meggee, Inc.
Northwest Electronics
N. 102 Monroe St.
Seattle Radio Supply
Tacoma
C. & G. Radio Supply
2502 Jefferson Ave.

West Virginia

Charleston
Charleston Elec. Sup.
914 Kanawha Bvd.
Chemcity Radio & Elec.
1225 Wash. St., E.
Hicks Radio Service
10 Virginia St., E.
Huntington
King & Irwin, Inc.
314-16 11th St.
Parkersburg
Randle & Hornbrook
536-38 7th St.

Wisconsin

Green Bay
Northern Elec. Dist.
708 S. Broadway
Madison
Satterfield Radio Sup.
326 W. Gorham St.
Milwaukee
Electro-Pliance Distr.
2458 W. Lisbon St.

For Complete Technical Data on These FM and FM-AM Tuners, Address:

BROWNING LABORATORIES, Inc.

700 Main Street, Winchester, Massachusetts

AFTER approximately a year of operating experience under the public safety radio service Rules which became effective on July 1, 1949, the FCC has issued a number of clarifying or relaxing amendments. The provisions of the more important of the amendments proposed are summarized below:

High Power for Police:

The authorized power on a number of police frequencies located between 1,610 kc. and 45.06 mc. was increased to 10,000 watts input for police base stations serving state police mobile units. The former power limit was 500 to 2000 watts, depending on the frequency involved. Maximum that may be authorized in such cases is now 10,000 watts, provided greater power does not cause harmful interference to other stations.

Changes in FCC Rules:

The frequency 7,805 kc. was made available for police point-to-point voice communications in Alaska only.

Low-power mobile units that have been built for police use since the original public safety radio services Rules were issued found recognition in a relaxation of the spurious-radiation attenuation requirements for these equipments. The new table would provide for a 50-db attenuation in the case of equipment with an input of between 3 and 25 watts, and 60 db for equipment between 25 and 150 watts input. The present Rule requirement calls for 60 db attenuation on all equipments of 3 to 150 watts input.

Station identification requirements would be relaxed to specify transmission of the call letters at the end of each transmission or exchange of transmissions, or once each 30 minutes of the operating period, as preferred by the licensee. The present requirement is every 15 instead of 30 minutes.

A new station identification provision was also added to take care of mobile stations authorized under a separate call signal from that of the associated base station, or which transmit on a frequency other than the transmitting frequency of the base station. In such cases the required identification may also be made at the end of each transmission or exchange of transmissions, or once each 30 minutes of the operating period, as preferred. More important, however, a single mobile unit in each general geographic area may be assigned the responsibility for this identifying transmission, thereby eliminating the necessity for every mobile unit of the mobile station involved to transmit the required identification.

The procedure for equipment-test notification was also spelled out for mobile units authorized by the simultaneous issuance of a construction permit and covering license, by requiring the licensee in such cases to notify the engineer in charge of the local radio district of the receipt of the authorization, giving the name and address of the licensee, the assigned call signal, the authorized frequencies and the general area of operation.

The procedure with respect to the specification of remote control points in public safety licenses was also clarified, because of the apparent confusion existing on this subject on the part of many licensees. Prior to July 1, 1949, if a police transmitter was locally controlled, the Commission would indicate on the license that there was no remote control point. The present practice is to specify a control point in all cases. If the transmitter is controlled locally, then the remote control location is specified on the license "same as transmitter."

If the remote control point is located only 25 ft. from the transmitter, however, the old practice called for specifying on the license the distance of the remote control point from the transmitter. Under present practices, in urban areas the location of the remote control point, although physically separated from the transmitter, will be designated "same as transmitter" unless the control point is at a street address different from that of the transmitter. A police transmitter located on top-floor of a 20-story office building but controlled from first floor will therefore have the location of its control point identified on the license as "same as transmitter."

In rural areas, the control location will be specified to be the same as the transmitter unless the control point is more than 500 ft. from the transmitter, in which case the approximate location of the remote control point in distance and direction from the transmitter will be specified on the license.

These and other proposed amendments were issued by the Commission on its own motion. All interested parties were given until May 24, 1950, to file comments on the proposed amendments.

NMRS Growth:

National Mobile Radio System, the association of non-telephone company common carriers furnishing mobile radio service on a charge basis in urban areas, has expanded its membership to include a score of carriers operating on the Pacific Coast. These western operators have formed a regional association known as Western Mobile Radio Association, with Everett LeGette of San Luis Obispo, President; Robert C. Crabb of Los Angeles, Vice President; and Glen Page of Modesto, California, Secretary. Directors of WMRA, in addition to the foregoing, are Harry Fisher of Visalia, California, and M. R. Sink of Portland, Oregon.

As might be expected, California operators, through Glen Page, spearheaded the formation of the first such regional association. Mobile radio use has received a particularly wide acceptance in California, which seems to have less resistance than any other sector of the country to new methods of improving business — in this case through radio communications service. As a result, California has long been a leader in the number of miscellaneous common carrier authorizations. At present New York and California are the only states with more than 15 authorized carriers, California having 23 and New York 24. But sales have been much tougher in New York and New England than on the Golden Coast.

A total of 179 carriers altogether have been authorized on an experimental or regular basis throughout the country. Only states not represented are Delaware, Nevada, the Dakotas, Tennessee, Vermont, and Wyoming.

Western Mobile Radio Association affiliation with National Mobile Radio System has led to plans for further encouragement of regional associations, all working within the framework of the national association. It is believed that this format will best permit the successful handling of the national and local operating problems. At the moment, the most pressing problem in all of the regions is to arrange for common-frequency use over intercity highways by a number of operators, to facilitate requirements of over-the-road truckers.

*1707 H Street N. W., Washington, D. C.

MULTIPLE CC BROADCASTING

A SUPERSONIC SWITCHING SYSTEM SUFFICIENTLY FLEXIBLE FOR MULTIPLE-SERVICE FM BROADCASTING WITH CONTROLLED COMMERCIALS—*By* RAY WILSON*

MOST FM broadcasters appreciate the profit-possibilities of selling service under the various headings of musicasting, storecasting, and transitcasting, so programmed as to serve home listeners simultaneously. While there have been some inspired protests against such services, notably in the case of transitcasting, comments from home listeners indicate that they consider the moderate, low-level style employed to present commercials much more acceptable than the shouting and discordant noises which characterize commercials from conventional stations.

Judging from the discussions of these methods of operation so interestingly presented at the NAB Convention by Messrs. Lane, Thomas, Joseloff, and Davis, it appears that broadcasters have tended to specialize in just one field of controlled-commercial transmission.

Multiple CC Service:

Controlled-commercial operation has developed as a single-purpose service largely because the original equipment was designed that way. It lacked the flexibility necessary to handle commercials for storecasting, for example, during transitcasting hours. Or, having made a contract with one chain store, the equipment did not provide for silencing such commercials at those stores which could be sold to a different chain.

Of course, multiple CC service is not necessary if a station can sell the maximum possible number of spots to one sponsor, but that does not appear to be the case in actual practice. Moreover, demand varies for different services at different times of the day. Transitcasting, most effective during peak passenger hours, can be switched advantageously to storecasting during shopping hours, when relatively few people are traveling on street cars and buses. But musicasting can be sold to many restaurants from early breakfast until after-theatre supper time.

New Control Methods:

In the early methods of controlling receivers during commercial announcements it is necessary to transmit a supersonic tone for the duration of the commercial. For storecasting or transitcasting, this raises the sound level, or for musicasting it silences the speakers. Tests were made with sequence relays, but they proved dangerous because one failure to actuate the relay would reverse the control action. In restaurants, for example, if the sequence relay failed to operate once, the commercials would be heard, and the music would be cut off.

Later equipment, designed for storecasting to two different chains, provides two supersonic frequencies. Receivers are so arranged that when the first tone is transmitted during a commercial, the level is raised at all speakers in Chain A stores, and the speakers silenced at Chain B stores. The opposite result is obtained when the second tone is transmitted. This is good as far as it goes, but it precludes the control of any other groups of receivers.

Experience with these operational limitations prompted the development of the highly flexible control system now offered by Multipulse Sales Company. Basically, any reasonable number of receiver groups can be controlled by the transmission of 0.5-second pulses of different supersonic frequencies. Further, any uncertainties that might be introduced through the use of relays have been eliminated by providing vacuum-tube controls.

With the Multipulse system, a single pulse of frequency A silences every controlled receiver. Transmission of tone B turns on all speakers in Group 1. Volume can be raised at Group 1 speakers by transmitting tone C. In Group 2, tones D and E are used for the same purpose. An operation table of frequencies for four groups would look like this:

	OPERATING FREQUENCIES		
	CUT OFF SPEAKERS	TURN ON SPEAKERS	RAISE LEVEL
GROUP 1	FREQ. A	FREQ. B	FREQ. C
GROUP 2	" A	" D	" E
GROUP 3	" A	" F	" G
GROUP 4	" A	" H	" I

Great flexibility is afforded by the fact that all speakers are turned off by the frequency A, and by the use of extremely short operating tone pulses, rather than continued tone transmission over the duration of commercials.

Suppose, for example the groups are divided in this way:

GROUP 1: Transitcasting
GROUP 2: Musicasting
GROUP 3: First National Stores
GROUP 4: A & P Stores

In early morning hours, service would be provided for Groups 1 and 2. Before each transitcast commercial, the operator would transmit 0.5-second pulses of frequencies A, B, and C. This would turn off all the speakers, and then turn on and

(Continued on page 44)

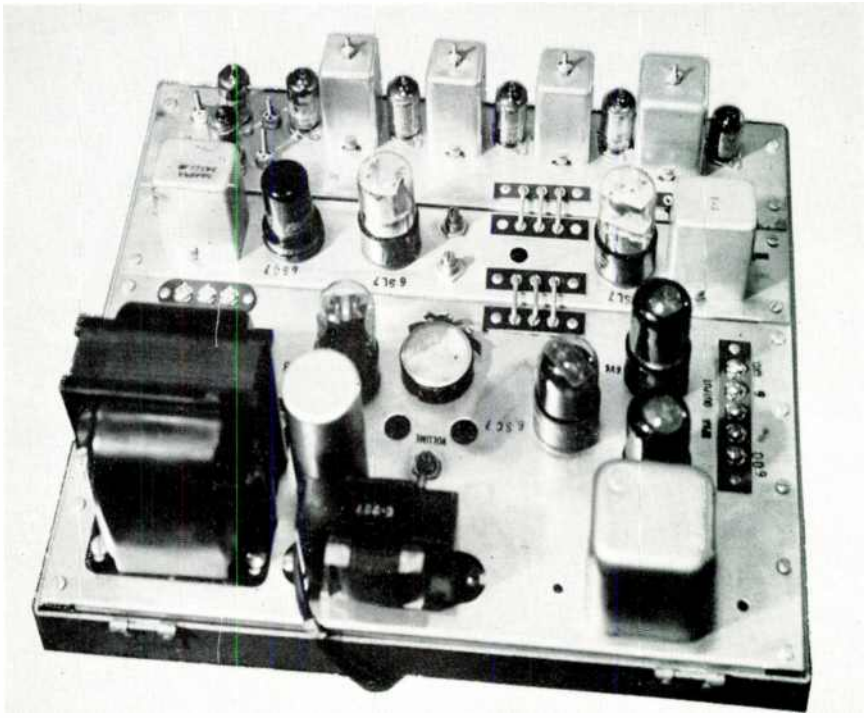
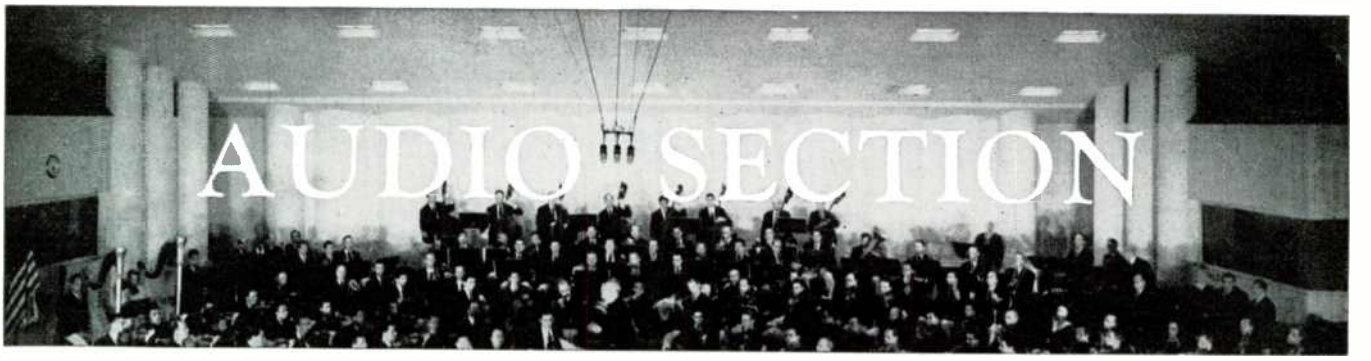


Fig. 1. Receiver for multiple-service FM has three supersonic control filters

*Chief Engineer, Multipulse Sales Co., 64 W. Randolph St., Chicago 1, Ill.



A SIMPLIFIED PRE-AMP EQUALIZER

THE FAIRCHILD UNIT 622 COMBINES THE FUNCTIONS OF THREE EQUALIZERS AND A PRE-AMPLIFIER IN ONE LOW-COST PACKAGE — *By* LEON A. WORTMAN*

THE Fairchild unit 622 pickup pre-amplifier equalizer, shown in Figs. 1 and 3, is designed specifically to reduce costs by simplification and combination. A single unit now performs the functions of three separate equalizers and a pre-amplifier, and at the same time offers results better than formerly obtained.

Isolation Circuit:

Equalizers have usually been manufactured for use with specific types of pickup cartridges. They will not function properly when used with other cartridges, primarily because they are designed for operation within the relatively close limits of specified input impedances. A typical practice in radio stations and recording studios is to mount three pickup arms on one playback console; one for standard lateral phonograph records and vertical transcriptions, a separate pickup arm and cartridge for standard-pitch 33-1/3 transcriptions, and another pickup assembly for microgroove recordings. Usually, three equalizers are installed, with individual response-selector switches. This is inconvenient, expensive, and entails difficulties in installation. The adoption of newer types of pickups, having various output impedances, has only added to the problems of the broadcaster.

A totally new approach is used in the Fairchild equalizer. If the equalizer circuit is isolated from the input signal source, and is fed from a fixed impedance regardless of the pickup cartridge type, then one equalizer circuit can be used for all pickups. As can be seen from the circuit diagram, Fig. 2, a stage of amplification precedes the actual equalizer circuits. This provides effective isolation and increases the signal level at the same time.

Noise Reduction:

Most conventional equalizers consist of a configuration of resonant *LC* circuits. Swamping resistors are sometimes inserted, to reduce the circuit *Q*'s and thereby eliminate sharply resonant points. This increases the equalizer insertion loss and, although solving one problem, introduces another. The tendency toward noise pickup, especially hum, increases with insertion loss.

The signal level at the output of a pickup is lower than at any other point in the system, disregarding equalizer insertion loss. It is imperative, therefore, that hum pickup and other extraneous noises be kept as low as possible at this point. Also, the signal level should be reduced as little as possible. This is accomplished in the Fairchild equalizer as follows:

1. Pre-amplification before equalization. The signal level is kept above that at the output of the pickup.

2. Elimination of the input line-to-grid transformer. This is a common source of hum pickup.

*Technical Data Division, Fairchild Recording Equipment Co., Whitestone, L. I., New York.

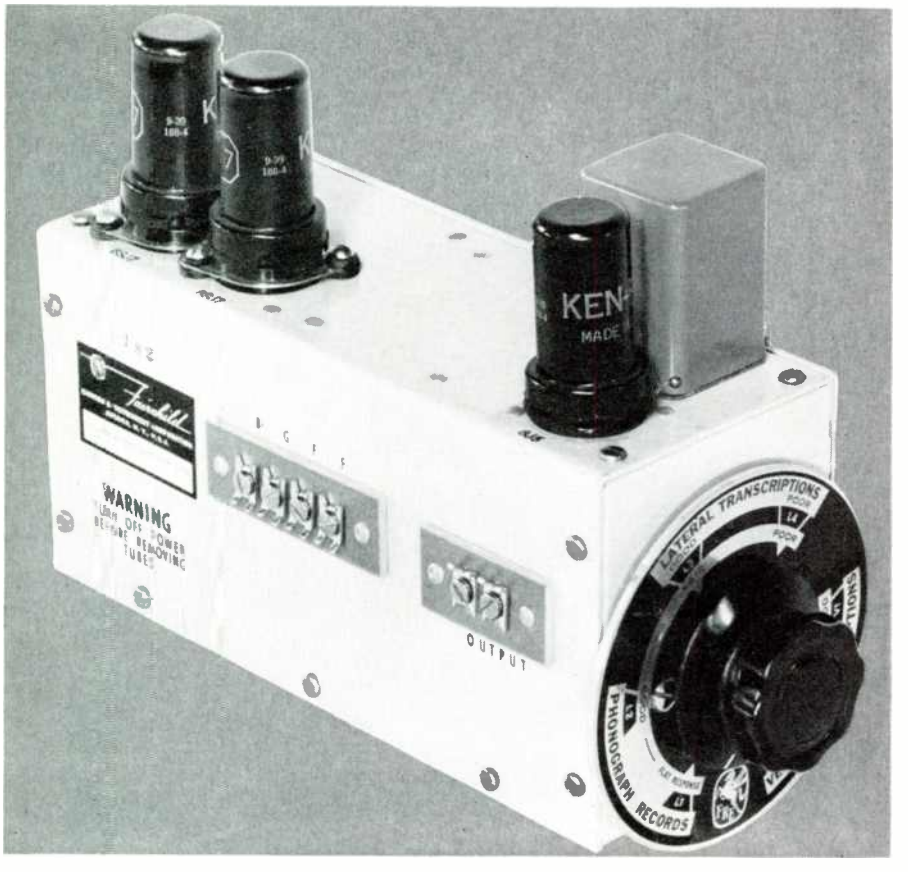


Fig. 1. Pre-amplifier and equalizer chassis of unit 622. Power supply is separate

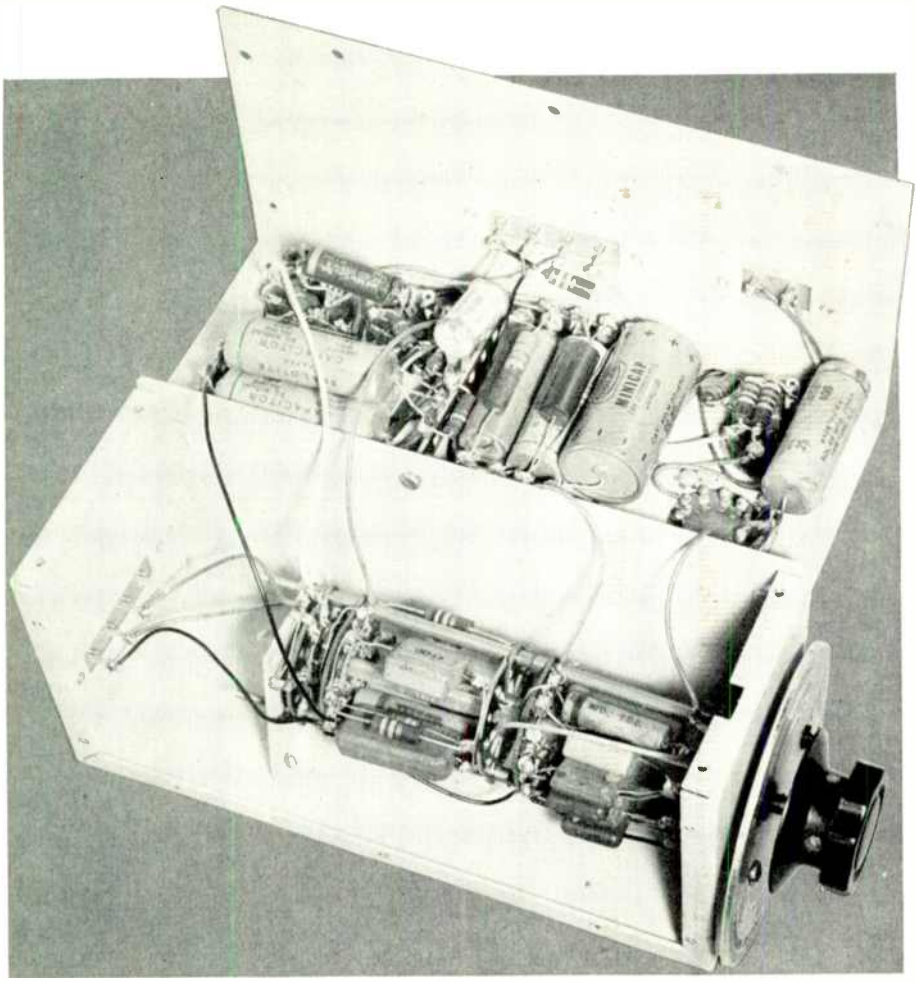


Fig. 3. Switching section for equalizer is below, pre-amplifier chassis above

3. Long-distance low-level speech wiring is unnecessary, because the unit is small enough to be installed in the turntable console. The line leaving the turntable console is at a comparatively high level, about −10 dbm.

4. Thermal noise is reduced by employing a wire-wound resistor as the plate load in the first stage.

5. The power supply provides virtually pure DC for filament operation. A full-wave selenium rectifier, with heavy filtering, gives 18 v. DC with less than 0.4% ripple. The B supply, also, has an extremely low percentage of ripple. This is necessary not only for hum elimination, but to insure low-frequency stability.

6. No coils are used as equalization circuit components.

Unit Construction:

Two L-shaped chassis, which separate for inspection as shown in Fig. 3, make up the pre-amplifier equalizer. On one chassis are the tube sockets, output transformer, and the pre-amplifier circuit components. The bottom chassis contains the wafer-switch assembly and the equalization components. Another separate chassis, which can be placed anywhere in the vicinity of the pre-amplifier-equalizer assembly, contains the power supply. This is advantageous because power for a cuing amplifier is provided from the same source. Thus, the power supply chassis can be located approximately midway between the pre-amplifier equalizer and the cuing amplifier.

When the unit is installed in the turntable console, only the selector switch and dial are visible. Two 8/32 machine screws hold the unit firmly in place, making installation or removal a simple matter.

Equalization Characteristics:

As can be seen in Fig. 2, four 11-position wafer switches are ganged to provide six equalization positions, only the odd switch-points being used. In switch positions 2, 4, 6, 8, and 10, the output of the final stage is shorted to ground. This is done to prevent any transients or oscillation noises from being passed on for further amplification. In the six equalizer positions, oscillation is prevented in two ways: by heavy power-supply filtering and decoupling, and by suppression of the supersonic response. Care is taken, of course, that this does not cut into the usable audio range.

Fig. 4 shows the equalization characteristic for each of the six positions. The first four positions are for lateral recordings, and the last two for vertical transcriptions.

Position L1 provides base-boost with a 500-cycle crossover, and a flat response at higher frequencies.

Position L2 is intended for common phonograph records in good condition. A 500-cycle crossover point is provided,

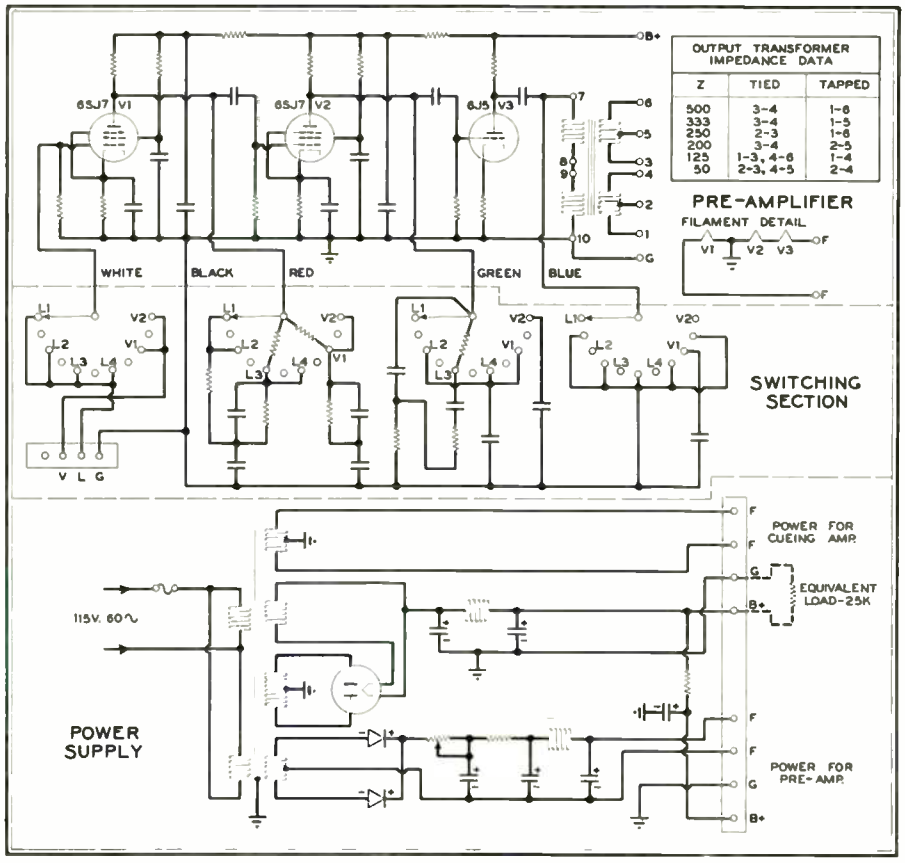


Fig. 2. Complete circuit for unit 622. Note heavy filtering of DC filament supply

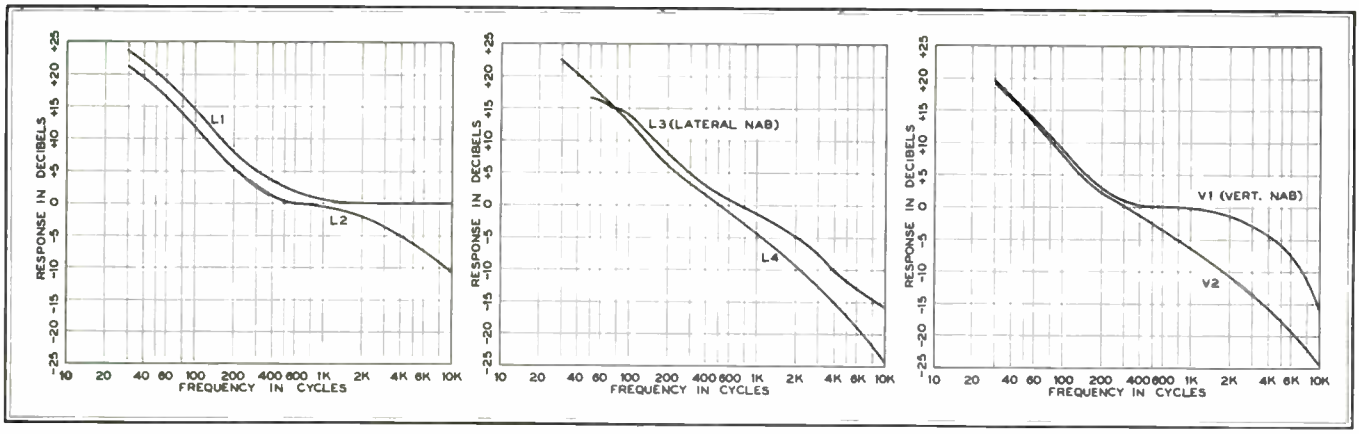


Fig. 4. Equalization curves of the six switch positions. Four curves at left are for lateral recordings, two at right for vertical

with somewhat less than standard NAB roll-off at the high end. At 10,000 cycles, attenuation is 5 db less than NAB standard.

For lateral transcriptions in good or fair condition, position L3 is recommended. This gives the standard NAB lateral equalization curve.

Position L4 has the same general characteristics as position L3 except that more roll-off is provided at the high end. It is recommended for poor lateral transcriptions.

The standard NAB equalization curve for vertical transcriptions is obtained in position V1. Bass boost is incorporated, with a crossover of 500 cycles and a sharp cutoff at the high end.

Position V2 is intended for vertical transcriptions in poor condition, and provides about 8 db extra attenuation at 10,000 cycles.

Dial markings should not be considered as inflexible. Because of the wide variety in recording characteristics found in records and even transcriptions, individual discs of the same type often require quite different degrees of equalization. For this reason, it is advisable to determine the proper equalization for each disc before it is used, and to note the switch position in a file or mark it on the record label. This assures uniformly good results. And with the wide-range characteristics of FM in both audio and video broadcasting, proper equalization for both records and transcriptions is more important than ever.

Conclusion:

It is not often that new equipment offers as many advantages in cost, versatility, performance, and convenience as the unit 622. Its immediate acceptance by the industry indicates that, as never before, broadcasters are concentrating on long-needed simplification and modernization of studio equipment.

DESIGN DATA for AF AMPLIFIERS — No. 1 Operating Classes

CLASSIFICATION OF AMPLIFIER STAGES BY OPERATING REGION OF THE INPUT WAVEFORM, DETERMINED BY BIAS POINT AND SIGNAL AMPLITUDE

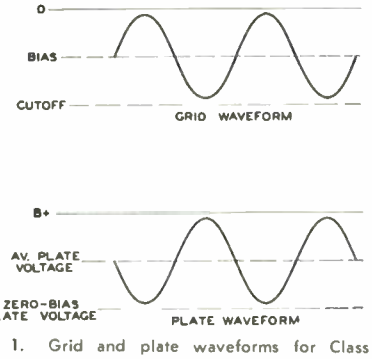


Fig. 1. Grid and plate waveforms for Class A

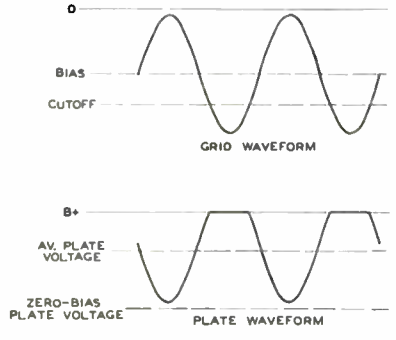


Fig. 2. No grid current is drawn in Class AB1

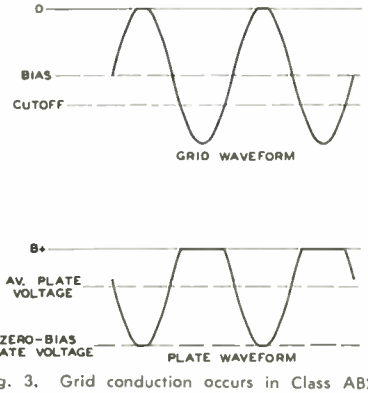


Fig. 3. Grid conduction occurs in Class AB2

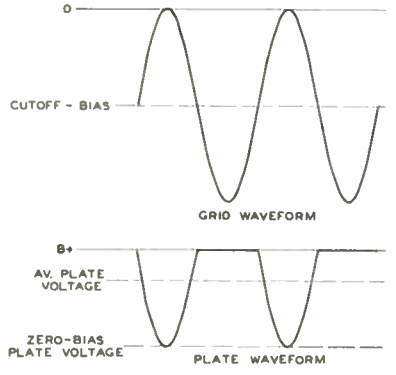


Fig. 4. Bias is at cutoff in Class B operation

AUDIO amplifiers can be classified broadly on a basis of the percentage of the input waveform which causes conduction, as shown in the illustrations here.

CLASS A — Fig. 1: Bias and AC grid voltages are such that the tube conducts during 100% of the input electrical cycle. Voltage amplifiers are invariably operated class A. Power amplifiers may or may not be.

CLASS AB1 — Fig. 2: The tube is so biased that conduction occurs during more than 50% but less than 100% of the input electrical cycle, and no grid current is drawn by the input waveform.

CLASS AB2 — Fig. 3: This is identical with class AB1 except that some grid current is drawn at the extreme positive part of the input waveform.

CLASS B — Fig. 4: The bias is set at approximately cutoff so that conduction occurs only during the positive half of the input waveform.

APPLICATION NOTES

Classes AB1, AB2, and B are used only for power amplifiers, and only in push-pull circuits.

In general, it can be said that class B operation gives greatest efficiency (35 to 65%) but produces most distortion. Class A is the least efficient method of operation (20 to 30%) and is least likely to generate distortion.

The AB classifications are compromises, with class AB1 introducing less distortion but having lower efficiency than class AB2.

It should be understood that in audio amplifiers, efficiency is not important in itself, but only as a measure of the maximum power obtainable with given tubes. Therefore, most amplifiers for home use, or for any use where quality is more important than volume, are operated class A or AB1. Public address systems, and other applications in which it is desirable to obtain the maximum possible output, are generally operated at class AB2 or B.

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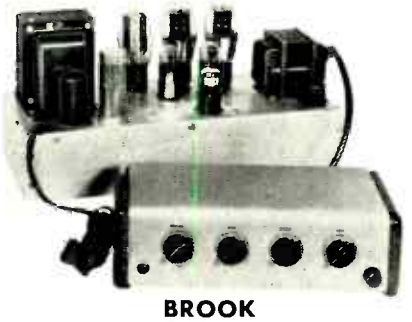
AMPLIFIERS



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Phenomenal performance characteristics. McIntosh circuit and transformers make possible instantaneous peak power of 100 watts from two 6L6G tubes at substantially less than 1% distortion over range 20 to 20,000 cycles. Useful bandwidth 10 to 200 kc. Negligible impulse distortion, low harmonic and phase distortion.

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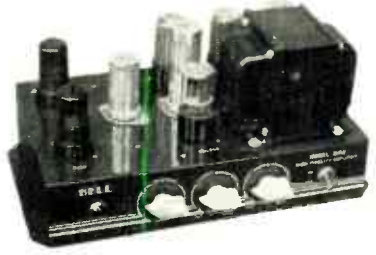

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**Indicates shipping weight.*

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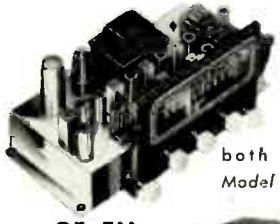

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PRESTO MODEL K—records 15 minutes at 33⅓. Plays all makes LP records 6 to 12 inch. Also may be used as PA system **$348.00**

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MAGNECORD—Harvey stocks all models of the Magnecord for rack or portable use. Amplifiers, spooling mechanisms, continuous loops, etc.

BELL RECORD-O-PHONE, dual track tape, records up to 1 hour.

Come in and see our new sound room with all makes and types of recorders, changers, amplifiers and speakers on display and demonstration. Or write for literature and prices on any type of sound equipment you need.

All prices are net, F.O.B., N.Y.C. and subject to change without notice.

Telephone: LOngacre 3-1800

hrc HARVEY RADIO COMPANY INC

103 West 43rd St., New York 18, N. Y.

SPOT NEWS NOTES

(Continued from page 10)

nance. AM broadcast circuits are expensive to add to TV receivers, while FM circuits are relatively cheap.

Educational Station:

St. Louis has spent $98,000 on FM station KSLH which went on the air April 11. Effective radiation is 12.5 kw. on 91.5 mc. Margaret Fleming is in charge of the station, with Ernest Vogel as engineer.

TV Thaw:

Every once in a while some individual, more hopeful than realistic in his thinking, bursts into print with the prediction that TV will be unfrozen by the end of this summer. Yet Chairman Coy, speaking in Portland, Ore., on May 19, said that, in his best judgment, the hearings cannot be completed "and the freeze ended much before the end of this year. If the freeze is lifted by the end of this year, the Commission will begin processing applications early next year." We still believe that the TV timetable published on page 13 of our April issue will prove to be very accurate.

John H. Ganzenhuber:

Former manager of broadcast sales for Western Electric, has been elected vice president of Standard Electronics Corporation, now a wholly-owned subsidiary of Claude Neon, Inc. SEC will produce a complete line of audio and TV broadcast equipment, and associated items.

400-Mile Relay System:

Humble Pipe Line Company will have 18 microwave relays to connect terminal stations at Houston and Kemper, Texas. Route will follow pipe lines between those cities. Philco will supply and install the equipment.

Miniature Tube Guide:

A new chart has been issued by Hytron Radio & Electronics Corporation, Salem, Mass., listing 132 miniature types, together with their characteristics, equivalent types in larger sizes, and basing diagrams. Copies are available on request.

IMSA Convention:

Annual meeting will be held at Hotel Commodore, New York City, September 18 to 21. Exhibit chairman is Henry Rippel, Superintendent of Fire Alarm, Rockville Center, New York.

Lee Jacobs Was Embarrassed:

Along with the other ghouls planning appropriate obsequies for FM at the

(Continued on page 38)

It's NEW . . . exclusive "triple-action"

It's UNIQUE . . . plays all speeds, all sizes

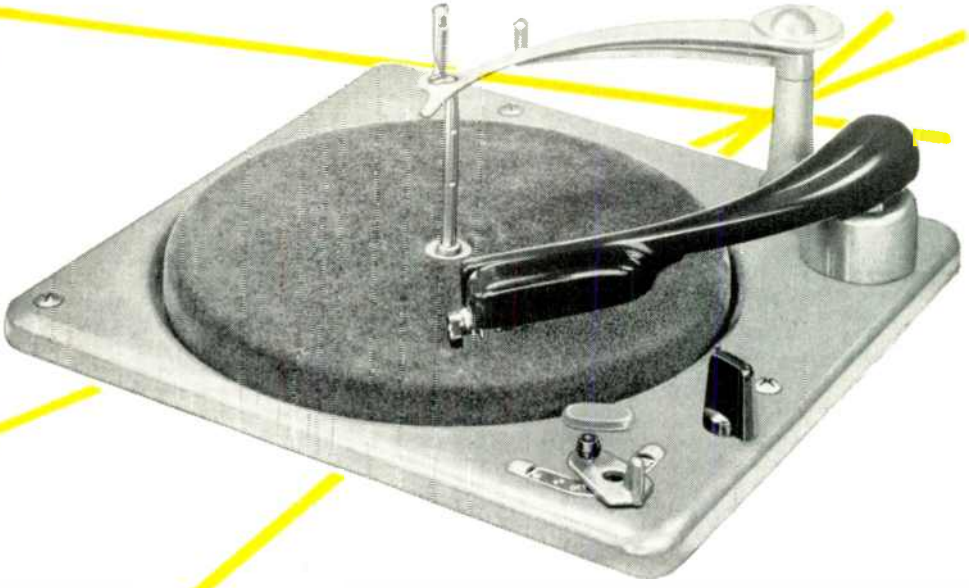
It's the FINEST . . . naturally, because

It's a WEBSTER-CHICAGO

Balanced Tone Arm
Gives perfect record touch on all size and all speed records.

Velocity Trip
New mechanism gives all records increased quality playing life.

Cushion-Drop
New spindle gently lowers records; heavy flock turntable cushions drop.



Here's the new Webster-Chicago completely automatic record changer that plays all three sizes at all three speeds—*with only one control lever.*

It's the ideal replacement unit for consoles now equipped with single and dual speed record changers.

Check these Model 100 features—you will not find them on any other unit. Each of these outstanding "triple-action" features means more sales for you.

- **Automatically plays 12-inch, 10-inch or 7-inch records at 33⅓, 45 or 78 rpm without any special adjustments.**
- **Pick-up arm comes to rest position after last record is played.**
- **Idler wheel retracts when control speed is off: eliminates flat spot which causes "wow."**
- **Fewer working parts for longer life of carefree operation.**
- **New automatic manual position plays home recordings or "inside-out" records without special adjustment.**
- **Operates on 105-120 volts, 60 cycle AC 50-cycle adaptor available.**
- **Dimensions: Base 13 x 13½ in., 5⅛ in. above mainplate, 3⅛ below mainplate. Shipping weight: 14 lbs.**

Another WC *Product*

WEBSTER-CHICAGO
Chicago 39, Illinois

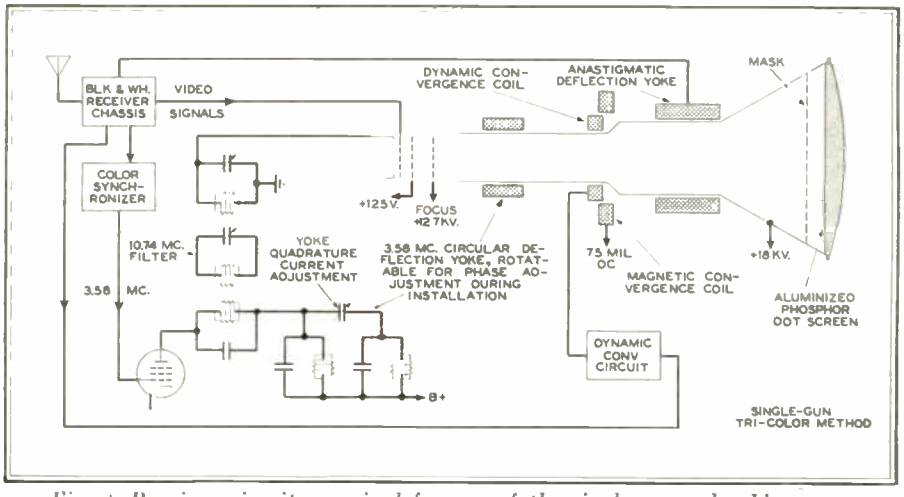


Fig. 2. Receiver circuits required for use of the single-gun color kinescope

COLOR PICTURE TUBES

(Continued from page 15)

tially by the permanently-installed delay lines which are cut initially to proper length.

The front-panel operating controls are the same for color as for black-and-white operation. Individual service-adjustment controls are provided in the cathode circuits of the three guns, in order to permit initial equalization of the control characteristics of the three guns.

The deflection circuitry is conventional. Minor changes in deflection-tube types have been made to supply the additional deflection power necessitated by the increased kinescope second-anode potential. The deflection yoke is of the anastigmatic type, and has an internal diameter of 2 ins. to accommodate the three guns.

Registration in this three-gun tube is built in by the proper registration of the masking apertures with their corresponding groups of phosphor dots. Means are also provided to converge the three beams to the same point on the phosphor screen during scanning. This is done for the undeflected beams by a convergence electrode, operated at 9 kv. and, when necessary, by small correcting magnets provided as a permanent service adjustment when the tube is installed. Because of the essentially flat face of the phosphor screen, simple geometrical considerations show that slightly less convergence is desirable as the beam is deflected from center. This dynamic convergence is accomplished by deriving a voltage from the vertical and horizontal deflection circuits of the receiver, and applying it to the convergence electrode.

An RF-type voltage supply provides a potential of 18 kv. for the kinescope final anode, 9 kv. for the electrostatic converging electrode, and approximately 3.5 kv. for the parallel-connected first anodes which give initial electron-beam focus. A small auxiliary power unit provides heater and plate voltage for the other added circuits.

Receiver for the Single-gun Tube:

A block diagram, Fig. 2, shows the circuit arrangement of the receiver utilizing the single-gun tri-color kinescope. Video signals, from the output of the video amplifier in a conventional black-and-white television receiver, are applied to the control grid of the single-gun kinescope as usual. Here, as in the receiver described previously, another signal from the video amplifier actuates an automatic color-phasing and sampling synchronization circuit. This produces a local 3.58-mc. signal, which is locked in step with the transmitter sampler. Circular deflection of the beam, which produces sampling automatically, is provided by a small deflection yoke having two sets of coils. These are fed with quadrature currents, at sampling frequency, to produce a rotating field.

Service adjustment of color-phasing is provided for by mechanical positioning of this yoke. The amplitude of circular deflection is adjusted to produce the proper convergence-angle as required by the mask and phosphor-dot screen. The duration of the sampling period is controlled by a signal having a frequency three times the sampling frequency, which is injected into the cathode circuit of the kinescope. The amplitude and phase of this signal are determined by the alignment of a filter circuit, which utilizes the third harmonic of the circular-deflection driver tube.

As in the receiver for the three-gun tube, the front-panel controls for the single-gun set are the same as those used in a conventional black-and-white receiver. Color balance is achieved by proper deposition of the phosphor dots.

The deflection circuitry and deflection yoke are the same as those employed in the three-gun receiver, described in the preceding section.

(Concluded on page 38)

Type 50W-2 $249.50

AUDIO power peaks reach 200 to 400 times the average power of speech and music. The unique design of McINTOSH amplifiers provides adequately for such peak power requirements.

A bass drum delivers 140 decibels above threshold at 20 cycles, and a cymbal delivers 120 decibels above threshold at 20 kc. McINTOSH amplifiers, delivering full-rated power at all frequencies from 20 cycles to 20 kilocycles with less than 1% distortion, satisfy this requirement of dynamic range.

The ear is extremely sensitive to distortion. For completely enjoyable reproduction, intermodulation at peak powers must not exceed 1%. McINTOSH amplifiers type 50W-2 and 20W-2 meet that requirement for 100-watt and 40-watt peak powers, respectively, regardless of the frequency combination within the band of 20 cycles to 20,000 cycles.

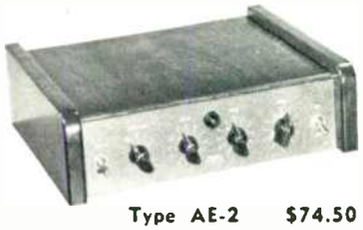
Here is another important specification: Be sure to choose an amplifier that works properly with a variable impedance load such as a speaker or cutter head, not just into an ideal resistive load. McINTOSH 50W-2 and 20W-2 amplifiers perform substantially the same under dynamic conditions into a speaker load, as into a pure resistive load.

Full dynamic range can be realized only if the noise is low. McINTOSH amplifiers are designed so that the noise components (rms) are 80 to 90 decibels below full rated output, which is an inaudible noise level.

Factors of economy should not be overlooked. The efficiency of McINTOSH amplifiers almost equals class B, with the highest theoretical efficiency possible. They are the most economical on tubes and power requirements — the most watts at the lowest distortion at the least cost. Service is simplified by plug-in circuits. Size is small because of the high efficiency.

Type 20W-2

$149.50



Type AE-2 $74.50

Performance of the control unit should compare with the amplifier. The McINTOSH AE-2 8-stage Amplifier-Equalizer provides stable, distortion-free performance that matches the performance of the 50W-2 and 20W-2 amplifiers.

Engineers agree that McINTOSH amplifiers reach the practical limits of low distortion and high efficiency. Music lovers agree that the theoretical advantages are fully reflected in superlative audio reproduction. For further information, write or telephone:

McIntosh
Engineering
Laboratory Inc.
910 KING STREET JUniper 7-2900 SILVER SPRING, MD

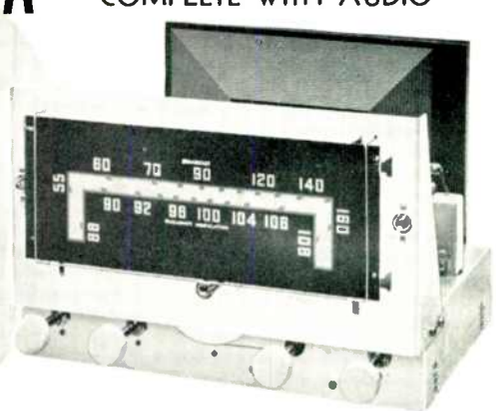
NEW! the MEISSNER 9A

AM-FM TUNER CHASSIS COMPLETE WITH AUDIO

AMERICA'S GREATEST RADIO VALUE!

MEISSNER takes great pride in announcing their new 9A AM-FM chassis complete with Audio. The 9A brings real "Custom" quality reception into the low price field! A complete AM-FM unit — everything you need for a deluxe custom installation or for converting older radios. Nine tubes, including rectifier, give the 9A ample power while a high degree of stability and selectivity is attained through superior MEISSNER circuit design and the use of high quality components. MEISSNER engineers stress that only a high quality speaker is capable of reproducing the wide range fidelity and tonal richness inherent in the 9A. See this fine instrument at your dealers now. Examine the workmanship—hear the glorious richness of its tone! Compare the MEISSNER 9A with units selling for twice its price. You will agree, it's MEISSNER—For Magnificent Reception!

Write today for information on other MEISSNER Chassis.



Here's the outstanding 9A — complete with tubes, power supply, built-in antenna, escutcheon, knobs, etc.

features that place the 9A in a class by itself

- High Selectivity and Sensitivity
- Full Audio Fidelity
- Full 4 Watts Output
- FM Circuit Temperature Compensated
- Air Wound FM Coils
- Separate AM and FM Condenser Sections
- Built-In High "Q" Die Stamped Loop Antenna
- Full Range Tone Control
- Complete Provision For Phono Input
- All Controls On Front Panel
- Power Outlet For Phono Motor

MEISSNER FOR MAGNIFICENT RECEPTION

MEISSNER MFG. DIVISION, MAGUIRE INDUSTRIES, Inc., MT. CARMEL, ILLINOIS

COLOR PICTURE TUBES

(Continued from page 36)

The kinescope gun employed is the same as that used in the commercial type 5TP4 kinescope. Potentials of 18 kv. for the final anode and 2.7 kv. for the electrostatic focus electrode are derived from the kick-back voltage of the horizontal-deflection output transformer, just as in conventional black-and-white receivers. A small auxiliary power unit provides heater and plate voltage for the other added circuits.

Convergence of the circularly-deflected beam is produced by a magnetic lens in this single-gun kinescope, Fig. 2, rather than the electrostatic method employed in the three-gun version. A coil similar to the focus coil normally employed in conventional black-and-white receivers is used for this purpose. The dynamic convergence voltage is also applied magnetically, and is introduced by means of a smaller auxiliary coil located near the main convergence coil. As in the previous receiver, the dynamic convergence waveforms are derived from the deflection circuits.

SPOT NEWS NOTES

(Continued from page 34)

NAB Convention was KBKR's president. Speaking at the Sunday luncheon for unaffiliated stations, he cracked gleefully: "The FM meeting tomorrow will be attended by both broadcasters." But Lee's neck was out a mile. The FM meeting drew the largest attendance, and proved to be the most interesting and constructive of any during the convention. Highlight was Morris Novak's blast at manufacturers who sell FM transmittters, and then concentrate receiver production on TV sets.

Norman B. Krim:

Elected vice president of the Raytheon Manufacturing Company, Waltham, Mass., in charge of the receiving tube division.

Interference Locator:

A new instrument, operating from AC or self-contained batteries, has been announced by Sprague Products Company, North Adams, Mass. It is suitable for locating all types of man-made interference. Power supply is available for use in automobiles. Descriptive bulletin will be sent on request.

FM Interference on TV Reception:

Cy Braum, Chief of FCC's TV broadcast division: "FM interference with TV reception is seldom due to the second harmonic, but to pickup of fundamental FM frequencies on TV sets with badly de-

(Concluded on page 40)

new **HORIZONS** *in sound reproduction . . .*
new **CONCEPTS** *in speaker design . . .*

NOW YOURS IN THE

NEW E-V

2, 3 and 4-WAY
HIGH FIDELITY
LOUDSPEAKER SYSTEMS

For the first time, separate 3- and 4-way reproducing systems for the home...*for the first time,* the RADAX Principle of super-efficient high-frequency propagation and dispersion...*for the first time,* acoustically-correct corner cabinets with authentic furniture styling...these and other E-V exclusives set new standards of high fidelity reproduction.

Electro-Voice loudspeakers include *only* RADAX coaxial 2-way and separate 2, 3 and 4-way systems, yet prices are surprisingly low and realistic. E-V components offer a wide selection of low-frequency and high-frequency drivers, horns, crossover networks...and cabinets of both bass-phase-inverted-reflex and corner and folded types, in furniture and utility models. Also 40 and 80 watt theater systems.

Investigate this entirely modern loudspeaker line...today! Write for Catalog No. 111 describing E-V loudspeaker systems and components.

FULL, NORMAL TRADE DISCOUNTS PREVAIL

RADAX Super-Eight. Coaxial 2-way system in economical 8" speaker. Response to 13,000 c.p.s. **Model SP8-B. List $34.00**

RADAX Twelve. Two cones, including RADAX high-frequency propagator, divide reproduced spectrum. Perfect balance between highs and lows. **Model SP12-B. List $36.50**

RADAX Super-Twelve. Bass diaphragm reproduces lows, RADAX "whizzer" cone reproduces *only* upper octaves. Response is full, uncompromised from 70 c.p.s. through 13 k.c. Oversized 3 lb. Alnico V magnet. **Model SP12. List..$75.00**

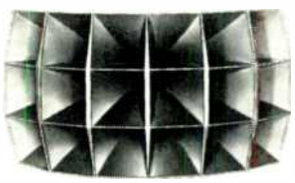
RADAX Super-Fifteen. Full 15" low frequency driver *plus* RADAX high frequency cone. Smooth, distortion-free reproduction 50 c.p.s. through 13,000 c.p.s. 5¼ lb. Alnico V magnet. **Model SP15. List..$95.00**

Model 12W. Low-Frequency Driver. Heavy ribbed cone, reduces transient distortion. Outer compliance specially treated to prevent frame reflections from emphasizing or cancelling certain frequencies. **List $75.00**

Model 15W. Low-Frequency Driver. Powerful 5¼ lb. Alnico V magnet. Maximum instantaneous power input 20 watts to 30 c.p.s. 30 watts above 100 c.p.s. Sturdy frame **List $95.00**

Model 18W. Very-Low-Frequency Driver. Bass response to 32 c.p.s. Cone specially treated for moisture and fungus. Outer periphery damped with semi-viscous compound to reduce transient and intermodulation distortion. **List.....$120.00**

Each cell of E-V horns is truly exponential permitting full efficiency with spherical wave shape. Horns supplied in 6 models for 800, 600 and 400 cycle crossovers. **From $30.00 list to $250.00 list.**



Model 4–3x6. Horn. For finest quality theater systems. **List $250.00**

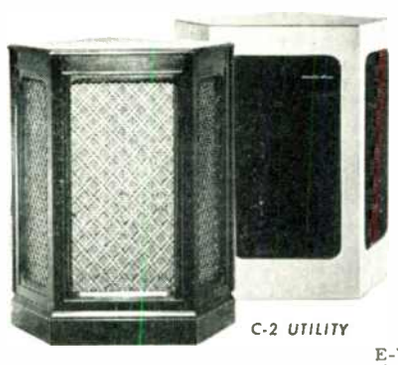
E-V High-Frequency Drivers for clean, clear reproduction of higher octaves.

Model T-40. Input power, 40 watts. Peak, above 400 c.p.s. **List $150.00**

Model T-25. Input power, 25 watts. Peak, above 500 c.p.s. **List $75.00**

Model T-10. Input power, 10 watts. Includes eight-cell horn. **List.....$50.00**

All ELECTRO-VOICE crossovers utilize specially wound high Q air cored coils, quality paper condensers. 5 models. 3 db loss points 3500, 800, 600, 400 c.p.s. and combination 3500, 600 and 200 c.p.s. **List prices $10.00 to $100.00.**



C-2 UTILITY

THE REGAL

THE PERIOD C-4 UTILITY

THE CONTEMPORARY

E-V Corner Cabinets are available in three sizes in furniture and utility styling. PATRICIAN utilizes separate 4-way reproducing system. REGAL (illustrated) employs separate 2-way system. MARQUIS is ideally designed for *Electro-Voice* RADAX coaxial 2-way units.

Conventional bass-phase-inverted-reflex cabinets house wide variety of components. In two models, PERIOD and CONTEMPORARY. PERIOD, designed for separate 3-way or 2-way systems. Mahogany or bleached blonde finish. ESQUIRE table cabinet (not shown) ...for 8 or 12 inch RADAX units.

Electro-Voice INC.

RESEARCH-ENGINEERED MICROPHONES · PHONO PICKUPS · SPEAKER SYSTEMS

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SPOT NEWS NOTES

(Continued from page 38)

signed front ends. In fact, FCC engineers now refuse to check complaints of interference from FM on certain makes of TV sets."

John F. Harris:

Has joined Langevin Manufacturing Company, 37 W. 65th Street, New York, as chief transformer engineer. He has specialized in transformer design for the past 20 years, first at Bell Telephone Laboratories and then at American Transformer Company.

Antenna Plant:

Workshop Associates has moved into a 3-story factory and separate office building on Crescent Road, Needham Heights, Mass., a short distance from their former location. New phone number is Needham 3-0005.

"Captive Audience":

Ed Kobak's definition of those unwary souls who attend (NAB) convention luncheons.

AAR Communications Section:

Office of the communications section of the Association of American Railroads have been moved from New York to 59 E. Van Buren Street, Chicago 5. A. H. Grothmann will continue as secretary, and L. E. Kearney as communications engineer.

Transitcast Receivers:

Looks as if REL has this business pretty well sewed up. Modifications of home receiver designs have not stood up under the gruelling conditions of transitcasting service.

WHAT'S NEW THIS MONTH

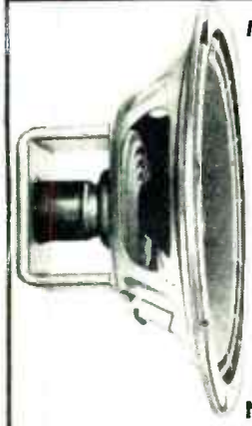
(Continued from page 22)

4. *TV stations will require extensive program-creating facilities:* The current efforts by individual radio stations to create their own programs will not withstand high-grade professional competition. Right now, stations can get away with a lot, but home-talent will disappear in TV just as it did long ago in AM. The equipment and talent requirements for TV productions will increase in magnitude and cost, with the result that TV features will have to be mass-produced for large numbers of stations, and repeated in the same areas. Syndication to stations may some day be accomplished by a single national program distribution wire or relay service working 24 hours a day, with stations

(Concluded on page 42)

"I think Terminal's Sound Department is the best in the country" says leading audio authority*

*Richard H. Dorf, New York audio consultant and author of authoritative articles in leading radio publications



New *Permaflux* ROYAL EIGHT

A BARGAIN! The speaker that amazed 'em at the Audio Fair! Response 50 to 12,000 cps, 8 watts. Efficiency high, distortion low! 8" diameter, 8 ohm V.C.

Now only 8.82

New UNIVERSITY 6200 Wide Range 12" Speaker

30 watt FOCUSED FIELD wide range PM speaker! Advanced magnetic structure concentrates all of the magnetic force where it belongs — in the voice coil. Response of 45 to well beyond 10,000 cycles with amazing efficiency. Standard 12" mtg., 6 to 12 ohm voice coil.

A real buy, at only 20.58

New Webster-Chicago series 100 3-speed Automatic Changers

Terminal has the new Webster-Chicago record changers, available with Audak polyphase, General Electric reluctance, Pickering magnetic and standard crystal cartridges. Wide range cartridges with sapphire or diamond styli.

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EVERYTHING IN AUDIO FOR THE STUDIO & CUSTOM BUILDER!

radio craftsmen chassis as used in the finest custom installations

RC-100A TELEVISION CHASSIS

with built-in booster.

This is the finest! Use 19" or 16" square or round kinescopes. Less picture tube, amplifier, speaker

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radio craftsmen RC-10 FM-AM tuner with built-in pre-amplifier

compensated for G.E., Pickering and crystal phono cartridges. Continuously variable bass and treble controls with flat response from 20 to 20,000 cycles. Automatic frequency control entirely eliminates station drift.

119.50

RC-2 wide range amplifier

Companion unit for RC-10 tuner, or any high fidelity application. Over 10 watts output with less than 1% distortion. 20-20,000 cycles frequency response.

Net **39.00**

There is a UNI-MODE cabinet ensemble for every custom requirement!

RECORD CHANGERS
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LOUDSPEAKERS RECORDERS

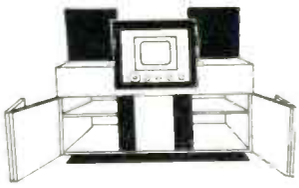
With Uni-Modes, you can create an entertainment center that will combine utility, beauty and allow for future expansion. It's easy and surprisingly moderate in cost! UNI-MODE is available in beautiful hand-rubbed Blonde and Cordovan Mahogany; also unfinished, if desired. Interiors are attractive Tarragon Green or Afghan Red.

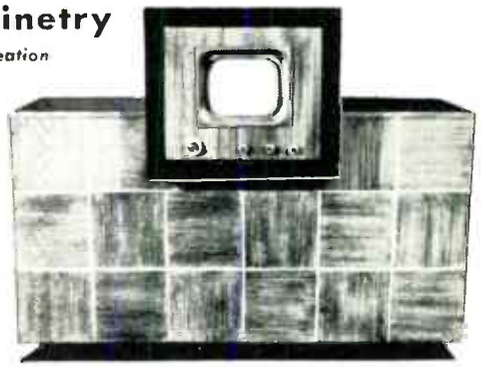
See UNI-MODE in our sound catalog for pictures, sizes and prices.

Masterpiece in Cabinetry

An ELECTRONIC DECORATORS creation

Artfully constructed of finest woods, scientifically planned layout far proper housing of TV, radio, amplifier, record changer, speaker and record storage.





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RADIO CORPORATION

Distributors of Radio & Electronic Equipment

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WHAT'S NEW THIS MONTH

(Continued from page 40)

making film recordings as they now make AM tape. Local movie theatres get along without creating any programs; TV originations by stations may become no more than a curiosity of their halycon days.

It is not hard to go on with other evidence that TV is not AM with a peephole, even though a log of current programming suggests that. The best preparation for success in TV broadcasting operations is a watchful eye, a sensitive ear, a minimum purchase of initial equipment, and an expansion of facilities based on self-supporting projects. That means buying studio cameras when a number of locally-originated shows have been sold to sponsors, a field unit when enough sponsored sports events have been lined up to warrant it, a relay system tapping network sources when the network and agency commissions are low enough to make it pay off.

A competitive market for TV film should be encouraged because, if quality improvement continues, film will have the same place in TV as the transcription has in AM. Then all that investment (usually two-thirds of total) in studios and studio facilities may go into other requirements, such as remotes for sports or equipment for high-speed film production from incoming lines or relays. The best thing for TV is intense competition from many film program sources, including perhaps present network organizations as program producers, transcription companies, movie independents, and the old-line movie producers.

RELAY INSTALLATIONS

(Continued from page 24)

40 miles an additional 3 db be allowed, and over 60 miles 5 db. For an additional 3 db the correction factor is 0.71; for 5 db, 0.56.

Other Considerations:

The distances calculuated are for unobstructed, straight-line paths. In hilly or heavily built-up sections, it is wise to make a terrain plot of the proposed path, in order to ascertain the antenna tower heights necessary to clear all obstacles. Long-distance hops, even in the absence of interfering objects, necessitate high locations or towers to overcome earth-curvature effects. For long distances or for obstructed paths, it may be found less expensive and more satisfactory to insert one or more repeaters along the route.

If transient obstacles such as airplanes are anticipated, allowance must be made

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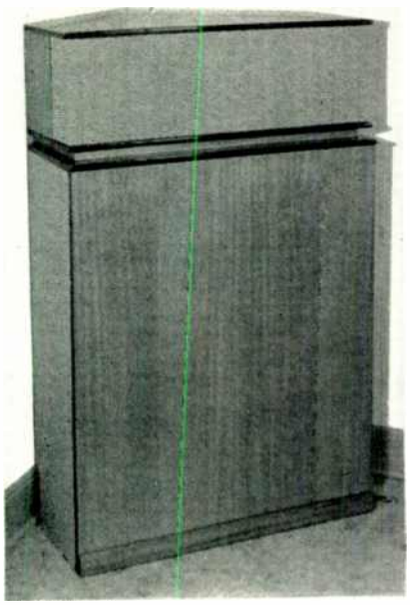

Facts about the Klipschorn:

3. MANY substitutions ond neor-imitotions of the Klipschorn, revived from a former decade, or derived without knowledge of prior art, oppear as ghosts of ideas recorded during the development of the Klipsch design. These revived discards from our 1940 research do indicate, however, that the art has caught up with our early reseorch from which was developed the prototype giving the leost bulk for o given performance.

Our continued development hos improved upon thot prototype design to the extent thot full range is a demonstrable fact, not o mere claim. And today's production type of Klipschorn, descendont of the experimental prototype, has proved both its performance ond its esthetic dignity before highly quolified, critical observers.

The authentic Klipschorn is a sound REproducer offering smooth, distortion-less range from the low-C_3 of the organ to the highest audible overtones. Least possible bulk and lowest possible price follow from rigorous design and skillful production by the originator of the system. Its gracious appearance qualifies it for environments furnished in the most discriminating toste.

Write for detoils,

KLIPSCH and ASSOCIATES

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AUTHORIZED SALES & SERVICE FOR PRODUCTS OF KLIPSCH & ASSOCIATES

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Gulf Coast Electronics
1110 WINBERN STREET
HOUSTON 4, TEXAS
HARRY A. KEEP — JUstin 1551

The Klipschorn
CUSTOM RADIO SOUND TV INSTALLATIONS

CONTINENTAL SOUND CONSULTANTS

GEO. E. BEGGS, JR.
P.O. BOX 172
WARRINGTON, PA.
Doylestown 5929

M. B. Foster Electric Co.
368 Congress St.
Boston 10, Mass.
LIberty 2-8385

PAUL ST. GEORGE

JOE H. MINOR
Electronic & Acoustic Engineering

Berkeley Custom Electronics
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RELAY INSTALLATIONS

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for them. The type of remedial action required depends on the severity and frequency of the interference and upon the type of service for which the relay is intended. Expert engineering advice is advisable in many instances.

Occasionally the signal from ground reflection increases or decreases the intensity of the main signal, depending on the phase relationship. Careful adjustment of antenna height will reduce this effect, as will the use of extremely directional antennas.

Finally, on frequencies above 10,000 mc., attenuation due to falling rain[5] becomes severe enough to warrant consideration.

[5]Howard E. Bus, "Attenuation Due to Rainfall," RADIO COMMUNICATION (*FM-TV*), February, 1950

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raise the level of the speakers in the street cars and buses. At the end of the commercial, transmission of frequencies A and B and D would silence the transit-cast speakers, then restore all speakers in groups 1 and 2 to normal operation.

Suppose someone in a Group 3 store turned on a receiver before the scheduled operating time. As is explained in the section following, speakers in First National and A & P Stores would be turned on by the transmission of frequencies F and H. In other words, there is no way that the controls can get out of step, or be deliberately tricked into faulty operation.

Receiver Controls:

Fig. 1 shows the complete Multipulse receiver, amplifier, power supply, and audio control unit. It is designed for wall mounting, so that it can be located where it will be safe from physical damage and tampering.

The control circuit, Fig. 2, is simple and positive in action. Tube A is the control triode, and tube B a conventional resistance-coupled audio stage. When the receiver is first turned on, the triodes begin conducting simultaneously. The plate current of triode A, passing through R5, biases triode B to cutoff. The receiver, consequently, remains silent until a negative pulse of a few volts is applied to the grid of tube A by reception of a supersonic pulse of the correct frequency. Its plate current then decreases, the voltage across R5 decreases, and tube B begins to conduct. The voltage drop across R9 increases the bias on tube A, further decreasing its plate current until it cuts off and triode B operates normally. A

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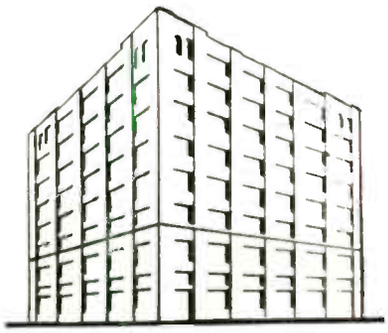

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C C BROADCASTING

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positive control pulse to the grid of tube A reverses the action, silencing the receiver again.

One method of controlling speaker output utilizes the rectified control voltage to bias a tube with a relay in its plate circuit. This switches volume controls which are preset at the desired levels. However, the relay contacts are in the audio circuits, and disagreeable noises are sometimes produced.

A simple and dependable circuit used in the Multipulse receiver consists of a T pad in which the vertical element is a triode, as shown in Fig. 3. Biasing the

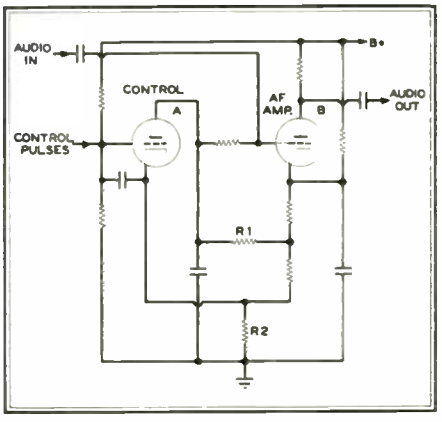

Fig. 2. Control tube turns AF on or off

triode to cutoff decreases the attenuation of the pad. In this method the triode acts as a variable resistance only, and no distortion or unwanted noises are introduced. Two parallel audio stages, each with a separate volume control and arranged so that either one can be biased to cutoff, provide another excellent method of control.

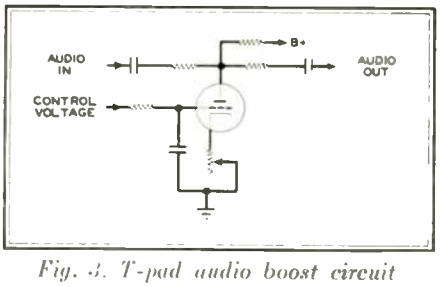

Fig. 3. T-pad audio boost circuit

Receiver Specifications:

The unit illustrated in Fig. 1 is a crystal-controlled, limiter-discriminator design, with a sensitivity of less than 10 microvolts for 20 db limiting. A line-cord antenna is provided in order to eliminate the use of an outside antenna under favorable operating conditions. Supersonic tuning range is 15 kc. to 50 kc. The audio gain is 14 db, with a range of audio boost of 0 to 8 db. Both treble and bass boosts are provided for the 10-watt amplifier.

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Output impedances are 4, 8, 250, and 500 ohms.

The tuner has a 6AG5 RF amplifier, 6AG5 1st detector, 6AU6 oscillator-multiplier, 6AU6 1st and 2nd IF, 6AU6 limiter, and 6AL5 discriminator. Four tubes in the power amplifier are a 6SC7 phase inverter, two 6V6 power output, and 5Y3 rectifier. There are three sections in the control circuit, with 6AQ6 1st amplifier and 6C4 output for the supersonic amplifier, 6SL7 audio on-off control, and a 6SL7 level-boost control.

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ring at random, but only during the time of the vertical synchronizing signal. With adjustment of the noise signal by means of the limiter, the blocking oscillator can be made to operate between 60 and 20 times per second. Signals from the blocking oscillator produce square-wave control signals by means of a multivibrator. The square wave output, in turn, switches on an oscillator operating at the key signal carrier frequency. The output from this oscillator is shaped in an amplifying stage for a rise time of approximately two-thirds of a field period, and is then distributed through the control link.

The key oscillator output is fed also to the second section of the coder, which generates the coded horizontal drive used by the cameras, monitors and shading generators. Oscillator signals are combined with the vertical pulse in a gating circuit which, in turn, determines the points of transition of a single-trip multivibrator. Vertical pulses from the gate circuit are positive when the key signal is applied, and negative in the absence of the key. Application of the positive and negative pulses to one of the control grids of the single-trip multivibrator causes a change in the mode of operation, at the time of the first vertical pulse present with the key signal and at the first vertical pulse after the key has been turned off.

A normal horizontal drive pulse is fed into the coded horizontal drive generator through a phasing circuit, which produces a pulse shifted in phase with respect to the normal horizontal synchronizing pulse. A blocking oscillator triggered by the shifted pulse drives a delay line, having a delay equal to the time-change desired in the video. An electronic switch chooses either the pulse from the input or from the output of the delay line, as determined by the single-trip multivibrator, and in this way produces the horizontal drive waveform, coded according to mode of operation.

As indicated earlier, the horizontal shift in the video signal is obtained by using time normally required for the horizontal blanking pulse. This necessitates a horizontal blanking signal of less width. The altered blanking signals are generated in the third unit of the coder by feeding horizontal pulses from the output of the delay line through an isolation amplifier to a single-trip multivibrator. Normal vertical blanking signals and the output of the single-trip multivibrator which forms the horizontal blanking signals are mixed in the blanking mixer, and then amplified, clipped, and distributed through a cathode follower.

An additional requirement, that of coded blanking insertion, is provided for in the fourth section of the coder. The output of the coded horizontal drive generator triggers a single-trip multivibrator to obtain coded blanking signals. Video from the camera chain is applied to the blanking inserter, and mixed with the coded blanking signal.

The second section of the blanking inserter adjusts the blanking level, maintaining this level at approximately the average video level. After insertion of coded blanking, the signal is distributed

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to the usual mixers through a cathode follower.

Decoding the Signal:

A television receiver is altered slightly by the addition of Phonevision. The receiver, shown in Fig. 6, consists of the normal RF amplifier, first detector, mixer, and local oscillator, followed by video IF stages, the video detector, video amplifier, and picture tube. The video detector feeds the sync pulse separating circuit. Vertical pulses are separated in normal fashion and actuate the vertical sweep circuit. The horizontal sync pulses, on the other hand, are fed into a decoder unit. This unit, actuated by the key signals coming over the control link to the receiver, applies a correction to the horizontal sync pulses which trigger the horizontal sweep circuit.

A block diagram of a typical decoder unit is given in Fig. 7. Since the level of

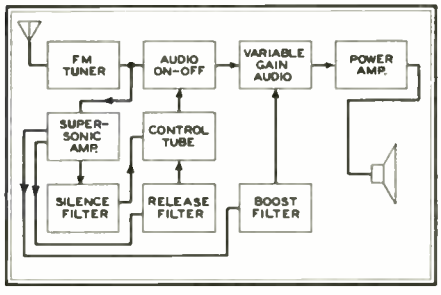

Fig. 7. Components of the decoder unit

the key signal from the control link is approximately 50 millivolts, the decoder incorporates a key signal amplifier. A gating circuit combines the key information with the vertical pulse obtained from the television receiver to trigger a square wave generator. The gating circuit and square wave generator have the unique ability to detect the first vertical pulse in the presence of the key and the first vertical pulse in the absence of the key. Thus, the square-wave generator determines the mode of operation as dictated by the key information, and is synchronized at the same time with the vertical sync signals. The square wave output controls the phase of pulses used to drive the horizontal sweep of the picture tube. This phase shift, controlled by the key signal, corrects for the phase shift incorporated in the transmitter by the Phonevision coder.

A blanking circuit is provided also, which is controlled by the coded horizontal pulses and which restores the blanking interval to normal width.

EDITOR'S NOTE: *Concluding part 2 of this article, describing methods of distribution of the Phonevision key signal, will appear in a forthcoming issue of* RADIO COMMUNICATION.

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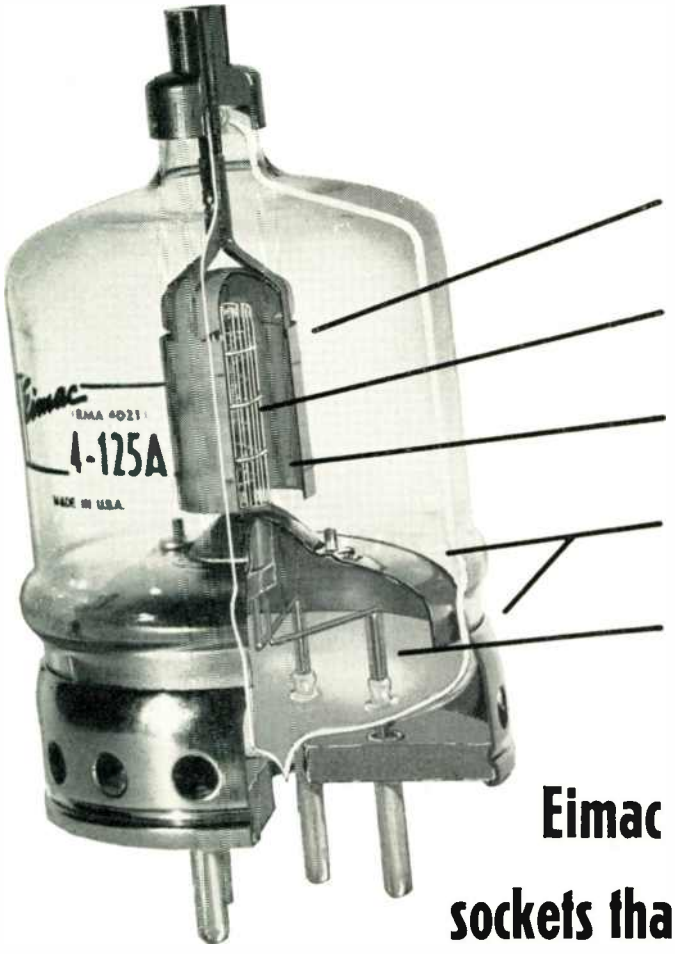

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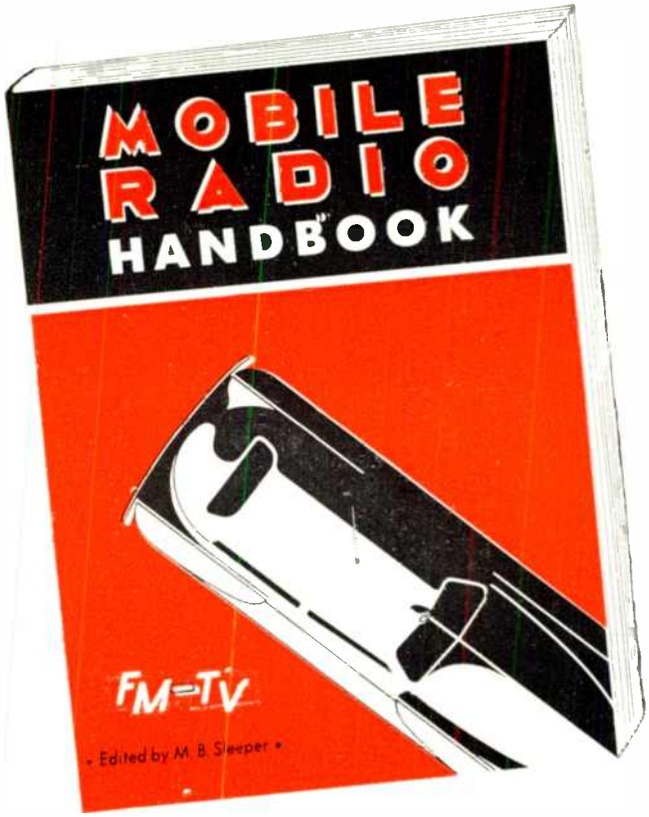

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