# TELE-TECH

Formerly ELECTRONIC INDUSTRIES

**TELEVISION • TELECOMMUNICATIONS • RADIO**

IN TWO PARTS • PART ONE

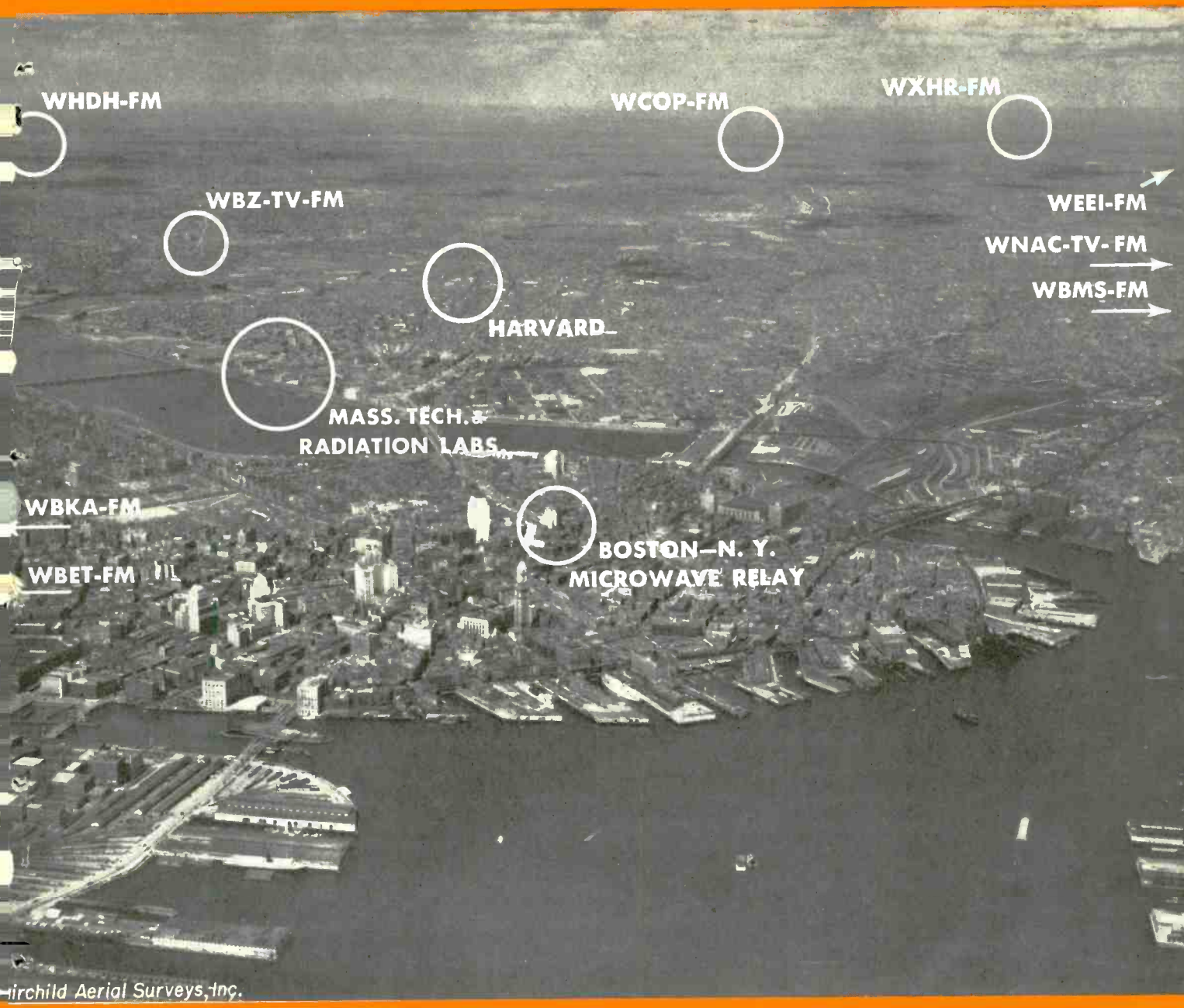


Photo: Airview of Boston, Mass. highlighting the points of interest to communication engineers

***Making Most of Audio Consoles***

***Design of Horizontal Wipe Amplifier***

***FM Broadcasting in the United States*** — See Part Two

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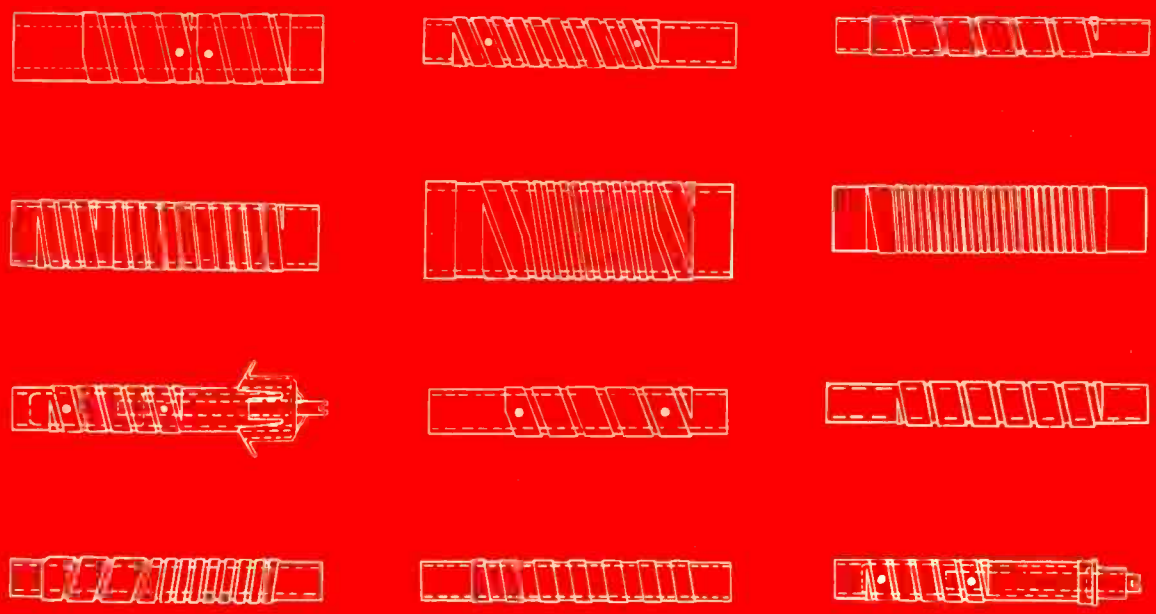
CALDWELL-CLEMENTS, INC. July • 1950



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## WITH CORNING METALLIZED GLASS INDUCTANCES

About the only limiting factor in Corning Metallized Glass Inductances is that they cannot be designed to operate much below 30 Megacycles. Aside from that, just give us your specifications and Corning engineers will quickly design and send you samples. Once approved, they can be easily duplicated to surprisingly close tolerances on a production basis.

When special tuning characteristics or convenient terminating areas in inductances with fine turns are desired, variable pitch coils are easily supplied. Double pitch windings are available for r.f. transformer or inductive coupling purposes. The conductor width may even be modified to give you distributed parameters. Gaps between turns can vary from as little as .020″ to as much as one-eighth of an inch.

Fixed tuned, permeability tuned, or permeability tuned inductance-trimmer combinations can be supplied with appropriate powdered iron cores and convenient mounting bushings. Assembly can be made by conventional methods.

Corning Inductances offer many special advantages. High temperature stability due to low expansion coefficient of the glass coil form, and the low temperature coefficient of the dielectric, results in negligible drift characteristics. Minimum allowable Q is 150. The smooth glass form assures noiseless tuning. Rugged and durable, they can stand repeated handling. Assembly costs are lower. Whatever your inductance requirements, Corning engineers can help you. Write for further information today.

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ELECTRONIC SALES DEPARTMENT

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*Corning means research in Glass*

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# TELE-TECH

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*Edited for the 15,000 top influential engineers in the Tele-communications industry, TELE-TECH each month brings clearly written, compact, and authoritative articles and summaries of the latest technological developments to the busy executive. Aside from its engineering articles dealing with manufacture and operation of new communications equipment, TELE-TECH is widely recognized for comprehensive analyses and statistical surveys of trends in the industry. Its timely reports and interpretations of governmental activity with regard to regulation, purchasing, research, and development are sought by the leaders in the many engineering fields listed below*

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BROADCASTING • RECORDING
AUDIO & SOUND • MUNICIPAL
MOBILE • AVIATION
COMMERCIAL • GOVERNMENT


JULY, 1950


**PART ONE:**




**CALDWELL-CLEMENTS, INC., Publication, Office, Orange, Conn., Editorial & Executive Offices 480 Lexington Ave., New York 17, N. Y., Tel. Plaza 9-7880**

Publishers also of RADIO & TELEVISION RETAILING

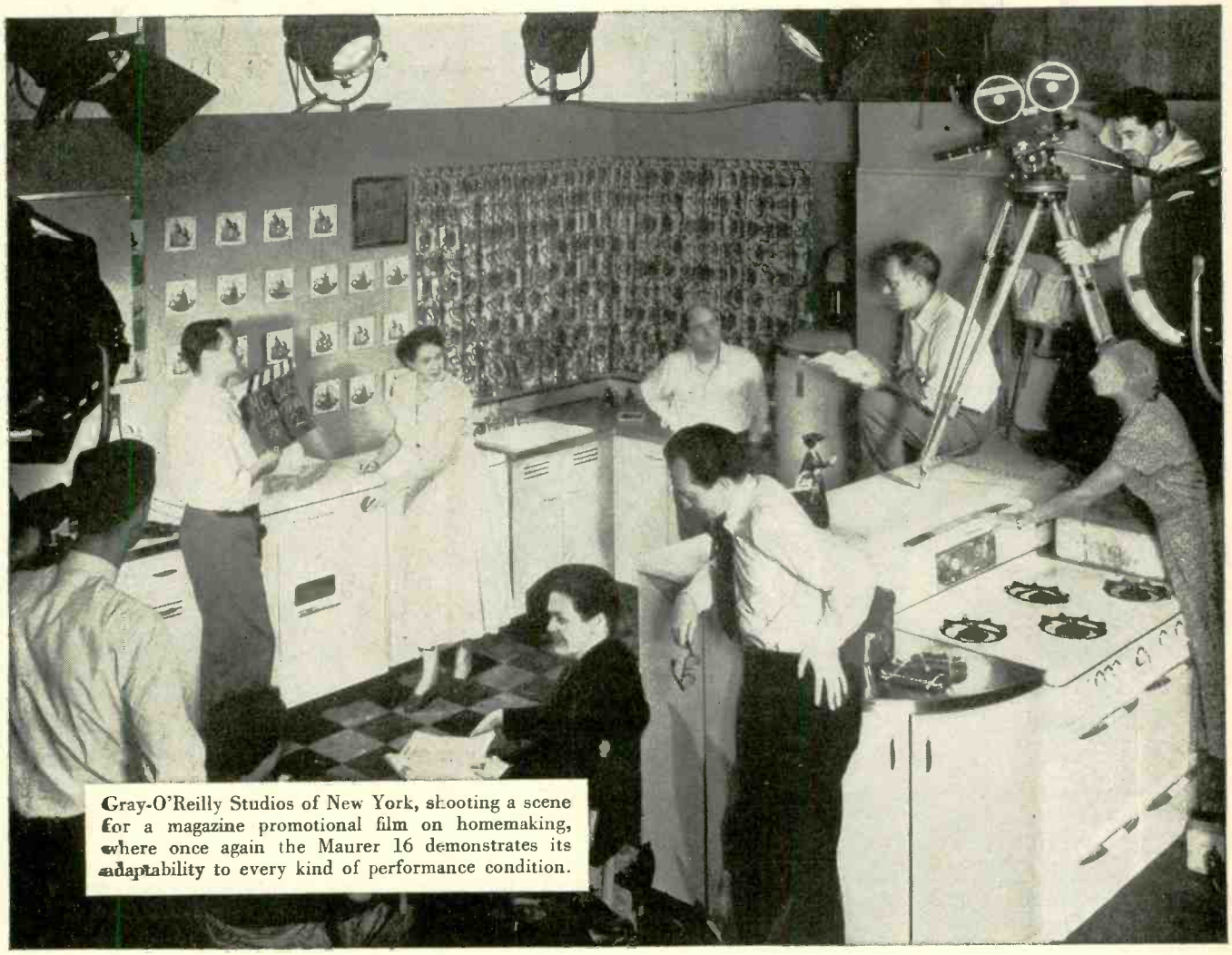
# TELE-TIPS

**COLOR TUBES FOR M'F'RS** will be available this Fall when RCA's pilot production line is expected to be turning out a hundred tri-chrome tubes per day. Each licensee will be supplied 25 to 50 tubes for full experimentation. Already each licensee has been furnished 13 different manuals on color-set circuits, so that each manufacturer can do own design and development of his color-TV line.

**IT WON'T BE LONG** before color broadcasts start in metropolitan centers, but even in such cases plan is to have color on air only a few hours each day,—continuing majority of programs in familiar black-and-white. This will insure satisfaction of present millions of set-owners, while new color-set purchasers have couple of hours daily to enjoy and show off their new color jobs!

(*Continued on page* 14)

# *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. J

**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.

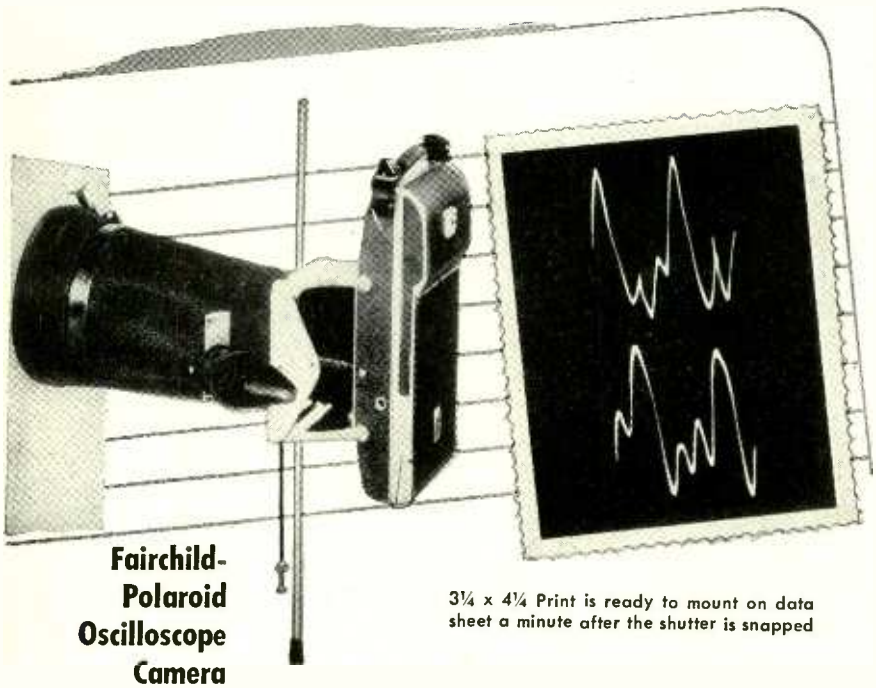
**J. A. Maurer, INC.**

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

16mm maurer

CABLE ADDRESS: JAMAURER

# Don't draw it- Photograph it!



## Fairchild-Polaroid Oscilloscope Camera

3¼ x 4¼ Print is ready to mount on data sheet a minute after the shutter is snapped

Fairchild now offers an inexpensive oscilloscope camera that gives you accurate photographic records of waveshapes in almost as little time as it takes to sketch them from memory. Only one minute after the shutter is snapped, a print is ready to mount in your notebook. This permits you to evaluate oscilloscope "stills" immediately and then proceed with laboratory work.

The 3¼ x 4¼ print is small enough to mount easily in a notebook or on a data sheet, large enough for accurate evaluation. Each print records two traces to facilitate comparison runs and cut film costs in half. Operation is simple – no focusing, no darkroom processing. You just snap the shutter and remove the print from the back of the camera.

The complete Fairchild-Polaroid Oscilloscope Camera consists of a *scope adapter* to fit any five-inch oscilloscope, a *light-tight hood* with viewing port, and a *Polaroid-Land Camera body* with special lens and two-position shift device.

Write today for complete details and prices on the ready-to-use F-284 Oscilloscope Camera Kit including camera, carrying case, and Polaroid film. *Fairchild Camera and Instrument Corp., 88-06 Van Wyck Blvd., Jamaica 1, N. Y.* Distributors: *Tektronix Inc., Portland, Oregon; Electronic Tube Corp., Philadelphia, Pa.*

### Specifications

**Lens** — Special 75 mm. f/2.8 Wollensak Oscillo-anastigmat.

**Shutter** — Wollensak Alphax; speeds 1/25 sec. to 1/100 sec., "time," and "bulb."

**Focus** — Fixed (approx. 8 in.).

**Picture Size** — 3¼ x 4¼ in. (2 images per print; 16 exposures per roll of film).

**Image Size** — One-half reduction of scope image.

**Writing Speed**—to 1 in/$\mu$sec at 3000V accelerating potential; higher speeds at higher voltages.

**Dimensions** — Camera, 10½ x 5¼ x 6¼ in.; hood, 11 in. length, 7½ in. dia.; adapter, 2 in. width, 6⅝ in. max. dia.

**Weight** — Complete, 7¾ lb.

Fairchild
CAMERA AND INSTRUMENT CORPORATION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**LAMINATED PHENOLIC TUBES**

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COSMALITE known for its many years of Top Performance. CLEVELITE for its ability to meet unusual specifications.

Available in diameters, wall thicknesses, and lengths desired.

These CLEVELAND TUBES combine . . . High Dielectric Strength . . . Low Moisture Absorption . . . Great Mechanical Strength . . . Excellent Machining Properties . . . Low Power Factor . . . and Good Dimensional Stability.

For the best . . . "Call Cleveland."

Samples on request.

*Trade Marks

**Ask about CLEVELAND TUBES**
**in various types and specifications being used in the Electrical Industry.**

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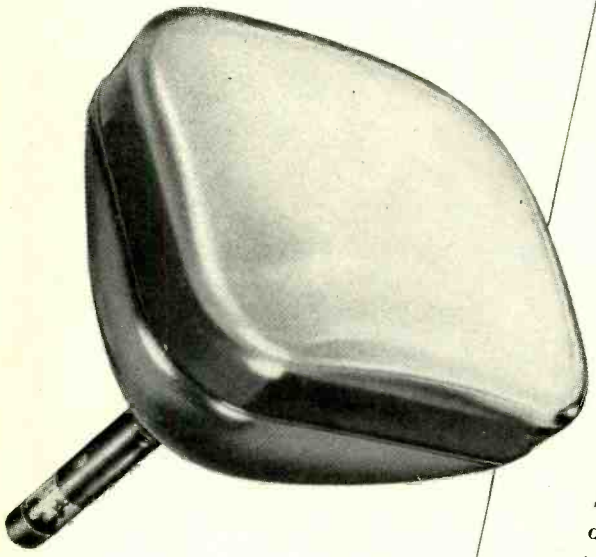


# Everything points to SYLVANIA as today's Picture Tube Leader

**Radio Tube Leadership**—Improved manufacturing techniques and quality control methods, acquired during 25 years of perfecting Sylvania's world-famous line of radio tubes, have contributed to the fine performance and nation-wide acceptance of Sylvania's TV Picture Tubes.

**Electronics Leadership**—During the war, Sylvania's all-out efforts in designing and producing precision electronic equipment, electronic and cathode-ray tubes, resulted in much of the valuable data applied today in making Sylvania's improved TV Picture Tubes.

**Lighting Leadership**—A background of half a century of lighting experience has further contributed to the outstanding quality of Sylvania TV Picture Tubes. From this experience has come the development of improved coatings, and phosphors for brighter, longer-lasting screens.

Sylvania Picture Tube leadership is a "natural" . . . resulting from continuous research plus a happy combination of experience in *radio, electronics, and lighting.*

Of special importance is the invention of the famous Ion Trap...now adopted, under Sylvania license, by other important TV tube makers. Today, Sylvania has 2 great plants devoted exclusively to picture tube manufacture.

For the latest data and ratings on all Sylvania TV Picture Tubes, write today to Sylvania Electric Products Inc., Dept R-2407, Emporium, Pa.

# SYLVANIA ELECTRIC

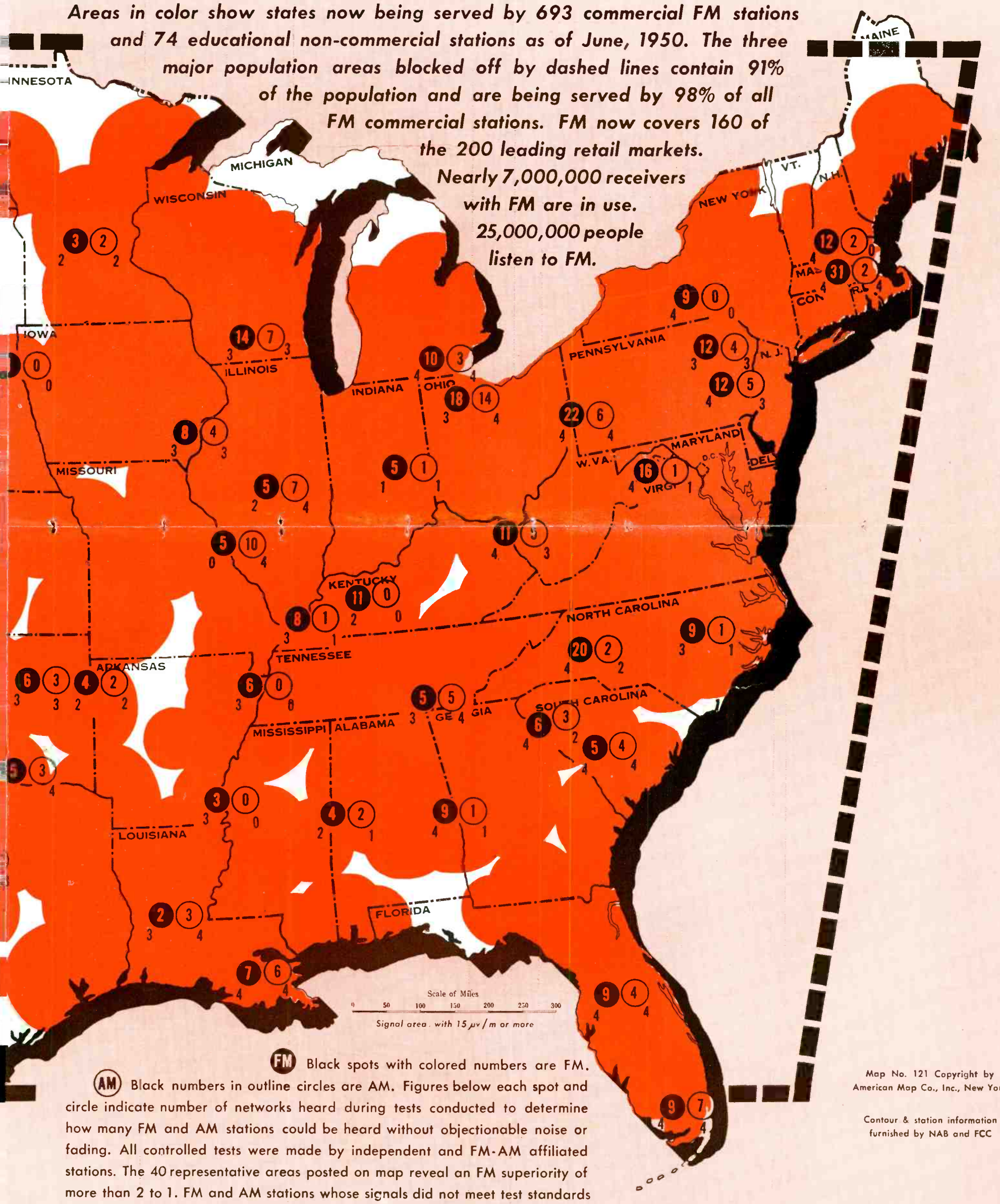
RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

# UENCY MODULATION

RADIO & TELEVISION RETAILING
JULY • 1950

## ajor Market Areas with 91% of U. S. Population.

*Areas in color show states now being served by 693 commercial FM stations and 74 educational non-commercial stations as of June, 1950. The three major population areas blocked off by dashed lines contain 91% of the population and are being served by 98% of all FM commercial stations. FM now covers 160 of the 200 leading retail markets. Nearly 7,000,000 receivers with FM are in use. 25,000,000 people listen to FM.*




FM Black spots with colored numbers are FM.

AM Black numbers in outline circles are AM. Figures below each spot and circle indicate number of networks heard during tests conducted to determine how many FM and AM stations could be heard without objectionable noise or fading. All controlled tests were made by independent and FM-AM affiliated stations. The 40 representative areas posted on map reveal an FM superiority of more than 2 to 1. FM and AM stations whose signals did not meet test standards were not counted.



Contour & station information furnished by NAB and FCC

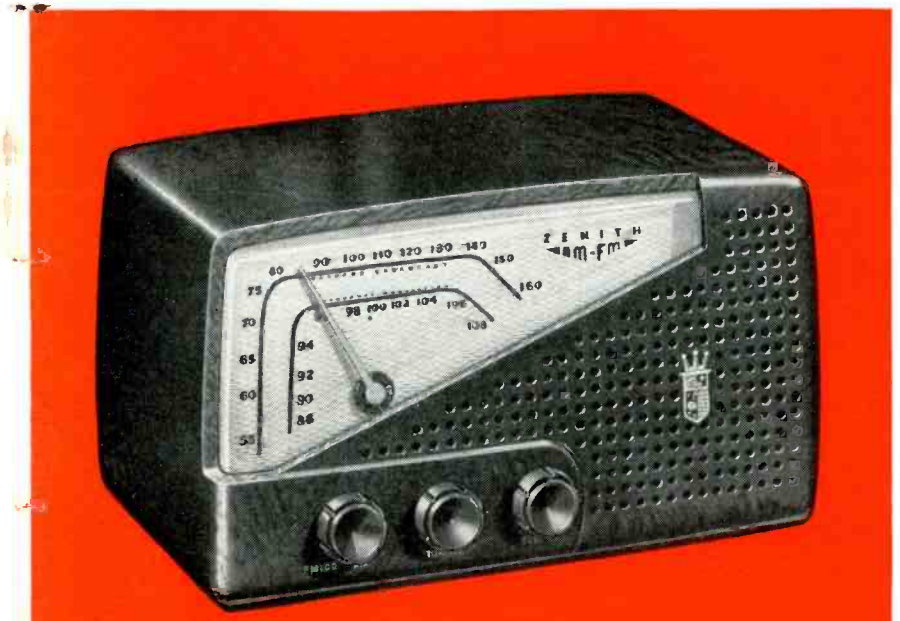
# There's A Rich New Summer Market

## *with these New Zenith FM-AM Sensations!*

**Survey after survey shows it . . .** a ready-made market with thousands of FM prospects. In many sections, summer static, cross talk and radio interference keep people from enjoying good, summertime radio pleasure. FM broadcasting increases the audience of baseball games, fairs and other outdoor events with its clear, sharp reception. And in many areas, of course, FM reception *only* can be enjoyed.

So realize your share of the tremendous summer market . . . with the best sets, in the smartest cabinets, at the right price . . . Zenith FM-AM radios. And remember, when you sell Zenith, competition is of no concern . . . for you are selling the finest.

**Remember this, too . . .** that in many areas which do have FM reception, some ordinary FM receivers will bring in only one or two stations, yet Zenith *Super-Sensitive* sets will provide FM reception from five, ten and even more stations.




### New Zenith "MEDALLION"

Priced to move . . . designed to perform. Handsome cabinet of Swirl Walnut plastic. Has the sleek, new "Cut-Away" Dial for easier tuning. Genuine Zenith-Armstrong FM with built-in Wavemagnet and exclusive Light-Line FM antenna. Just plug it in and play. Powerful Alnico "5" Speaker. AC/DC.

**$49.95***

## ORDER THESE SETS FROM YOUR ZENITH DISTRIBUTOR RIGHT AWAY


### New Zenith "SUPER-TRIUMPH"

A PLUS value . . . with big, sales features. "Flexo-Grip" handle, On/Off indicator, handsome "Roman Gold" trim and Broad Range Tone Control. New super-sensitive Zenith-Armstrong FM. Exclusive built-in Wavemagnet and Light-Line FM Antenna. Powerful Alnico "5" Speaker. Beautiful Swirl Walnut plastic cabinet. AC/DC.

**$59.95***

### New Zenith "MAJOR"

Most sensational value . . . the most sensitive FM only radio ever offered the public. It's a marvel of power and super-sensitivity. DialSpeaker. Big 270° dial gives added station separation for easier tuning. Built-in Wavemagnet and exclusive Light-Line FM Antenna. Just "plug-in" and play. Superb, rich, clear tone. Attractive Swirl Walnut plastic cabinet. AC/DC.

**$39.95***


*Suggested Retail Price—West Coast prices slightly higher.

Prices subject to change without notice.

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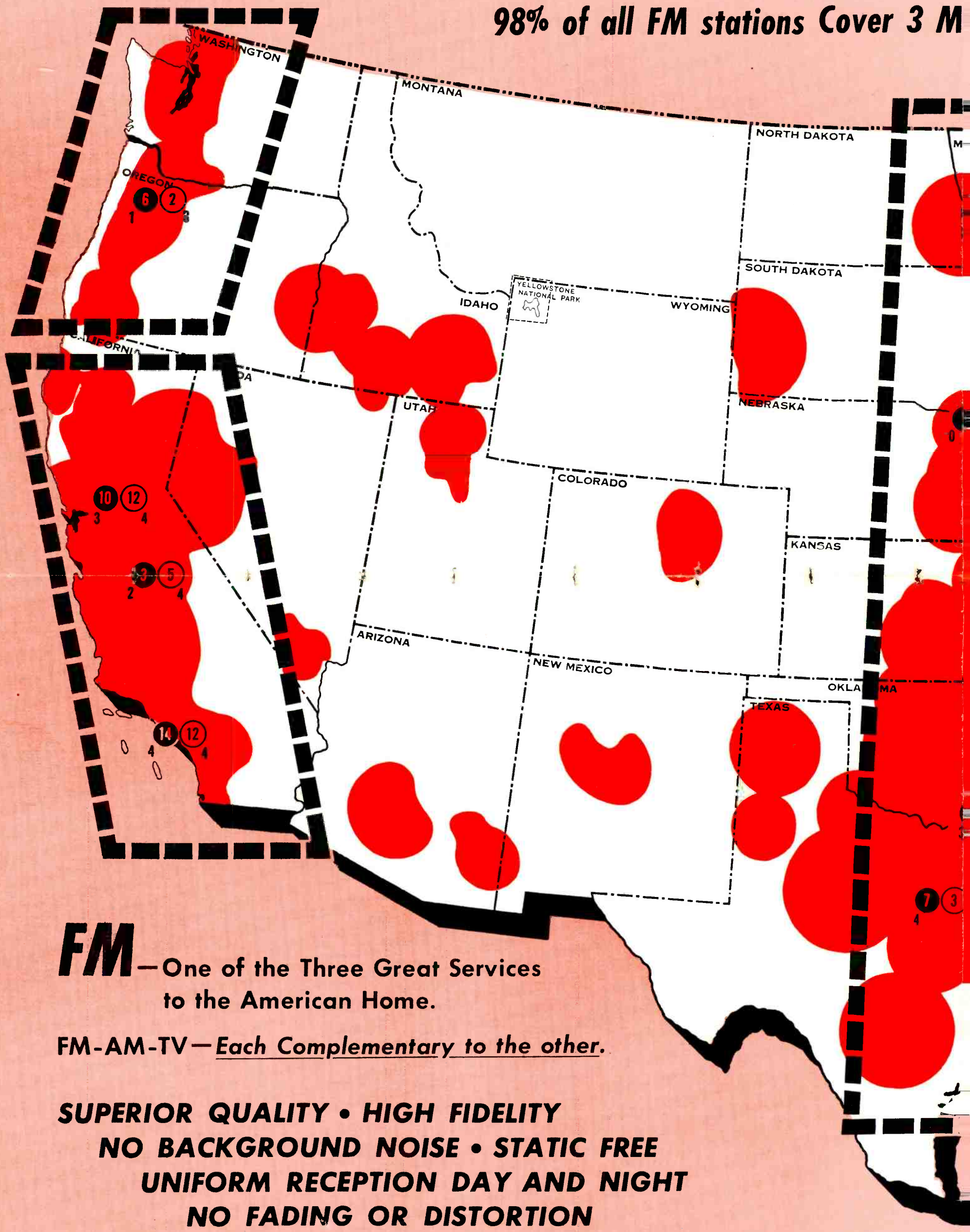
# 1950 Census of FREQ

## 98% of all FM stations Cover 3 M




**FM**—One of the Three Great Services to the American Home.

FM-AM-TV—*Each Complementary to the other.*

***SUPERIOR QUALITY • HIGH FIDELITY***
***NO BACKGROUND NOISE • STATIC FREE***
***UNIFORM RECEPTION DAY AND NIGHT***
***NO FADING OR DISTORTION***

SEE ALSO ARTICLE ON FM IN PART 1 OF THIS ISSUE

CALDWELL-CLEMENTS, INC. • 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

JULY, 1950

# TELE-TECH

Formerly ELECTRONIC INDUSTRIES

TELEVISION • TELECOMMUNICATIONS • RADIO

IN TWO PARTS
PART TWO



## Yes, Today, Even More Than Ever, There's a

# GREAT SALES VOLUME FOR ZENITH FM IN YOUR TERRITORY!

● Yes, a tremendous FM sales volume that *you* can realize is actually waiting for you—if you will *go after* it with consistent advertising and displays and actual demonstrations. Throughout much of the country, there are vast areas where FM provides the *only* dependable radio service.

And of course, the better the FM receiver . . . the larger the area of good reception becomes. So that, with the spectacular new line of super-sensitive Zenith FM receivers the bounds of FM areas are greatly extended—far beyond even that shown on the map.

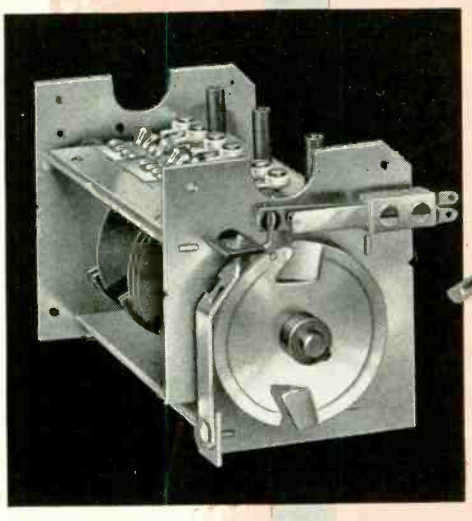
In many areas where only one or two FM stations may be heard with ordinary FM sets, Zenith *Super-Sensitivity* makes possible reception from five, ten or more stations.

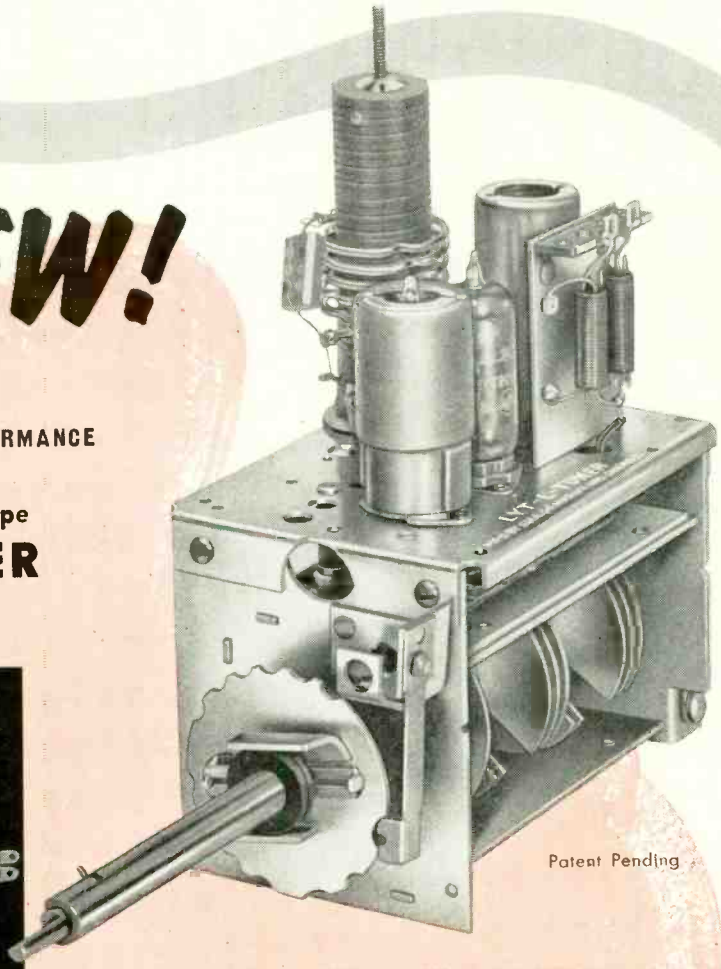
That is why Zenith FM opens up tremendous new radio territories for dealers, and new, untouched markets for both local and national advertisers. In many areas, people need and buy these extra-powerful, super-sensitive sets in order to have complete day and night radio entertainment. And in areas where satisfactory reception has been previously impossible with either AM or ordinary FM receivers . . . Zenith FM sets are the only means of radio enjoyment.

**See the Next Three Pages for Zenith's Great New Line of FM-AM Receivers . . . featuring . . . THE OUTSTANDING SUPER-SYMPHONY $79.95***

# IT'S NEW!

HIGH QUALITY T. V. PERFORMANCE
AT LOW INITIAL COST
with the inductance type
## LYT-L-TUNER





Patent Pending

***Investigate this outstanding tuner featuring T.V.-F.M. and Phono . . . eleven models. Write for all engineering data.***

**COMPARE THESE ADVANTAGES WITH ANY OTHER T. V. TUNER ON THE MARKET!**

1. Superior gain and uniform signal amplification in all channels. Now you can ship receivers to all signal areas with complete confidence in their positive performance.
2. Lower noise level—giving consistently better pictures in all areas.
3. No moving contacts while tuning—insuring reliability, accuracy, and simplicity.
4. Functional diversity—single knob control for Phono, all TV and FM channels, and UHF when needed.
5. Economy in design with optional elements for use in all price levels.

R.M.A.
Member
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"FOREMOST IN ELECTRONICS"

CHESTER W. LYTLE, PRES.

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4721 N. KEDZIE AVE., CHICAGO 25, ILL.

# A NEW LONG-LIFE TELEVISION TUBE

## High in Light Output!

**Produced with the Newest and Most Advanced Type Equipment in the TV Industry**

**KINESCOPES BY *Federal***
**Perform Better...Last Longer**
**Federal Kinescope Types**
RECTANGULAR SCREEN:
14", 16", 17", 19"
ROUND SCREEN: 12½", 16", 19"

Here's the precisely *right* tube for TV. Here's tube design based on more than forty years' tube manufacturing experience. It's Federal's New-Day Kinescope, introducing a new high in *light* output and fine performance.

Federal's Kinescope is the new over-all advanced design embodying the ion-trap type electron gun. Magnetically focused, magnetically deflected, delivering the sharpest contrast and picture definition, it assures the user quality-first pictures, quality-first performance. For complete details, write to Dept. K-466.

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# The look that keeps telephone costs DOWN

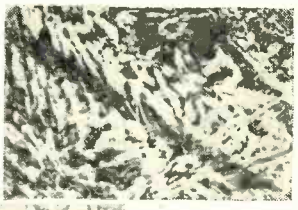
*Examining specimen on metallographic microscope at Bell Telephone Laboratories.*

Through his microscope this Bell metallurgist examines a bit of material which is proposed for telephone use. From what he sees of grain structure, he gains insight into performance not provided by spectrum or chemical analysis. He learns how to make telephone parts stand up longer, so that telephone costs can be kept as low as possible.

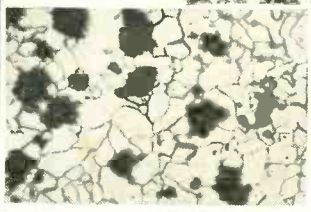
The items which come under scrutiny are many and varied, ranging from manhole covers to hair-thin wires for coils, from linemen's safety buckles to the precious metal on relay contacts.

In joints and connections—soldered or welded, brazed or riveted — photomicrographs reveal flaws which would escape ordinary tests. They show if a batch of steel has the right structure to stand up in service; why a guy wire let go in a high wind or a filament snapped in a vacuum tube; how to make switchboard plugs last longer.

In their exploration of micro-structure, Bell Telephone Laboratories scientists have contributed importantly to the metallographic art. You enjoy the benefits of their thoroughgoing testing and checking in the value and reliability of your telephone system, and the low cost of its service.



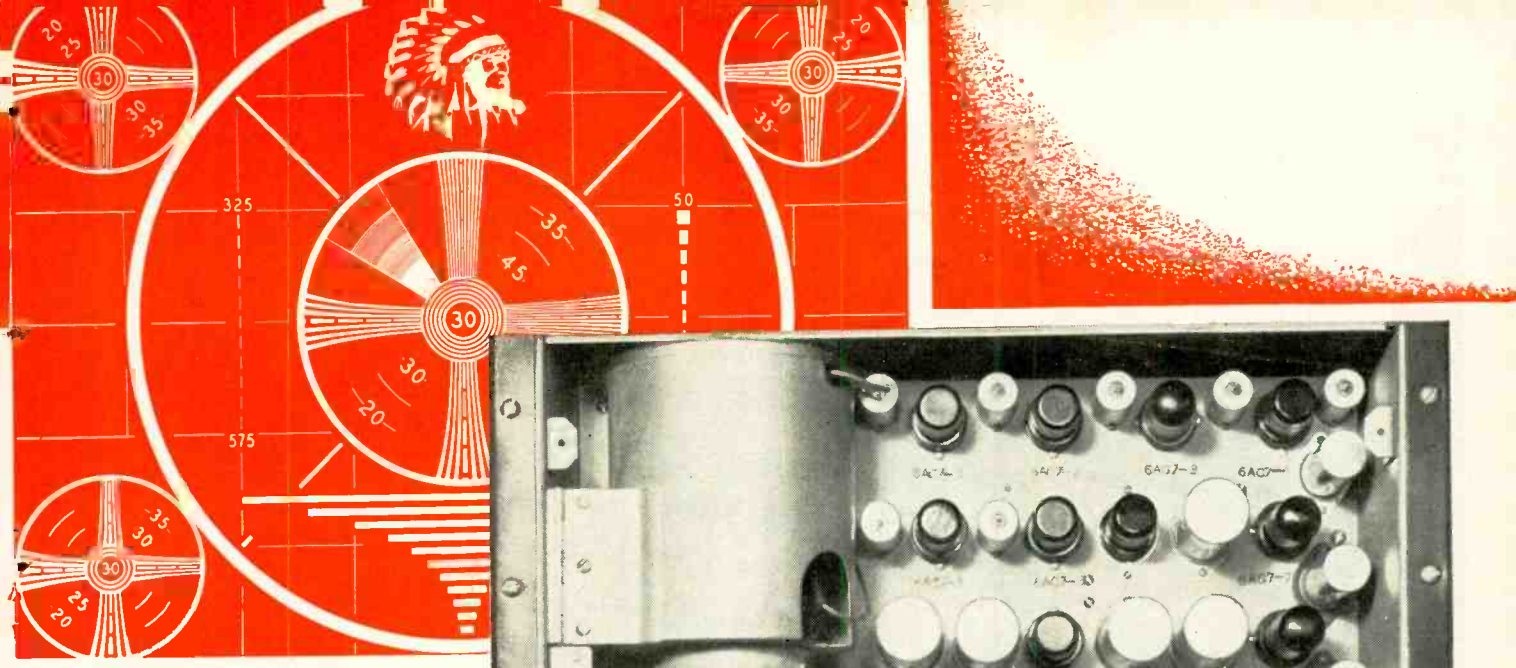
*Photomicrograph of white cast iron which is hard and brittle.*

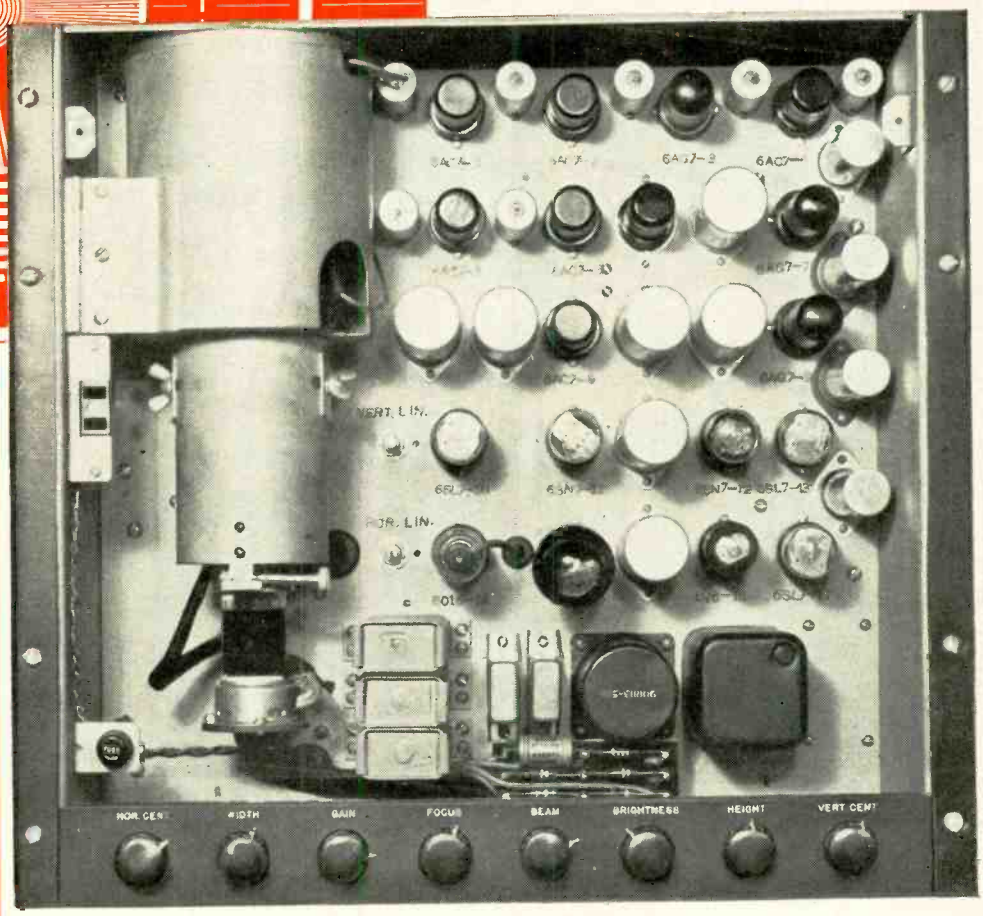


*Same iron rendered malleable by heat treatment. Shows spots of nodular carbon.*

## BELL TELEPHONE LABORATORIES

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






**Video Monoscope Camera TK-1A**

# . . . "patternmaker" for the industry

The test pattern produced by RCA Monoscope Cameras is the standard by which picture quality has been judged since the beginning of electronic television . . . in TV stations . . . in laboratories . . . in TV receiver production.

These are the standard test-pattern cameras used by many TV receiver manufacturers. These are the standard "picture micrometers" used by TV stations to make precision measurements of video transmissions.

Deliberately designed to excel in all things, RCA Monoscope Cameras have earned the extraordinary respect of television men. Evenly lighted patterns as steady as Gibraltar. Resolution as fixed as the cut of a diamond. Operation as reliable as a ship's chronometer.

Type TK-1A pictured here is RCA's newest Monoscope Camera—built to the highest standards known. It can be delivered to you with the familiar monoscope pattern (shown above)—or with a pattern of your own choice.

Ask your RCA Television Equipment Sales Engineer for prices. Mail the coupon for data.

RCA

**TELEVISION BROADCAST EQUIPMENT**

**RADIO CORPORATION of AMERICA**

**ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.**

In Canada: RCA VICTOR Company Limited, Montreal

Radio Corporation of America
Television Broadcast Equipment Section
Dept. 87G, Camden, N. J.

Send me your technical bulletin on the RCA Type TK-1A Monoscope Camera.

Name_____

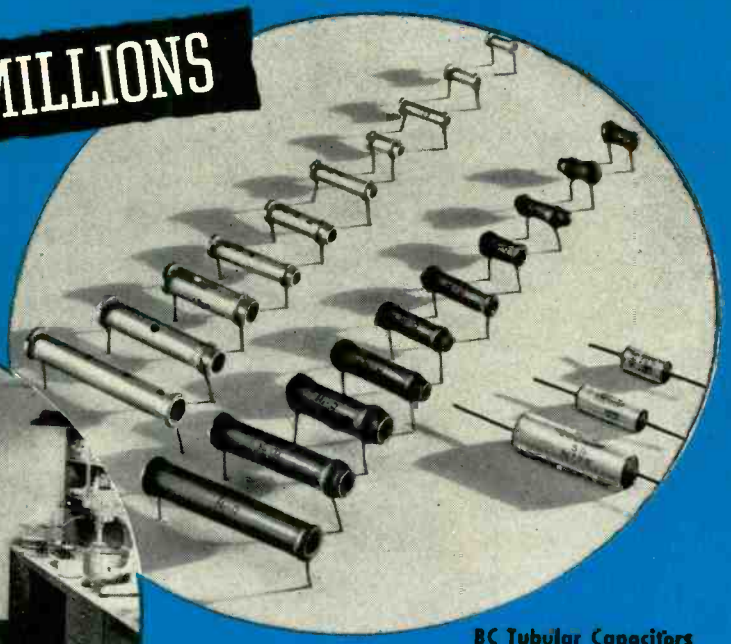
Company or station_____

Address_____

City_____ State_____

# PRODUCED BY THE MILLIONS

The Hi-Q Ceramic Laboratory



BC Tubular Capacitors

*- by the top specialists in the ceramic field*

**HI-Q COMPONENTS**

Capacitors
Trimmers • Choke Coils
Wire Wound Resistors

**BETTER 4 WAYS**

- ✔ PRECISION
- ✔ UNIFORMITY
- ✔ DEPENDABILITY
- ✔ MINIATURIZATION

● **HI-Q** BC Tubular Ceramic Capacitors for by-passing, coupling and filtering are available with any of three types of insulations:—clear non-hydroscopic styrene coating (CN)...Durez impregnated with low loss microcrystalline wax (SI) ... or a ceramic (steatite) cover tube sealed with a specially developed end seal (CI). The **HI-Q** trade mark is your assurance that like all **HI-Q** Components, they rigidly meet specifications and are uniformly dependable in every respect. As leading specialists in the ceramic field, **HI-Q** has come to be regarded by producers of radio, television, communications and electronic equipment as their best source of technical assistance in developing components to meet the needs of any circuit.

JOBBERS – Address: 740 Belleville Ave., New Bedford, Mass.

**HI-Q** *Electrical Reactance Corp.*

**FRANKLINVILLE, N. Y.**

**SALES OFFICES:** New York, Philadelphia
Detroit, Chicago, Los Angeles

**PLANTS:** Franklinville, N. Y., Olean, N. Y.
Jessup, Pa., Myrtle Beach, S. C.

## TELE-TIPS (Continued)

**"IF I BUY BLACK-WHITE SET NOW** can I later have it converted to receive color-TV?" That is question being heard increasingly in TV stores? Perhaps such converters can be made available later; with resourcefulness of inventors and designers, it would take courage to say flat "no". But color-TV experts who have developed new tri-chrome sets do not themselves offer much encouragement for color converters at this time. "Better let customer buy a whole new color set!" say they.

**SERVICING COLOR-SETS** will offer no particular problems for qualified TV technicians, insist factory engineers who have made special study of maintenance of new tri-chrome receivers. If a technician thoroughly understands present television receivers, he will find color-TV far less of a step in advance, than was recent black-white TV over mere audible radio receivers.

**COLOR-TV CAMERA** can undoubtedly be developed by inverting the principle of the new color-kinescope, and this will probably come along in time. But meanwhile all color cameras to be used in TV stations in near future will employ three separate orthicons with color filters and dichroic mirrors. Three such complete color cameras will be needed for each TV station. These somewhat complex and bulky color cameras are relatively easy to build and can be handled well by qualified technicians, so that development of a single-tube color camera will probably be postponed for the present.

**BW-TV vs CTV!** These will be short hand terms you will be seeing and writing often during next few years, as you distinguish between "old-fashioned black-white television" and the new glories of color-TV. Or mebbe we'll just simplify it to WTV vs CTV

**COLOR-TV SET** prices have been predicted over a wide range, with minimum 16-in. sets running from $400 to $800. The latter (and even $1000) has been the estimate of more skeptical. But men behind RCA color job still stand on only a 50% advance over old TV, with $400 as possible selling price of a minimum 16-in. job.

**LAWRENCE COLOR-TV**—As we get the story, this new tube devised by Dr. E. O. Lawrence of the University of California, Berkeley, Calif., (who is also the famed inventor of the cyclotron) depends for its color operation on a series of vertical slats inside the tube, just behind the tube face. Alternate slats carry red phosphor, and the intervening slats blue phosphor. The tube face itself is coated with dots of green phosphor. A charge on the red slats will deflect the electron stream to excite the red phosphors; similarly with the blue slats. Absence of any charge permits the electron stream to pass between the slats and excite the green on the tube face. From this explanation we are not clear that color values would be the same from different front viewing angles, since it would appear that along the center line, with the slats viewed edge-on, the red and blue components would be deficient. Owners of the patents will divulge no explanation at this time.

**TV STATION AVERAGES**—With the aid of the material presented in TT's Television Station Data Chart in June, our staff statistician finds that the average TV station has:

An antenna height of 699.3 feet (above terrain), based on reports of 107 stations.

3.95 studio cameras, based on reports of 90 stations.

3.39 field cameras based on reports of 84 stations.

# CAPACITORS

## Silicone-Sealed for Life!

Silicone—the amazing new synthetic—made headlines when General Electric brought it out during the war. It's news again today—for G.E. has now made Silicone bushings and gaskets a *standard feature* of all its specialty capacitors up through 5000 volts.

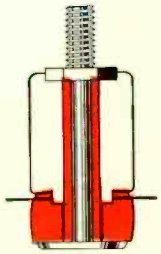
This means that your new G-E capacitor is sealed positively, permanently—for maximum life. For Silicone seals by compression alone, without the use of contaminating adhesives. It will never shrink, loosen or pull away—it remains elastic at any operating temperature a capacitor will ever meet. Moreover, it is impervious to oils, alkalies and acids, and its dielectric strength is permanently high.

This exclusive G-E feature—with the use of highest grade materials, with strictest quality control and individual testing—make General Electric capacitors finer and more dependable than ever before. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Silicone bushings used with capacitors 660-v a-c, or 1500-v d-c and lower.

Silicone bushings and plastic cups used with capacitors 660-v a-c, or 1500-v d-c and lower.

Silicone gaskets and plastic stand-offs used with capacitors rated 2000-v d-c and lower.



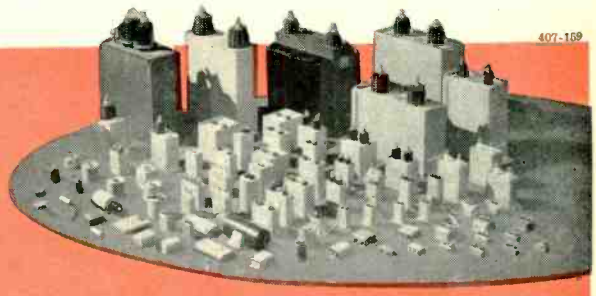
Silicone gaskets and porcelain stand-offs used with capacitors rated 2500-v to 5000-v d-c.

**GENERAL ELECTRIC**

*Specialty Capacitors* FOR

- Motors
- Luminous-tube transformers
- Fluorescent lamp ballasts
- Industrial control
- Radio filters
- Radar
- Electronic equipment
- Communication systems
- Capacitor discharge welding
- Flash photography
- Stroboscopic equipment
- Television
- Dust precipitators
- Radio interference suppression
- Impulse generators

AND MANY OTHER APPLICATIONS



# NEW DESIGN THRILLS AT YOUR FINGER TIPS...

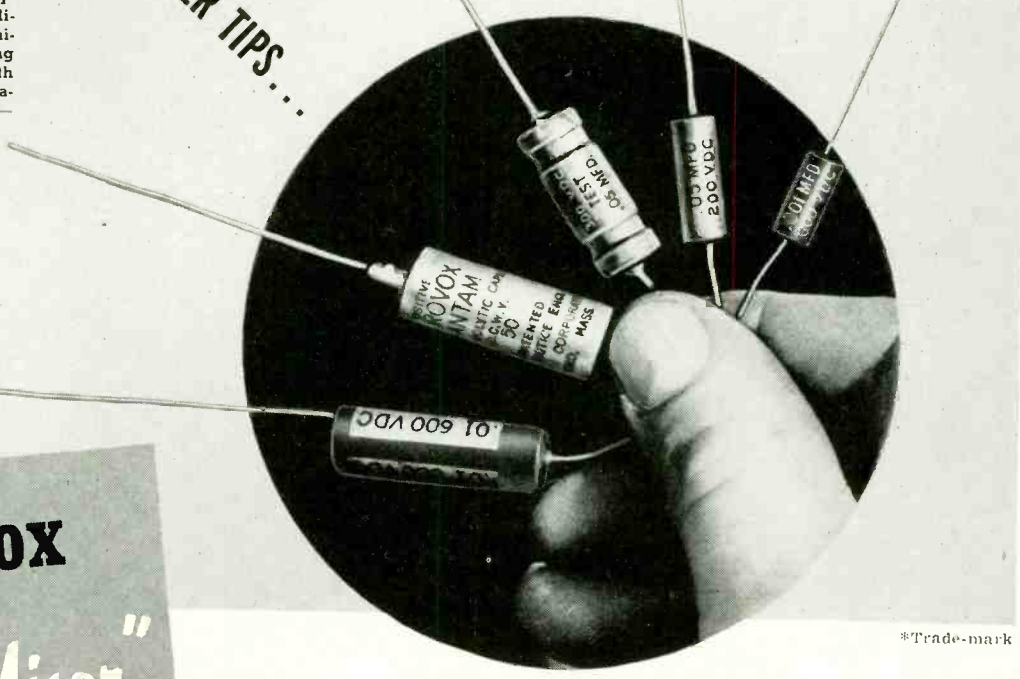
***Type 89ZXY Aerolites****—Aerovox-improved metallized paper capacitors were developed to meet present-day requirements for capacitors of improved reliability and reduced size. Type 89ZXY Aerolites* are metallized-paper capacitors in hermetically-sealed metal cases. Other Aerolite* capacitors are available in tubular, bathtub and other case designs.

***Type P123ZG Miniatures***—Metal-cased, metallized-paper capacitors featuring vitrified ceramic terminal seals for maximum immunity to climatic conditions—heat, cold, humidity. For severe-service applications and for usage in critical as well as ultra-compact radio-electronic assemblies.

***Type P83Z Micro-Miniatures****—Smaller than previous "smallest"—a distinct departure from conventional foil-paper and previous metallized-paper constructions. Radically new metallized dielectric makes possible exceptionally small physical sizes. Available in two case sizes (3/16" x 7/16" and 1/4" x 9/16"); voltages of 200, 400, 600; operating temperatures range from —15° C to +85° C without derating.

***Type SRE Bantams****—The smallest electrolytics yet. Especially suitable for personal radios, filter circuits and similar functions. Hermetically-sealed aluminum can with diameter-reducing stud terminals. Improved processing and materials combined with more efficient space utilization, means smaller sizes—but no reduction in life.

***Type '87 Aerocons***—Self-molded plastic tubulars with *new* impregnant, Aerolene*; new rock-hard Duranite* end seals. All the performance characteristics of molded-plastic capacitors at a price close to that of conventional paper tubulars. Excellent heat and humidity resisting qualities. Operating temperatures of —30° C to +100° C.




*Trade-mark

**AEROVOX**

**"Space Miser"**

**CAPACITORS**

● Tell us what you are designing or producing. Our engineers will gladly show you *better assembly possibilities* with *marked economies*. Literature on request. Write on your letterhead to Aerovox Corporation, Dept. DF-65, New Bedford, Mass.

## *There is something new in sizes!*

● Never was so much capacitance packed into so little bulk. And with improved performance and life, too. Aerovox Research and Engineering have developed capacitor materials that now challenge the thinking of the progressive radio-electronic designer on several counts:

For *elevated temperatures:* Immunity of Aerolene impregnant and Duranite end fills. For *humidity extremes:* perfected hermetically-sealed metal-can casings even in tiniest sizes. For *miniaturizations:* perfected metallized-paper sections. For *compact filters:* smallest electrolytics yet. For *maximum reliability:* the most conservative ratings. For *lower prices:* advanced engineering backed by highly mechanized fabrication.

New design thrills at your finger tips! That's what these latest Aerovox capacitors mean to you by way of still better radio-electronic assemblies.

CAPACITORS • VIBRATORS • TEST INSTRUMENTS

AEROVOX capacitors

*for Radio-Electronic and Industrial Applications*

AEROVOX CORPORATION, NEW BEDFORD, MASS., U. S. A. • Sales Offices in All Principal Cities

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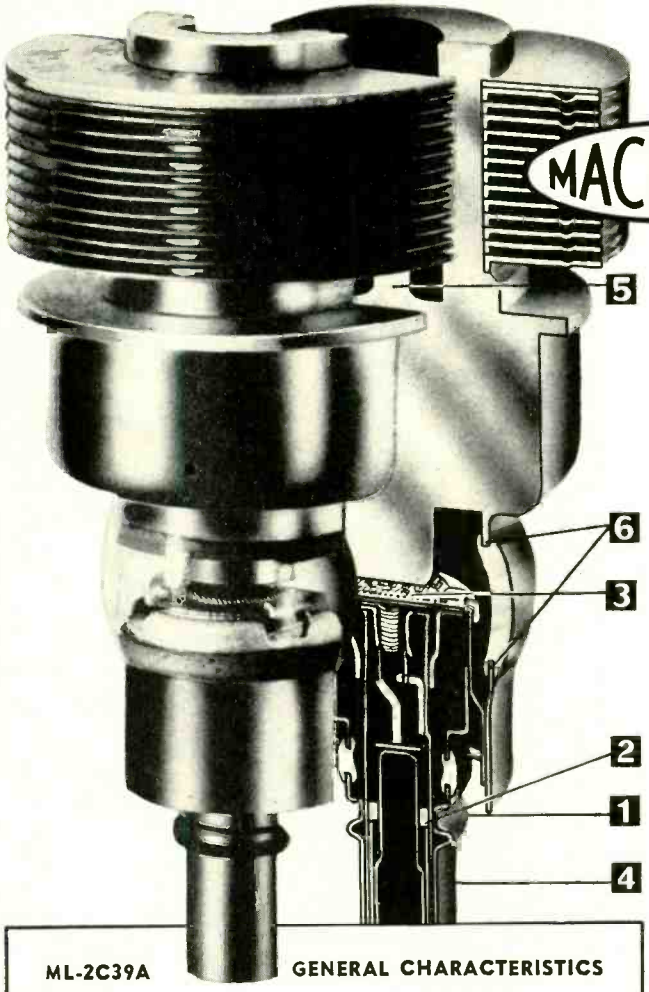
# The New ML-2C39A*...




## Proving once again that MACHLETT ..makes the Difference

1. Design of cathode lead for positive adjustment and control of transconductance; limits are 20,000-23,000 μmhos or only 25% of permissible specified range.

2. High temperature ceramic in hot cathode end eliminates danger of gas evolution from glass at high temperatures. Assures better protection under overload conditions.

3. Uniquely processed mesh grid assures greater frequency stability with variation in grid dissipation.

4. Gold over silver plating to maintain optimum surface conductivity even in corrosive atmospheres.

5. Machlett's high vacuum processing for good cathode activation and freedom from gasiness.

6. Stronger glass-metal seals. Less breakage inserting and removing tubes.

* *Conforms with recently issued JAN specifications.*

**ML-2C39A GENERAL CHARACTERISTICS**

**Electrical**

| | |
|---|---|
| Cathode: Coated Unipotential | |
| Heater Voltage | 6.3 volts |
| Heater Current | 1.0 amperes |
| Amplification Factor (Average) | 100 |
| Direct Interelectrode Capacitances (Average) | |
| Grid Plate | 1.95 μμfd. |
| Grid Cathode | 6.50 μμfd. |
| Plate Cathode | 0.035 μμfd. |
| Transconductance ($i_b$ = 70 ma., $E_b$ = 600 v.) (Average) | 23,000 μmhos |

**Radio Frequency Power Amplifier**
Class-C FM Telephony or Telegraphy
(key-down conditions, 1 tube)

| | |
|---|---|
| Maximum Ratings | |
| D-C Plate Voltage | 1000 max. volts |
| D-C Cathode Current | 125 max. ma. |
| D-C Grid Voltage | −150 max. volts |
| Peak Positive R-F Grid Voltage | 30 max. volts |
| Peak Negative R-F Grid Voltage | −400 max. volts |
| Plate Dissipation | 100 max. watts |
| Grid Dissipation | 2 max. watts |

**ML-381 FOR PULSED APPLICATIONS**

**Maximum Ratings (Tentative)**

| | |
|---|---|
| $e_p$, peak | 3500 volts |
| $i_p$, peak | 4.5 amps |
| $i_g$, peak | 2.0 amps |
| $I_p$, ave | 30 MA |
| $I_g$, ave | 15 MA |
| T, pulse length | 5 μ sec. |
| duty | 1% |
| $E_f$ | 5.5 volts ± 5% |

In all other respects the ML-381 is electrically and mechanically interchangeable with the 2C39A.

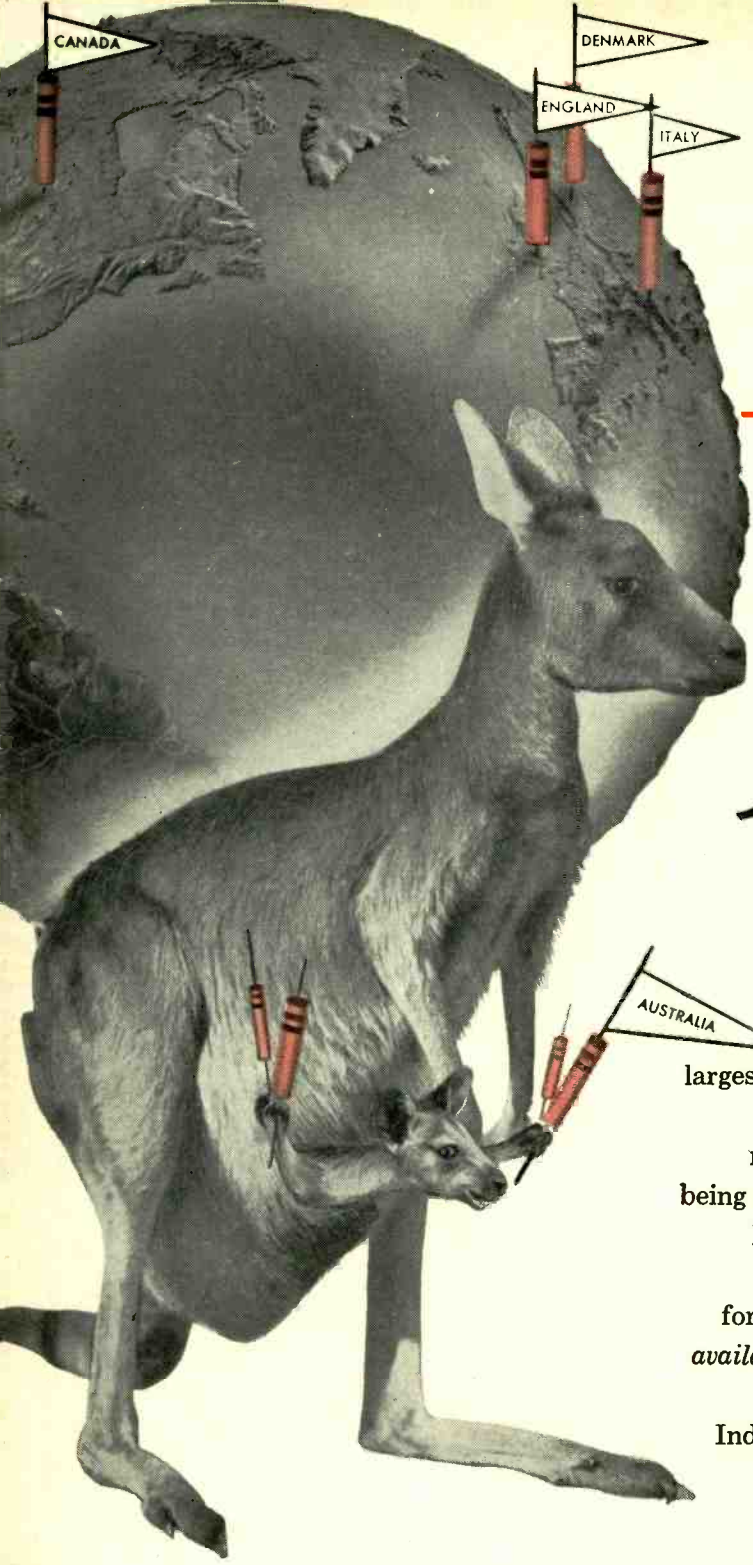
## "Look to the Tube Specialist"

Long experience in the development and manufacture of the 2C39A electron tube has given Machlett Laboratories a comprehensive understanding of the operating problems encountered in a wide variety of applications of this tube type.

*For assistance on your specific problem, write to Machlett Laboratories or contact your local Graybar office.*

Distributed by GraybaR ELECTRIC COMPANY

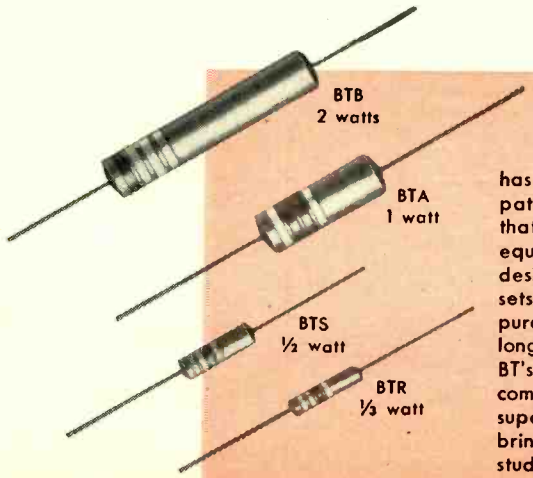
MACHLETT OVER 50 YEARS OF ELECTRON TUBE EXPERIENCE




# Logistics

## for resistors too!

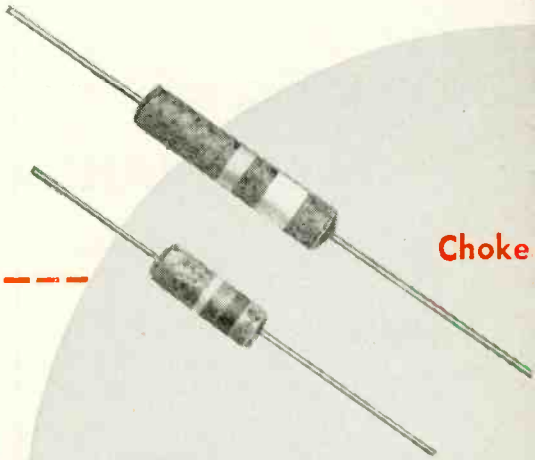
For *adequate* supplies of resistors in an ever-widening market, depend on IRC *logistics*. Already the largest manufacturer of resistors in the world, IRC has increased its output tremendously to meet your requirements. And in addition, IRC capacity is now being supplemented by licensees in Canada and Denmark—while English, Australian and Italian licensees provide resistors for other world markets formerly supplied from the United States. IRC *availability* extends even to your urgent, small-order requirements for standard resistors. Through our Industrial Service Plan, your IRC Distributor can supply these promptly from full stocks of the most popular types and sizes.




### Stock-piling of advanced BT's

has been proved practical by IRC's study of resistor-use patterns. A recently completed three-year profile shows that 80% of the BT resistors used in TV and radio equipment include only 30 values. This holds true despite design changes and shifts in the industry's emphasis on sets. And these facts prove that you can now simplify purchasing, stocking and expediting practices by placing long-term orders covering your basic, recurring needs for BT's. Engineered to meet JAN-R-11 specifications for fixed composition resistors, IRC BT's have established their superiority in all important characteristics. Bulletin B-1 brings you full details of IRC BT's, and a copy of our study is yours for the asking.

# is important



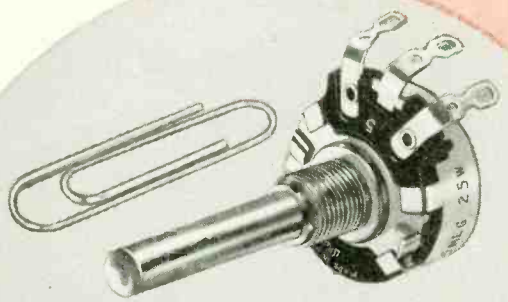
Choke

## The right Resistors . . .

for precision applications often require a *combination* of characteristics. IRC Deposited Carbon PRECISTORS combine accuracy and economy in:—Circuits in which the characteristics of carbon composition resistors are unsuitable and wire-wound resistors too expensive — Metering and voltage divider circuits requiring high stability and close tolerance of the resistance values — High-frequency applications. The two sizes of IRC PRECISTORS are manufactured to customers' specifications, rather than to standard RMA values (subject, of course, to minimum and maximum values for each type). For complete data on characteristics and values, mail coupon for Bulletin B-4.

## Modern mass production equipment . . .

plus exclusive manufacturing techniques, make IRC Insulated Chokes relatively inexpensive — and offer considerable savings over ordinary types. Available in two sizes, IRC chokes are insulated in molded phenoli housings for full protection agains high humidity, abrasion, damage dur ing assembly, and danger of shorting to chassis. "Q" improves with rise i frequency and is sufficiently high fo broad-band tuning in FM and TV re gions. Resistance is low enough t permit use as filament choke for moderately high powe tubes. Coupon brings you full information i Bulletin H-1



## Dependable source of small-size controls . . .

IRC meets your requirements with the new 1⅜" Type Q. Mechanization of production and testing assures increased supplies of these miniature controls. And elimination of hand operations provides complete uniformity of construction and performance. New IRC Type Q Controls are rugged and compact. Resistance element is the best IRC has ever produced. Increased arc of rotation permits the same resistance ratios used in larger IRC Controls. IRC Type Q's are characterized by low noise level, negligible changes in resistance even after long exposure to humidity, unusual durability and efficiency, and adaptability to a wide variety of small-space applications. Bulletin A-1 gives full information.


IRC

*Wherever the Circuit Says* ~~~

Power Resistors • Voltmeter Multipliers • Insulated Composition Resistors • Low Wattage Wire Wounds • Controls • Rheostats • Voltage Dividers • Precisions • Deposited Carbon Precistors • High Frequency and High Voltage Resistors • Insulated Chokes

**INTERNATIONAL RESISTANCE COMPANY**

401 N. Broad Street, Philadelphia 8, Pa.

*In Canada:* International Resistance Co., Ltd., Toronto, Licensee

INTERNATIONAL RESISTANCE CO.
407 N. BROAD ST., PHILADELPHIA 8, PA.

Please send me complete information on the items checked belo

- ☐ Advanced BT Resistors (B-1)
- ☐ PRECISTORS (B-4)
- ☐ IRC Study of Resistor Use
- ☐ New Q Controls (A-1)
- ☐ Insulated Chokes (H-1)
- ☐ Name and Address of lo IRC Distributor

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

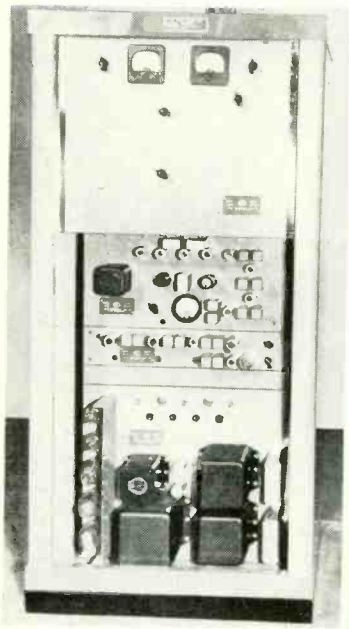
CITY..... STATE.....

# REL ... Foremost

## in FM TRANSMITTING and RELAY EQUIPMENT

*Leadership Gained through 15 Years of Devotion to the Sole Task of Advancing FM*

In producing types of equipment that represent the greatest advances in FM transmission and reception, from the first beginnings in 1935 to the very latest in microwave relay, REL has maintained its engineering leadership through high standards of research and design as well as rigid standards of quality.



REL 900 MC Studio-to-Transmitter FM Relay Link, model 707-B, with Serrasoid modulator. Used by many broadcast stations for program service from studio to AM or FM transmitters, or both. Effects large savings compared to the cost of wire lines where distance and terrain contribute to high costs. Completely crystal controlled. Designed for semi-unattended operation.

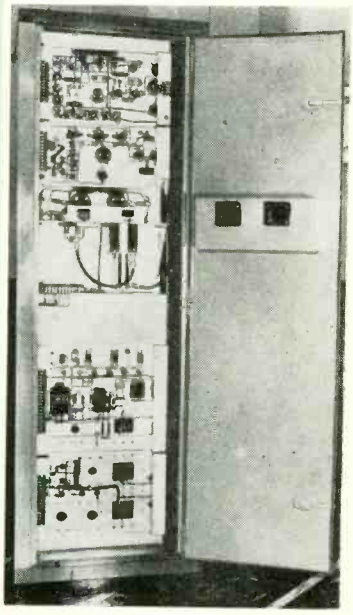
Invariably, the performance of REL equipment exceeds the requirements of the service for which it is designed by a wide margin.

### *Among REL's 1950 products are:*

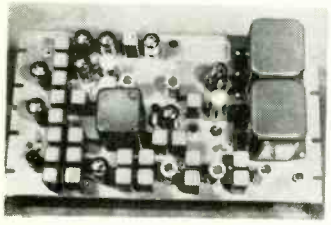
Studio-to-Transmitter Relays
Mobile Remote Pickup & Relay
Multi-Channel Repeater Type
Microwave Communication Systems
Broadcast Microwave Relay
F.M. Broadcast Transmitters
Special Purpose Receivers for
Transit-casting
Store-casting
Recording Field Data

In every REL product, Absolute Dependability is a "must". All units are crystal controlled. All transmitters employ the SERRASOID MODULATOR, outstanding for its simplicity, superior performance, and long time stability. All have the true FM characteristic of lowest noise level and minimum of distortion. In final tests, in ease of installation, in economy of operation, REL units stand alone.

*Literature covering any REL unit will be sent on request.*

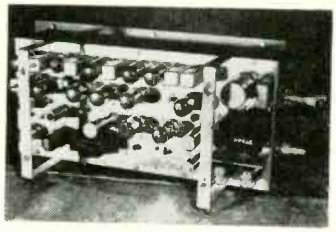


REL transmitter for multi-channel radio communication systems as used by leading Airlines, Industrial and Telephone Services.



REL crysfal controlled FM relay receiver, model 722. A special purpose receiver for transmitter to transmitter link. Similar type of receiver used by the Bureau of Standards for recording field data such as continuous readings of signal variations.

REL 10 KW Serrasoid-modulated transmitter used by Bayerischer Rundfunk in Munich, Germany, atop a 5,500-foot mountain. First German FM civilian station in the Western Zone. REL Microwave STL supplies programs from Munich studios.



REL Model 708-B FM Transit receiver. Manufactured for and distributed nationally by Transit Radio, Inc., Cincinnati, Ohio.


REL 50 watt FM remote pickup and mobile transmitter link, model 695, designed for continuous duty in the presentation of remotely-originated programs, with quality comparable to fixed studio facilities. Frequency range, 150-175 MC.

**REL RADIO ENGINEERING LABORATORIES, Inc.**
*Dept. T : 36-40 37th Street, LONG ISLAND CITY 1, N.Y.*

TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

# The Men Who Really Control the Radio Spectrum!

**Members of IRAC, and Government Departments Represented**

| | | | |
|---|---|---|---|
| E. W. Loveridge | Agriculture | S. L. Windas | Interior |
| Maj. R. G. Hall | Air Force | I. W. Conrad | Justice |
| Lt. Col. W. M. Lauterbach | Army | A. Osbourne | Maritime |
| L. H. Simpson | Commerce | Comdr. J. M. Grider | Navy |
| A. L. McIntosh | FCC | J. S. Cross | State |

Capt. D. E. McKay, Chairman, Treasury

Most radio executives and radio engineers are under the impression that the U. S. ether, our medium of radio communication, is controlled by the Federal Communications Commission. But not so!

For actually the FCC plays "second fiddle" to an inner Government group, reporting directly to the President, called the Inter-department Radio Advisory Committee. Little is ever heard about IRAC, but this group, made up of the individuals listed above, is the one which, by law, has "first choice" in withdrawing from the entire useable radio spectrum those frequencies desired by the Government agencies.

★ ★ ★

Did you realize that already IRAC has preempted about ONE HALF of the spectrum, for present and future use by the Government? The half that remains is then turned over to the FCC for assignment to the general public. The resultant scarcity of channels often forces litigation and also costly, interminable hearings in order that the allocation of this precious frequency space be made in the best interest of the public. Meanwhile Government agencies are "sitting on" valuable blocks of frequencies, most of which are seldom used. In fact, for some of these Government blocks, equipment has not been even ordered!

Why does IRAC do this? On what basis does this committee allocate frequencies to its members? Only those who take part in the secret, star-chamber sessions of the Inter-department Radio Advisory Committee know the answers.

★ ★ ★

TELE-TECH has been told by those close to IRAC that this Government agency demands — and takes — in practically all portions of the spectrum, an EQUAL share of space with the commercial FCC licensees.

This wholesale grabbing has resulted in the present 50-50 division; a division maintained in spite of the fact that the peacetime radio communication needs of the Government are vastly overshadowed by the growing demands of thousands of commercial users of the ether.

Why should not members of IRAC, holding half of our valuable radio channels, be made to justify such occupancy just as fully as must the licensees under FCC?

Let us have a showing,—in a manner that will not compromise national security, — of public interest, convenience and necessity regarding the IRAC-held frequencies!

# The RADARSCOPE

*Revealing at a Glance*

## THE FCC

**COLOR-TV FIRST, UHF, FREEZE-END!**—As forecast in TELE-TECH in previous reports, the FCC is going to render its first decision on the all-important subject of television with regard to color-television—what system or systems will be sanctioned and how public color-video service will be implemented. The color-TV ruling (undoubtedly to be the lengthiest opinion in the Commission's history) may be issued during this month or at the latest during the early or middle part of August. What is more important from manufacturing and economic standpoints of the television industry is the lifting of the "Freeze" on the station construction permit grants in the "low" or VHF video channels. But this has to await the end of this year, according to FCC Chairman Wayne Coy.

## COLOR TV

**RMA's** fundamental and continuing policy on color-TV, as defined to TELE-TECH by past President R. Cosgrove, favors "making color-television available at the earliest date consistent with sound standards." To this end, RMA has urged FCC not to approve final color standards until NTSC recommendations and adequate field and home tests have established their soundness. RMA also emphasizes the imperative importance of compatibility.

With such a platform looking to promotion of sound color-TV, reaffirmed for the future, the editors gladly withdraw an inadvertent line,—written with a different intended meaning but inferring past slowdown of public acceptance of color,—on page 18 of TELE-TECH's May issue,—this in the interest of industry unity and the great color-TV future ahead for all.

**RMA has now become RTMA—the Radio-Television Manufacturers Association. And here are Past-President R. C. Cosgrove, FCC Commissioner George E. Sterling (author of the Radio Manual and other radio volumes), Dr. W. R. G. Baker, director of the RTMA Engineering Department and vice-president in charge of General Electric's Electronics Division, Syracuse, N. Y., and Past-President Paul V. Galvin, president of Motorola, Inc. Picture taken at Chicago June 8 meeting, when new name was voted by the membership**

## UHF

**EVENTUAL TV MOVE?**—The time table of the FCC program of activities calls for another lengthy series of hearings in the Fall on television UHF stations, classification of metropolitan, rural, community and perhaps some intermediate class stations, oscillator radiation, stratovision, polycasting, non-educational television channels, metered television, and the other components making up TV standards. This may augur that on the basis of the latter proceedings the FCC might come up with the threatened proposal of moving all VHF television at some future transition date of five or ten years into the UHF spectrum.

## FREQUENCY MODULATION

**COY SUMS UP**—Said FCC Chairman Coy to the RMA convention at Chicago, June 8: "FM, despite its many growing pains as an infant service, has in these five post-war years grown to more than 700 stations that give the nation more total nightime coverage than is given by all the regional and local AM stations, after AM's quarter-of-a-century existence. The area covered by these stations holds 100,000,000 people. A survey just completed in New York City shows that there are now three times as many sets with FM as there were two years ago and furthermore that the number of families actually using their FM sets has also tripled. It also found that more than 10% of all the homes are using their FM sets in preference to AM."

## IRAC CHALLENGED

**THOSE MILITARY FREQUENCIES** are still under attack. Although the general allocations plans for TV consider VHF to 216 MC, and UHF from 470 to 890 MC. there is growing pressure to make the military "put up or get out". The future of TV depends on adequate propagation. VHF is known to provide suitable service, but UHF is not only comparatively unknown, but is also far inferior as regards shadow fill-in and attenuation.

The best thing for TV would be a continuous spectrum, and while the presence of firmly established services between channels 6 and 7 probably precludes it, there is no reason why the additional channels should not be added at the end of the high band after channel 13. "Military secrecy" makes it next to impossible to obtain figures on the amount of use the government makes of the frequencies from 225 to 328.6 MC, and 335.4 to 400 MC. But such use is reported to be negligible. Since much of this use is for aircraft, and is therefore line of sight, shifting the government to the proposed UHF TV band would not work any hardship particularly in view of the fact that most of the equipment is push-button controlled. Now is the time for the industry to make a concerted effort to obtain a just and fair distribution of frequencies. Once the new allocation plan is ratified it will be too late, and TV will be

stuck "upstairs", overhung by the tentative threat of Chairman Coy that all TV may go to the UHF!

## AVIATION

**VHF OMNIRANGE**—Hints that this VOR program is not as successful and widely accepted as was at first expected, continue to appear. It is contended that the VOR's are wasteful of air space, and fail to provide the clear-cut accuracy vital to safe air navigation. This is particularly so in the East, where flight paths of 30 miles wide cut too deeply into the congested air space. The use of airborne radar, plus beacons, for navigation is favored by some of the larger airlines, and it is rumored that with a little encouragement they would turn to this form of navigation. Radar certainly offers advantages since it can be used to indicate inclement weather ahead, as well as the proximity of other aircraft, in addition to its primary function of accurate navigation.

## FACSIMILE

**MULTIPLEX INCOME**—By the use of multiplex it is possible for any FM station to operate two simultaneous services without mutual interference. Thus in addition to the normal FM sound channel carrying speech and music, the FM broadcaster has available, on the same carrier wave, an entirely different service which delivers printed matter from the broadcast receiving set.

The cost of adding a multiplex facsimile channel to an FM sound station is relatively small, as may be the cost of facsimile operation and programming. Since the FCC now permits the sale to advertisers of white space on the pages of the facsimile newspaper, the FM broadcaster is provided with a new source of income which should more than meet the expense of the facsimile operation, and thus contribute to the cost of the FM sound operation.

## TV ACCESSORIES

**LIGHTNING ARRESTERS**—Manufacturers of lightning arresters for use on TV receiving antennas may be interested to know that a large number of the dealers and organizations installing antennas disdain to use these items—not because they don't want the protection, but because they consider most arrestors as a source of trouble. This is especially true in fringe areas, and wherever reception is critical. Arrestors are said to develop both mechanical and electrical troubles, especially when exposed to the weather, such as loose and/or intermittent contacts, shorts, high-resistance leakage paths—which faults may result in "static", picture flashes, picture deterioration, signal loss, etc.

Arrestor makers might do well to (1) insure that their products are not susceptible to these faults, and (2) point out to prospective customers via their advertising and circulars that they are incorporating constructional features which make the arresters trouble-free.

Robert C. Sprague, new president of RTMA is president of the Sprague Electric Company of North Adams, Mass., and a former chairman of the RMA Parts Division. During the War he was chairman of the OPA Radio Industry Advisory Committee and a member of the WPB Advisory Committee on Condensers. More recently, he has been directing a nation-wide trade educational program as chairman of the RMA "Town Meetings" Committee. President Sprague is a son of the famous electrical engineer-inventor, Frank Julian Sprague, who ranks with Edison, and pioneered the electrification of street railways, railroads and elevators

## OVERSEAS

**INTERNATIONAL TV FOR WORLD PEACE**—Since it is thought to come too late in the present Congress, the proposal of Senator Mundt, South Dakota Republican, for the establishment of microwave relay networks in foreign countries to serve community television receivers with programs that will depict the American "way of life", is an idea that may come to fruition during the next session of the new Congress next January if the "cold war" threat continues. Senator Mundt quoted in his proposal the views of Brigadier General David Sarnoff, RCA Board Chairman, who has always advocated that television could be a potent tool for world peace. The Senator's plan calls initially for a 22-station microwave system in Japan, Turkey, or Indonesia, to cost $4.6 million and a 71-station system in the Philippines to cost $3.86 million, while the costs for other countries are yet to be presented to Congress. He would have the community TV receivers of theatre size. Like Gen. Sarnoff, the Senator envisions transoceanic television programming.

# Console Modifications

***Custom-built consoles are expensive but are easy to ope- Company console which are dealt with here make them***

*By Q. G. CUMERALTO, Chief Engineer, WRZE, York, Pa.*

STUDIO operation can often be improved by a few simple modifications in the control circuits of audio console. Since no two studio layouts are alike and the equipment requirements never the same, use of production equipment sometimes has disadvantages. This article shows how many of these disadvantages may be overcome. Although, of course, custom built equipment is the ideal solution the cost is quite high, and most operators must be satisfied with production models.

By way of illustration the modifications made on the console at WRZE are discussed. As there is only one studio and an announce booth, it is necessary to do considerable combination work from the control room. Thus, provision for another control room microphone and a third turntable seemed advisable during installation of the station equipment.

The console used is the RCA Model 76-B2 Consolette. Anyone familiar with this console will realize it serves the aforementioned needs adequately as far as audio input channels are concerned. However, a few changes in the control circuits were necessary to accomplish control room speaker muting when using the second control room microphone. It also seemed advisable to change this muting circuit so that it would be necessary to operate only one switch to put the control room on the air.

The audio circuits are straightforward, with provisions for handling two studios, announce booth, control room microphone, and two turntables. There is also accommodation for six remote lines and the necessary monitoring circuits.

Only the control circuits of the Studio B microphone number two, the control room microphone and the announce booth are discussed at this stage. The three microphones mentioned all appear on a three position switch which controls the input to channel four. This switch, K7, also controls the control room speaker muting, and operates in conjunction with the Prg-Aud switch, K4, to control speaker muting in studio B when K7 is in the Stdio B position; (this is the center, or "normal," position). There is also provision for controlling external "On Air" relays for the control room, announce booth, studio A, and studio B, with contacts to operate audition light relays for studios A and B. In addition, there are internal speaker muting relays for studios A and B, and for the control room, all wi'h contacts to operate an external announce booth muting relay. Only the muting relays and contacts used for studio B and control room speaker muting are involved in the change.

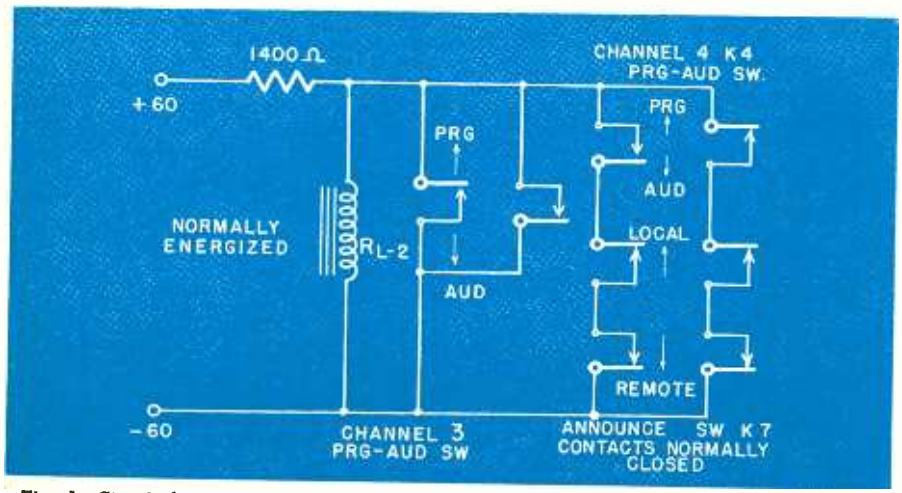
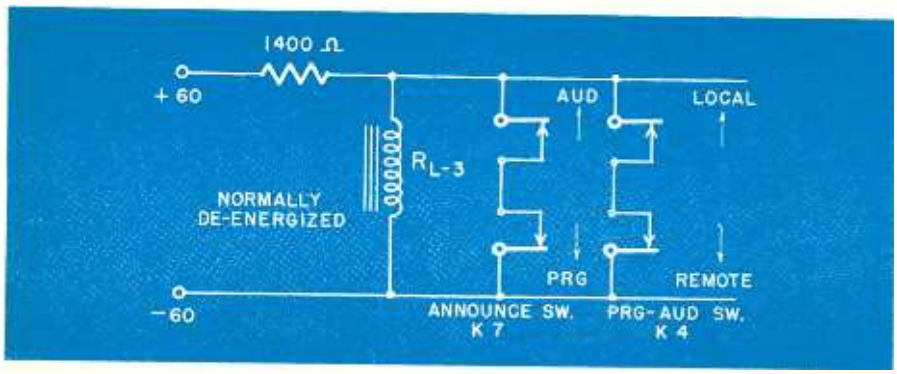



**Fig. 1: Circuit for muting studio speaker in normal position of master control switch.**

**Fig. 2: Simplified diagram of K4 and K7 connections to make changes described in text.**




## Control Room Muting Circuit

The changes are based on a simple muting circuit. The Prg-Aud switch, K4, for channel four is not in this circuit. The relay, RL-3, is normally de-energized, with the coil shorted out by the closed contacts on K7. Putting this switch into the "local" position opens the contacts, energizes the relay, and mutes the speaker in the control room.

Fig. 1 shows the studio B relay circuit for muting the studio B speaker with K4, when K7 is in the center or "normal" position. Again, only the contacts in use are shown, operating with relay RL-2 normally energized. Closing either of the switch strings in parallel with the

# Provide Audio Flexibility

***rate. Modifications of the RCA 76-B4 and US Recording the equal of many specially-designed high-cost installations***

coil will short it, causing the relay contacts to open, and muting the speaker. Each string of switches is made up of two sets of contacts on K7; one set operates in the "remote" position and one set operates in the "local" position.

In series with each pair of contacts on K7, is a set of contacts on K4; program contacts in one string and audition contacts in the other. The overall operation of these circuits is as follows. Putting K7 in the "local" position opens the switch strings in parallel with the studio B relay RL-2 (K7 contacts normally closed). Therefore, K4 is inoperative. Opening the circuit of Fig. 1, also opens the contacts of K7 and mutes the control room speaker at this time. With K7 in the center position the switch strings of Fig. 1 are open only in the Prg. or Aud. position of K4. Thus, closing the contacts of either the Prg. side of K4, or the Aud. side of K4 will complete one of the switch strings shorting the coil which opens the relay and mutes the studio B speaker. In the remote position, K7 again opens both switch strings, as shown in Fig. 1, without affecting the operation of the circuit as shown. In this position K7 closes a pair of contacts to operate the announce booth muting relay.

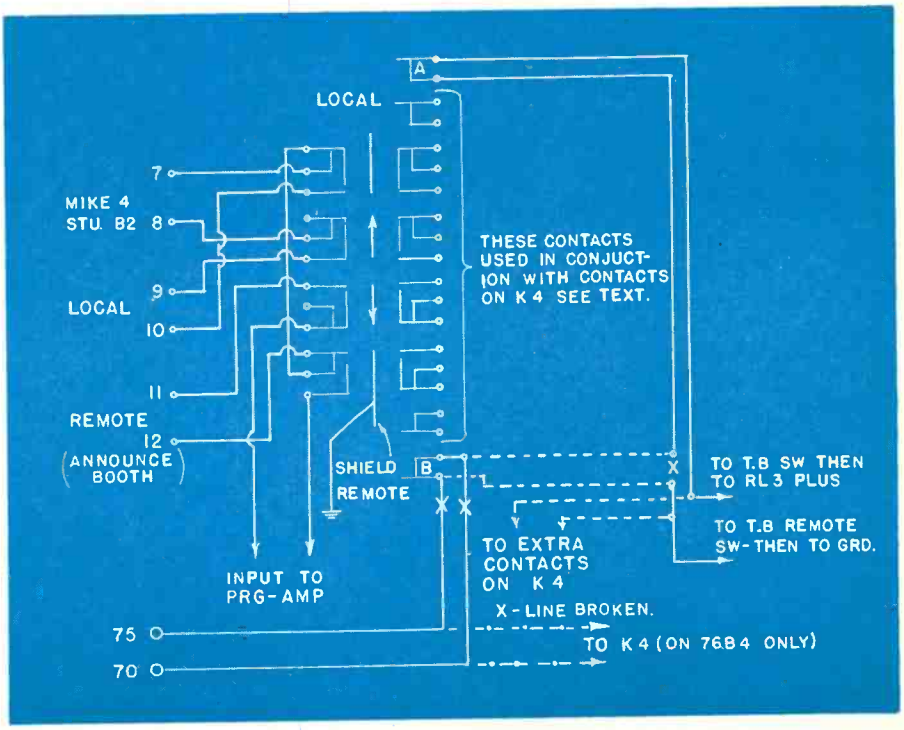
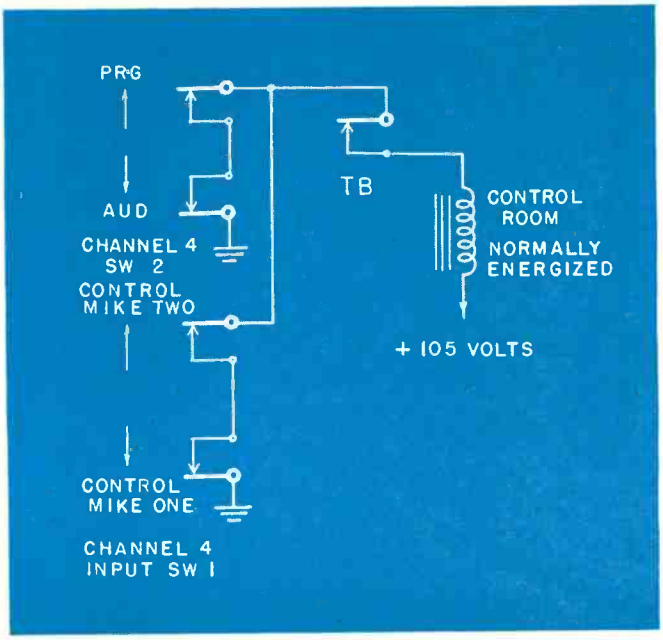
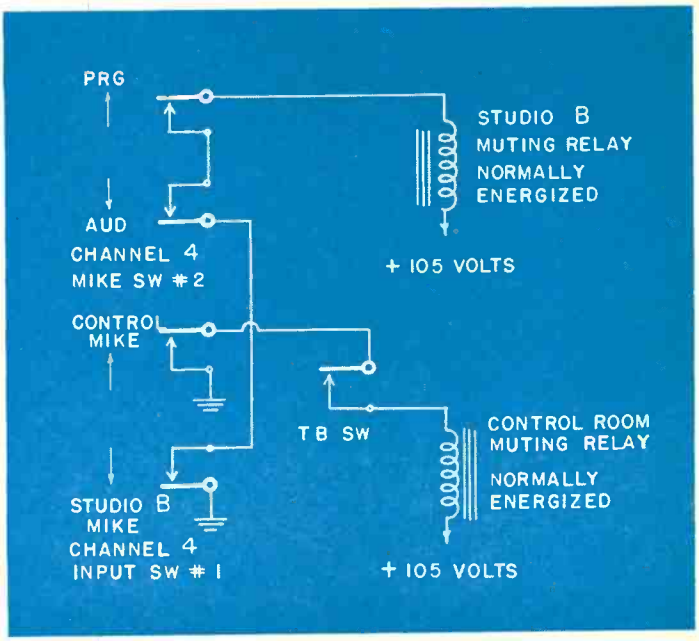



**Fig. 3: Switch K7 as installed in 76-B4 console showing circuit changes by broken lines**

The console was modified to operate as follows: The announce booth appears on the studio B microphone number one position, and operates as studio B. The control room microphone appears on channel four when the remote-local switch K7 is in the local position; control room microphone number two appears in the "remote" position, and the third turntable in the

**Fig. 4a: US Recording Co. console original connections. Fig. 4b: Modifications to console to obtain muting arrangements similar to Fig. 2**



## CONSOLE MODIFICATIONS (Continued)

center position. As mentioned previously, it was desired to eliminate the necessity for operating K7 and K4 when putting the control room on the air. With this modification the need to operate both is required only when using the third turntable. Fig. 2 is a simplified diagram showing the connections of the contacts on K4 and K7 to make possible the operation described above. Comparing Figures 1 and 2 makes the modifications quite clear.

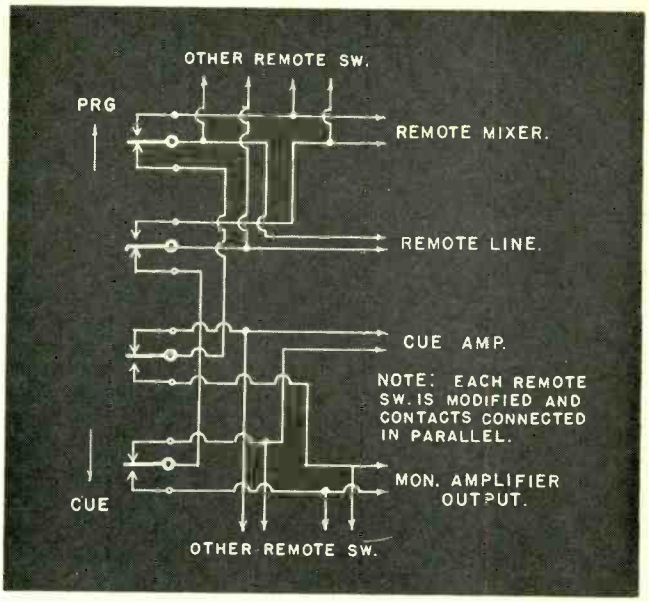



**Fig. 6: Schematic diagram of remote switch connections to cueing amplifier when remote switches are off**

### Modifications 76-B4 Console

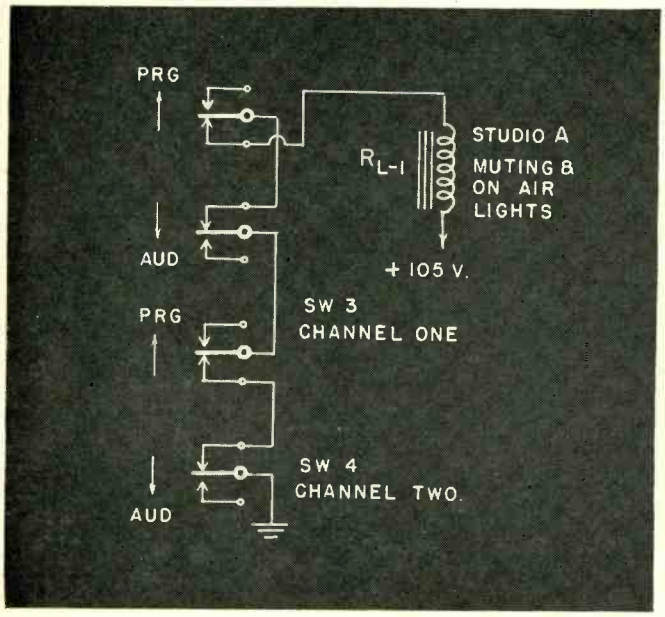
Fig. 3 is a copy of the RCA diagram of switch K7, with the dotted lines showing the changes. This switch has an extra set of contacts which were used to control the announce booth muting. However, since announce booth was connected to the studio B microphone number one channel these contacts were useless. They terminate on terminals 75 and 76 and are in series with the contacts A on Fig. 4. Required now is a set of contacts on K4; one set on the Prg. side, and one set on the Aud. side, to place in parallel with the contact on K7 (see Fig. 2). After this modification to the model 76-B4 RCA console, an extra set of contacts on K4 appear in parallel with the extra set on K7, (previously used for the announce booth muting) also terminating on terminals 75 and 76. If this model console is used, parallel the contacts as shown in Fig. 3. The RCA 76-B2 does not have the extra contacts on K4. So it becomes necessary to install a new K4. However, if studio B does not exist the contact formerly used in the studio B microphone number two circuit becomes available. In the case in point it was necessary to open this circuit. This was done to prevent muting the announce booth when using the third turntable. Notice that K4 and K7 are in series, and this series circuit is in parallel with K3, the studio B microphone number one switch.

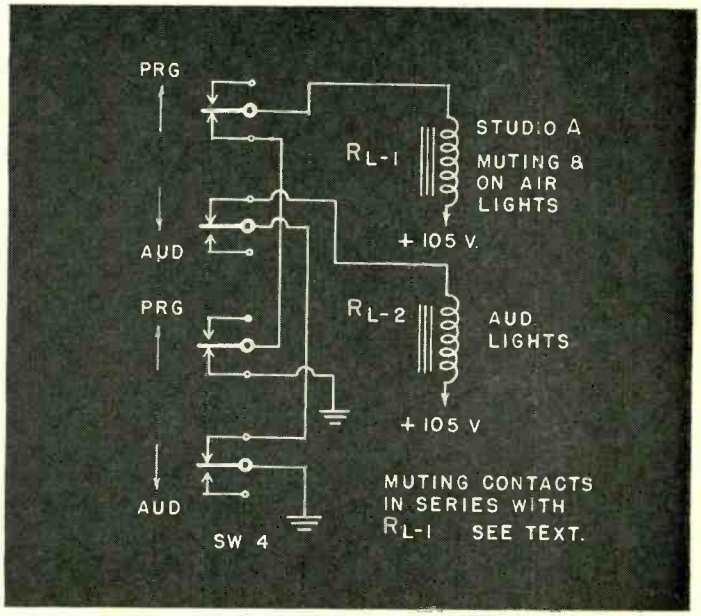
Fig. 4 shows the changes made on the US Recording Company console previously installed at WRZE. Generally speaking, the operation of the muting circuits were the same as the RCA 76-B2. Fig. 4a shows the original circuit, with the modified version shown in Fig. 4b. Note that studio B, and control room speaker muting are controlled by switch 1, the equivalent of K7 in the 76-B2, in the previous circuit example.

The addition of audition light relays to a console not so equipped is shown in Figure 5. This shows the changes in the mike switches necessary to operate the additional relays. While making this modification it would be wise to include provisions to have the talk-back switch over-ride the Prg.-Aud. switch, when in the Aud. position. This will save a lot of time during rehearsals.

Connection of the remote lines to the turntable cueing amplifier, when the remote switches are in the "off" position, is also a simple matter. This method is often to be preferred to the over-ride provisions now on most of the late model consoles. Figure 6 is the diagram of the remote switch. All switches are wired in the same manner and then paralleled.

**Fig. 5a, b: shows modifications to add audition and "on air" lights to consoles not so equipped. Talk-back provisions are included.**



# FREQUENCY MODULATION

***Medium offers lowest cost per listener combined with adequate coverage in many areas. See FM Map, Part II of this issue***

FAR from being the Forgotten Medium that its detractors would have it, FM is providing an increasingly valuable service to a large part of the United States. The FM Survey Map included in this issue has been compiled on the basis of reports from the operators of FM and AM stations, and shows the actual areas where blanket reception is obtained.

One fact which stands out, is the lack of use in those western regions where FM's qualities make it the only choice for adequate coverage. It is in the southern and western portions of the US that maximum population coverage can be obtained from the static free characteristics of FM with minimum power.

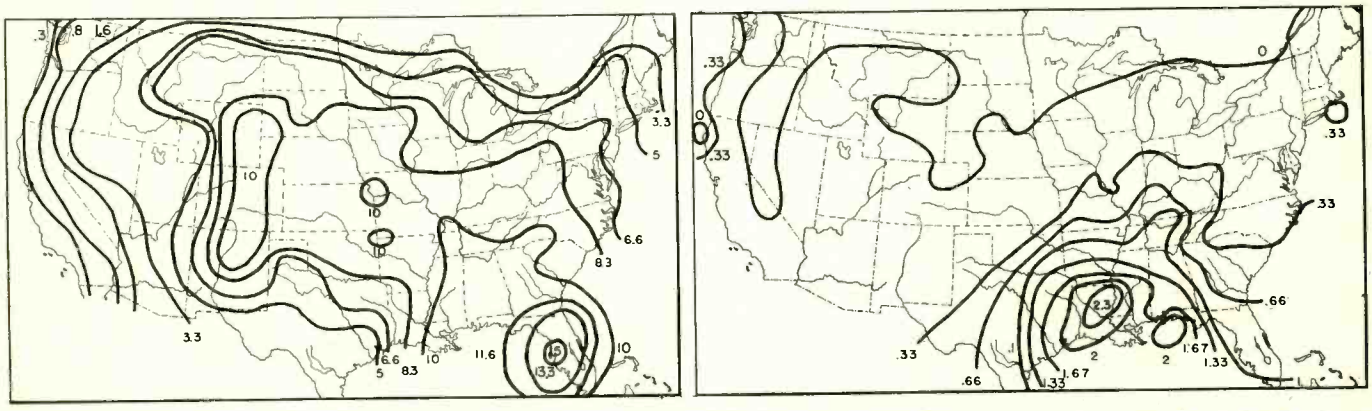
For purposes of calculating AM coverage 100 μv/m and 500 μv/m contours are used by the FCC and the broadcasting industry for day and night service respectively—*for clear channel stations.* These figures presuppose that the only interference level to be overcome is static. For other classes of station the day figures are 500 μv/m, and up to as high as 16mv/m at night, depending on the amount of interference. Many class II 50 kw AM stations are limited to 5mv/m or more at night.

FM coverage is based on service to the 50 μv/m contour. With the new high sensitivity high noise rejection receivers now on the market adequate FM reception is possible out to the 15 μv/m contour. For sparsely populated, rolling or flat country, such as abounds in many parts of the west where there is little man made static FM offers the lowest cost per listener. A point of significant interest to the networks is the fact that with the exception of CBS, more network programs could be heard in the 40 test areas on FM than on AM! Although complete figures are not available, based on the returns to date it would seem that this state of affairs exists in many other parts of the country. In many parts of North and South Carolina the only source of some network programs is FM.

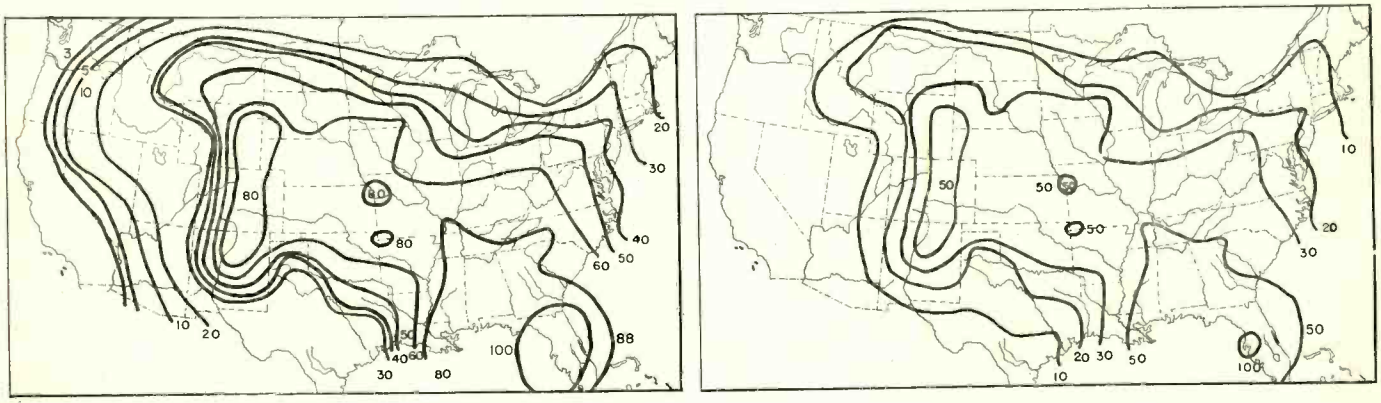
On this page appear maps, produced at FCC hearings in 1946, showing the incidence of thunderstorms in the US. As might be expected the midwest and western states have a total number of days second only to Florida. Also shown on another set of maps is the atmospheric noise level for 530 KC and 1600 Kc. While noise levels of 100 μv/m occur only in relatively small areas, 80 μv/m levels are found in many places.

In 1946 a series of tests was made from Cheyenne Mountain in Colorado. With 28 watts radiated from a simple dipole set up on mountain top a usable 50 μv/m signal could be obtained up to 30 miles away depending on the terrain and local conditions. At the same sites local AM stations were often unusable due to natural and man made static.

In the case of large metropolitan cities such as New York, Chicago, etc., the advantages of FM over AM are not so pronounced since the AM field strength is usually sufficiently high to overcome static. However, in the summer in New York there are times when network programs via FM are superior to AM, due to lightning discharges which mar AM reception. This situation probably holds true in many other parts of the country.



Shown above are charts of the average number of thunderstorm days in the U. S. for June (left) and December (right). On charts below, June average atmospheric noise is plotted for 530 KC. (left) and 1600 KC. (right) at night. Actual noise intensity in uv/m is below contours 90% of time.



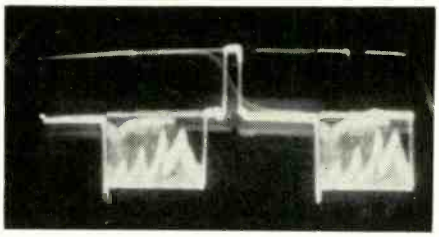
# Design for Horizontal

***Changing technics of television demand effect facilities equal to those studios. New equipment provides ingenious method of scene changing***

*By JOHN T. WILNER, Director of Engineering, WBAL-TV Baltimore, Md.*

IN an effort to add variety in changing television scenes an electronic wipe device was developed at WBAL-TV. The two methods commonly used at present are the instantaneous switch from one camera to another and the superimposition or lap dissolve from one scene into another. This new method allows the operator to displace horizontally one scene by another by means of a single control. Any combination of two scenes or smooth replacing of one scene with another is instantly available.

Referring to Fig. 1a, the horizontal drive is first transformed into a saw tooth wave form. This saw tooth wave form is fed into a special multi-vibrator which changes the saw tooth wave form into a rectangular wave form whose width can be varied by changing the bias on one of the two grids of the multi-vibrator. The resulting rectangular wave form is then cleaned up by the clipper stage and fed into a phase splitting network. The purpose of this network is to provide equal and opposite keying pulses to two video amplifiers. This permits each horizontal line of one video amplifier to be partially blanked out. The second video amplifier is also blanked out with a keying pulse of opposite polarity.



Typical waveform produced during operation of WBAL-TV horizontal wipe amplifier

The outputs of both tubes are fed into a mixer circuit after the undesired part of the mixed signals is clipped out. The combined output is then fed into a linear clipper which suppresses switching transients. A clamping circuit is incorporated to set the bias of the linear clipper. This cleans up the blanking portion of the signals as well as preventing unwanted low frequency components from entering the output line. The output of the clipper then feeds two low impedance output stages, one of which is used to feed the line, the other for previewing purposes.

## Circuit Description

In Fig. 2 horizontal sync of minus 1½ volts is fed into V1a, V1b. The horizontal drive is amplified directly into V1b to an amplitude of about 20V. This pulse is then transformed into equal and opposite pulses through the phase splitting tube V18. These equal and opposite pulses are then sent to the clamper diode V19. The bias developed in this circuit is used to control the clipping level of the linear clipper circuit composed of V16, V17 and V18.

At this point refer to V1a. The horizontal sync must be delayed approximately 5 μsecs. in order that the keying pulses at V8 will start during one blanking interval and wipe across one horizontal line into the next blanking interval. The sync is differentiated as shown in wave form "b" in Fig. 3. This is amplified in V1a as shown in waveform "c" and clipped by V2a to remove the positive part of the waveform. The resulting waveform "d" is now similar to the original horizontal drive waveform "a" but delayed in time as already described. The pulses are amplified to 17 volts in the first half of V3. These pulses are used to generate a saw tooth waveform as shown in "f" and fed to the grid of V4. V2b is used to provide the dc level of the saw tooth waveform. V4 and V5 form a multi-vibrator circuit and both tubes are biased to cut off in the absence of a triggering or synchronizing voltage on the grid of V4.

A study of this multi-vibrator shows that the plates are tied to plus 300 volts through their load resistors while their cathodes are connected to negative 300V through their bias resistors. The grid of V5

Series of pictures photographed on monitor tube at WBAL-TV during horizontal wipe from left to right. Station identification

# Wipe Amplifier

## *of motion picture for any TV station*

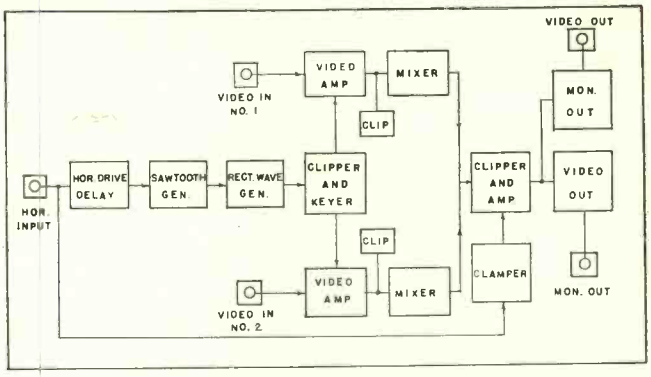



Fig. 1a: Block diagram of amplifier circuit. The actual schematic is shown on the next page; stages above are described in accompanying text. Although adjustment is sensitive it is not critical, uses dc control voltages

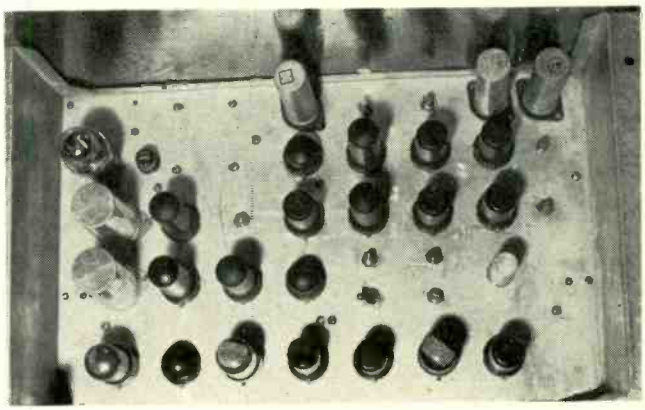


Fig. 1b: Photograph of completed amplifier mounted on standard rack mounting chasis. Shielded lines carry dc potential to remote fader position for studio control room operation

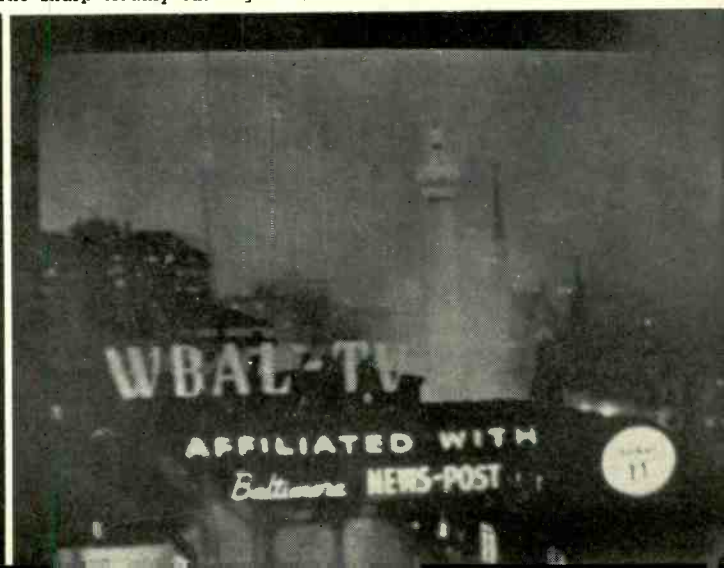
is supplied with a variable dc voltage which can be varied from zero to 65 volts. This control is the wipe lever. The portion of saw tooth waveform that is allowed to pass through V4 is dependent on the bias of V5. The waveform of the cathode voltage is shown as waveform "g." Thus it may be seen that the saw tooth which reaches the cathode of V5 can be made to vary from zero to maximum through the cathode circuit of V4. Since the cathodes of V4 and V5 are common, V4 will conduct current only when the peak value of the saw tooth is sufficient to bring V5 into conduction. As soon as conduction takes place the plate current of V5 reaches maximum and remains there until the return portion of the saw tooth again drives V5 into the cut off region. Thus a rectangular waveform is produced in V5 and the width of this rectangular waveform can be made to vary from zero to maximum. As a practical matter it is impossible to reach this condition of zero and maximum because of limitations on rate of rise and rate of fall of the sides of the rectangular waveform unless very low loads are used to obtain the high frequency components required for these steep wave volts. This is the reason for delaying the horizontal drive at the beginning in V1a. This allows the rectangular waveform in its maximum position to run into the next blanking period and thus allow horizontal wipe to take place to the right edge of the picture.

The output of the multi-vibrator is further cleaned up in V6 and V7 to improve the steepness of the wavefronts. V8 is used to produce equal and opposite rectangular waves the output of which is fed into cathode followers V9 and V10. The clearness of the dividing line between the two pictures is directly a function of the similarity of these two keying pulses, and much emphasis was placed on producing similar pulses both in amplitude and shape.

Two video sources are amplified by V10 and V12. The cathodes of these last two tubes are common with the cathode followers V9 and V10.

Thus V11 and V12 have video signals fed into their grids and keying pulses into their cathodes. The waveforms that exist in V11 and V12 are shown as waveforms "n" and "o". It is necessary that the lower half of each of the waveforms "n" and "o" be clipped out, and this is done by biasing V12 and V14 beyond cut off and allowing the clippers V15 to permit only the upper parts of the waveforms to be amplified. The clipped waveforms are shown as "p" and "q", but these individual waveforms cannot be seen on the oscilloscope unless either V13 or V14 is removed. If both tubes are in place the combination of "p" and "q" will be seen as waveform "r". It will be noticed that in waveform "r" a number of transients are present in the signal due to switching and

card is appearing from left and replacing previous announcement. The sharp cleanly cut edge of the two cards shows stable operation

clamping. These transients would seriously interfere with the operation of the stabilizing amplifier and must be removed. This occurs because the clamping that takes place in a typical stabilizing amplifier occurs at exactly the same place that the transients occur in V13 and V14. That part of the signal below the dotted line shown in waveform "r" must be removed in a linear clipper. This clipper is composed of V16, V17 and V18 and operates on the following principle:

One diode of V17 is in series with the load resistor and is placed across the load resistor of V16. Since the screen and plate voltages of V16 are very closely regulated it will be seen that no current will flow through the diode until the voltage on the cathode of V17 falls below the voltage that exists on the plate. The voltage on the plate is held very closely at 150 volts by virtue of the regulating action of V18. Any voltage below the cut-off point, which in turn is controlled by the bias on the grid of V16, will cause low current to flow in the plate circuit of V16. This means that diode V17 is nonconducting as long as this condition exists. As soon as the grid of V16 goes positive with respect to its cut-off voltage, the cathode of diode V16 becomes negative with respect to its plate and conduction takes place. Cut-off is extremely abrupt and the diode of V17 acts as an extremely fast switch. In order to suppress transients the other half of V17 is connected as shown, so that when the first half is cut-off the other conducts and the transients can be made to balance to zero. This is controlled by a variable voltage on the second diode cathode. Conduction and cut-off can be made to coincide exactly and will usually be set at the blanking level of the signal which is controlled in turn by the bias developed by clamper tube V20. The output of the linear clipper feeds V22 and V23 which are low impedance devices so that the line and monitor can be supplied with video signals.

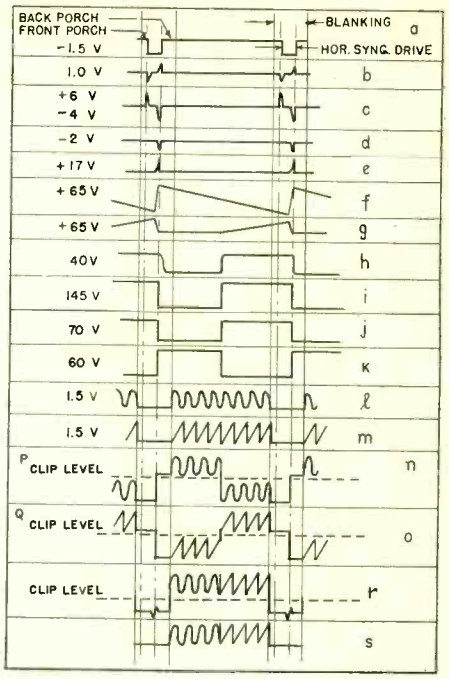
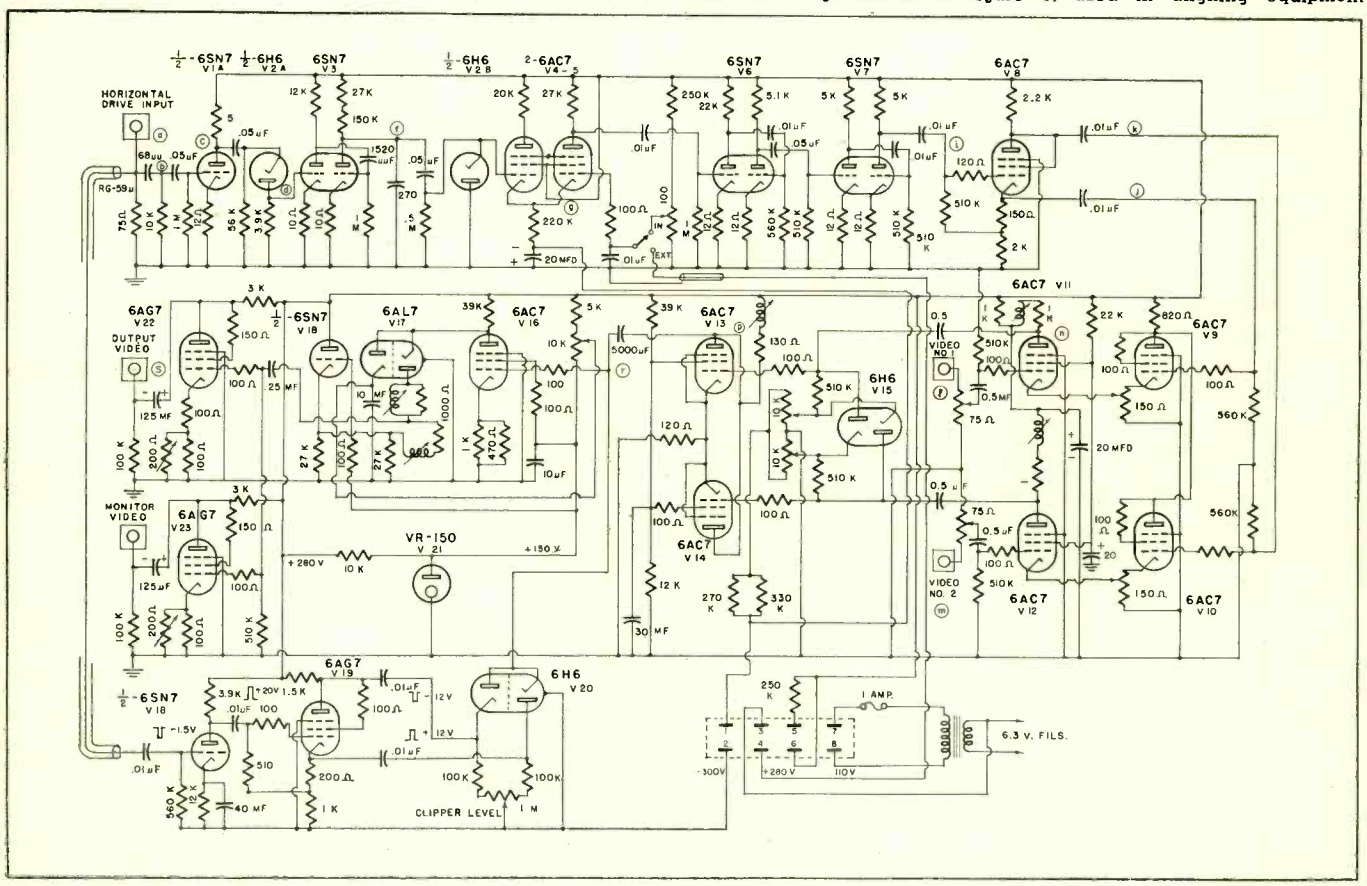


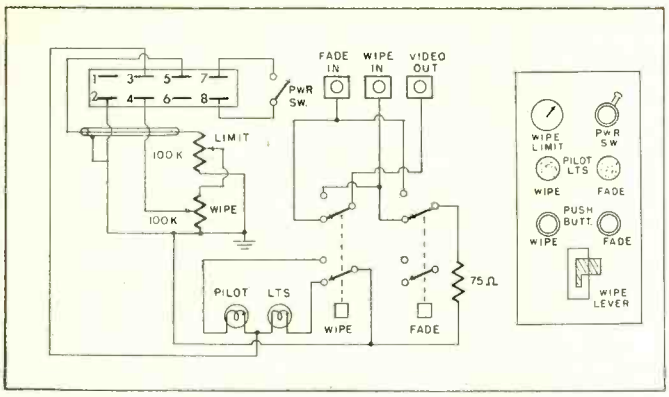

Fig. 3: Tabulation of voltages and wave forms appearing at various points in the amplifier referred to in Fig. 2

## Installation and Use

The horizontal wipe equipment may be installed at any distance from the control panel since the wipe control voltage is dc. The dc line which controls the wipe should be shielded to minimize hum pick up. For convenience in alignment the wipe process can be controlled by the 100K ohm potentiometer mounted on the chassis, but is normally controlled from a remote location. A switch selects chassis or

Fig. 2: Schematic diagram of wipe amplifier. Standard receiving tubes are used throughout and power is taken from regular 580 C supply. Identifying letters appearing at each tube position refer to wave-form drawings shown in figure 3, used in aligning equipment





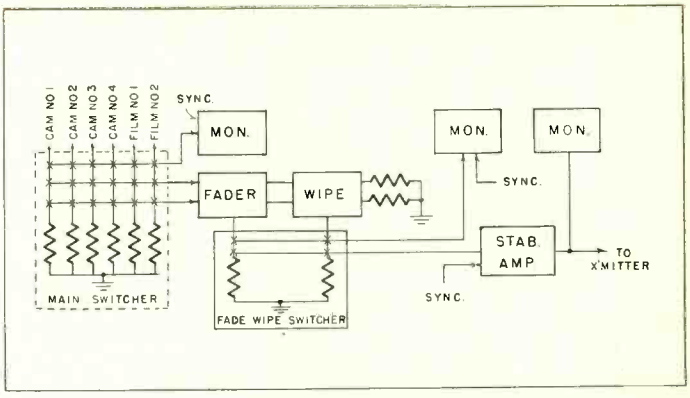




**Fig. 4. (left) Appearance and layout of remote control wipe panel Connections to main unit and Jones plug for pilot light power and operating potentials are shown on the left. Fig 5. (right) Modifications to the studio switcher to permit connection of the wipe control**

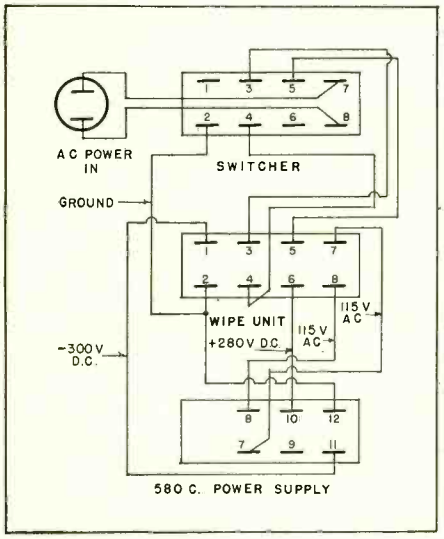
remote control. A standard RCA type 580C regulated power supply was modified by the addition of a negative 300 volt, 50 MA unregulated power supply mounted on the front of this unit. Terminal "11" on the Jones plug which was normally used for the 375 volt unregulated output was disconnected and the negative 300 volts was tied to this terminal. Both power supplies are remotely controlled by an ac power switch mounted on the remote panel. Fig. 4 shows the schematic of the remote panel as well as a drawing of the physical layout. The wipe lever which controls the horizontal wipe was constructed in similar fashion to the fader control on a standard switching panel. This wipe lever connects through gears to a 100,000 ohm potentiometer. To prevent overwipe of the picture another 100,000 ohm potentiometer is connected to provide the limit adjustment.

The wipe equipment was wired into the studio switcher of WBAL-TV as shown in the block diagram of Fig. 5. The fader amplifier which normally terminated the switcher in 75 ohms was rewired so that the inputs to the fader bridged the two video line between the switcher and the wipe equipment. A small auxiliary switching system was installed on the remote panel so that the output of either the fader amplifier or the wipe could be used. Both the fader amplifier and the wipe equipment were terminated in 75 ohms when in the unused position. Tally lights were included to tell the technical director whether the fader or the wipe was in use. The monitor output of the wipe unit was fed back to the preview switcher for preview purposes.

To align this equipment horizontal sync drive must be provided to its proper input plus two sources of video signals, a picture monitor and a stabilizing amplifier. By following the waveforms as shown on Fig. 3 the keying signal can be traced to the inputs of V9 and V10. Turn the potentiometers in the cathodes of V9 and V10 to zero. With an oscilloscope placed at the plate of V11, adjust the potentiometer in the cathode of V9 so that the signal looks like waveform "n", Fig. 3. Connect the oscilloscope at the plate of V12, adjust the potentiometer in the cathode of V10 so that the signal looks like waveform "o", Fig. 3. Adjust for equal amplitudes. Connect the oscilloscope to the common plates of V13 and V14. Remove V14, adjust the potentiometer of grid circuit of V13 so the signal looks like

(*Continued on page* 57)

**Fig. 6. Interconnection diagram for Jones plugs on studio switcher and wipe amplifier**




# Hazeltine Shows Color TV Developments

A DECREASE in unwanted effects which doubles the useful area of a TV station, accompanied by reduced dot structure visibility of the order of 8 db and reduction of vulnerability to interference are offered in Constant Luminance Sampling demonstrated by Hazeltine Electric Corp., Little Neck, L. I., N. Y. In essence the system is based on dot sequential principles shown to the FCC during the color hearing. The Hazeltine modifications developed from the Flicker Photometer and led to utilization of the fact that the eye is much less sensitive to variations of color than of brightness. The undesired signal variations caused by the sampling processes of the mixed and by-passed highs systems, are converted to color variations instead of brightness variations. A 90° shift in the horizontal position of the dots in the dot interlace renders them less apparent.

The patents were demonstrated on dichroic mirror receivers employing 10-in. tubes. Carrier interference was demonstrated as being reduced considerably, since the color fluctuations were less apparent than the brightness variation they replaced. Compatibility is claimed to be increased since the signal is more representative of the brightness of the original scene. The company emphasized that a television system, as such, was not being proposed, but merely modifications and improvements which should be considered at the time that the FCC sets the new color standards.

Also demonstrated were 4-MC monochrome pictures into which 0.1 MC of each color—red, blue, and green, had been introduced without color deterioration. This was a striking example of how little color is required to produce an acceptable color picture.

# Notes for R-F

***Use of parallel tuned loops indicated when dc continuity Q requirements are best met by series tuned loops. Instru-***

*By KEATS A. PULLEN, Ordnance Dept., Ballistic Research Laboratories, Aberdeen Proving Grounds, Md.*

THERE are two basic types of coupling loops: tuned and untuned. In the first, a capacitance is included as a part of the loop circuit to resonate the reactance of the loop. In the second, tuning is performed by reflected reactance from the coupled tuned circuit. The tuned loop may be either series or shunt tuned — the choice depending on the termination, the size of components used in the coupled tuned circuit, on availability of loop tuned capacitors, and of space for installation of the coupler.

Under untuned loops, distinction can be drawn between loops having negligible reaction effects from stray capacitance, and those having appreciable capacitance effect. Coupling to a coaxial cable which is properly terminated with minimum termination lead length corresponds to the first case. Coupling to an electron tube plate with its shunt capacitance corresponds to the second case.

For a tuned coupling loop to function properly, it is necessary that its loaded Q be at least somewhat greater than unity. Since the

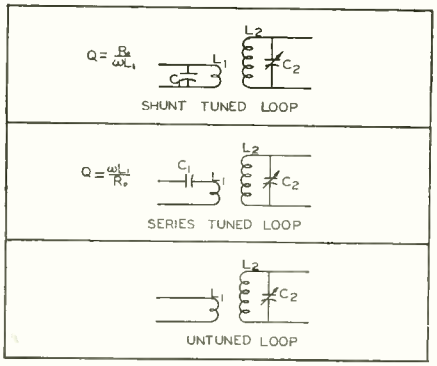



**Fig. 1: Circuit representation for tuned and untuned loops together with equations for Q of the series and shunt tuned types**

source or load determines the resistance being used, the limiting value, either upper or lower, of the reactance is established. For the series tuned loop, the Q is defined by

$$Q = \omega L_1/Z_o \qquad (1)$$

Hence, the reactance of the series tuned loop must be greater than the source or load resistance. For the parallel tuned loop, the Q is defined by

$$Q = b_L/g = \omega C_1 Z_o = Z_o/\omega L_1 \qquad (2)$$

The circuits for both of these equations, and also the circuit for the untuned loop are shown in Fig. 1. It is evident from Eq. 2 that the reactance of the parallel tuned loop should be less than the terminating impedance.

Matching to a 50 ohm coaxial cable, for example, would call for a coil reactance of the order of a minimum of sixty to several hun-

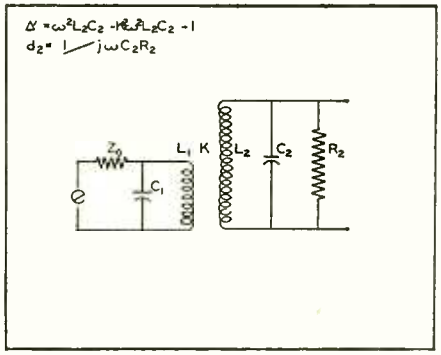



**Fig. 2: Circuit diagram showing positions of various elements in gain equation (4)**

dred ohms in a series loop. In the parallel tuned loop, the range is from a few ohms to a maximum of forty ohms. It is convenient to standardize on a Q of approximately two to three for both of these cases, so that a simple device for adjusting loops to the proper reactance can be prepared. Such a device will be described later.

Choice of a series or parallel loop often is completely arbitrary. In some cases, however, the characteristics of the circuit make one or the other preferable. A parallel tuned loop is indicated if continuity to dc is required where space is limited for location of the loop, but not for the tuning capacitor, (at a Q of two fixed tuning is surprisingly broadband) and where stray capacitance is large.

Series tuning is indicated if physical space prohibits use of larger loop tuning capacitor. Here the use of series loop with a Q of 10 or 20 provides a substantial reduction in the required capacitance. Also, if

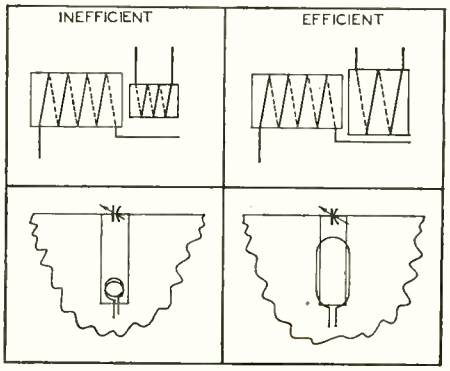



**Fig. 3: Diagram showing inefficient and efficient coupling shapes of loop coils**

the internal inductance of available capacitors is comparatively large, or to get sufficient coupling when the magnetic field of the tuned tank is spread out considerably and where the isolation of dc is desired, the series tuned loop is very convenient.

If series tuning is used in the presence of stray capacitance, it is desirable to have the tuning capacitance parallel the strays if at all possible.

The unloaded Q of the coupling loop should be as high as is consistent with the physical size permitted. A minimum unloaded Q of at least ten times the loaded Q is to be desired for reliable operation. If this is not possible with a parallel loop, the series tuned loop should be used. The design of the tuned loop is then resolved to the problem of getting a specific inductor as required by Eq. (1) or (2) and the required Q.

Since the untuned loop is actually tuned by reflected reactance, there are several restrictions on design. Analysis of the circuit to establish these limitations shows

# Coupling Loop Design

***is required and where loop location space is limited. High ment that simplifies adjustment of coupling coils described***

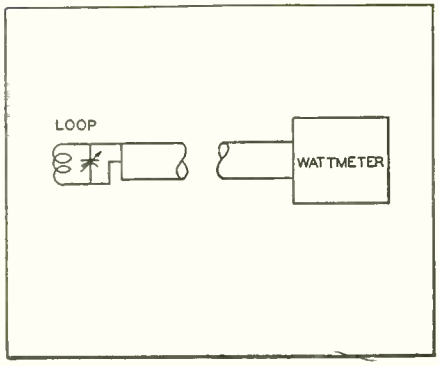



**Fig. 4: Diagram of device which permits adjusting reactance of coil to range of values encountered in coupling to a specific type of balanced or unbalanced transmission line**

that the reflection of reactance into the untuned loop makes the loop tuning in effect series tuning. A minimum value of loop self-reactance for satisfactory operation results, namely the self-reactance equal to the loading or the source impedance. Also, that unless the coupling is greater than the reciprocal of the Q of the main tuned circuit, the detuning of that circuit required to cancel the net reactance of the untuned loop lowers the efficiency of the tuned circuit excessively. Also, if actual losses in the loop are to be minimized, as small a copper and stray loss as possible must be maintained. This calls for maximum magnetic energy for minimum loss. This condition usually occurs near the reactance value given above.

The fifth conclusion is that the presence of shunt capacitance can serve to increase the effective loop inductance in some cases. However, since the currents in the loop are raised, this is primarily useful where mechanical limitations affect the size of the loop.

The technic for setting up an untuned coupling loop is similar to that described for tuned loops. The first step is determination of the proper inductance for the loop. In the high frequency ranges, a device like the loop designer is a useful way of getting the proper size of coil, as we shall show.

Where stray capacitance must be tolerated, minor modifications of the suggested technic may be used. The loop may be designed to show the proper reactance with capacitance equal to the strays across its terminals. Or the correct reactance may be computed from the equation

$$\omega L_1 = Z_o\sqrt{1-\omega^4 L_1^2 C_1^2} \qquad (3)$$

The equation for voltage gain in a circuit of this type is approximately given by

$$e_o/e = [j\omega K\sqrt{L_1 L_2}]/ \qquad (4)$$
$$[(\Delta'+jd_2)(j\omega L_1+Z_o[1-\omega^2 L_1 C_1])]$$

The variables in this equation are explained in Fig. 2. The approximations made in this equation are those required for an untuned loop to be useful. With $C_1 = 0$, the condition of reactance equal to resistance is in the vicinity of maximum voltage stepup. The reduction of the required value of $L_1$ with increase of $C_1$ is also evident from Eq. (4).

## Coil Adjustment

Adjustment of both the coil parameters and the coupling may be needed in any given case to get proper operation. Where the untuned loop is used for input coupling, the coupling required to give proper operation normally loads the circuit sufficiently to cut the loaded Q to at most half the unloaded Q. Increase of coupling from the minimum value broadens the passband, but has little effect on the amplification.

Use as an output coupling loop requires that the value of K be quite high. Only in this way can the majority of the energy reach the load. After the proper coupling inductance has been constructed, it is coupled to its companion circuit. A wattmeter or other form of terminating load is connected to the cable being excited by the loop. Coupling is tightened until maximum power transfer occurs.

The coupling loop may be used to excite either a loop, notch or slot antenna as well as the more ordinary types of loads. In this case a little experimentation may be required to obtain the best coupling shape. If the source or load consists of a multiturn coil, the coupling coil may be of approximately the same diameter. (See Fig. 3.) Adjustment of coupling calls for moving the untuned loop axially into the field from the ground end until the power being transferred is a maximum.

The first is to test for a better physical shape for the loop. The coupling loop must be located in the area of high magnetic field. The shape of the loop may be varied, holding the inductance approximately constant. In some cases it may be necessary to use a conductor having a smaller inductance per unit length in order to obtain sufficient coupling. The slot antenna can be loop excited in a similar manner, the only difference from the notch being the presence of the tuning cavity behind the slot.

In exciting the notch, a single turn loop appears to be preferable. This loop is placed in the neighborhood of the high current end of the notch and is adjusted so that its window area is slightly wider than the width of the notch. It extends as far up the notch as the required inductance permits. Its proximity to the notch is varied until maximum power transfer occurs. The notch is usually tuned with a grid dip meter prior to coupling.

If insufficient coupling is available, two modifications can be made.

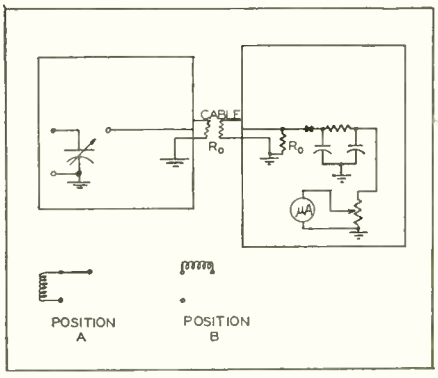
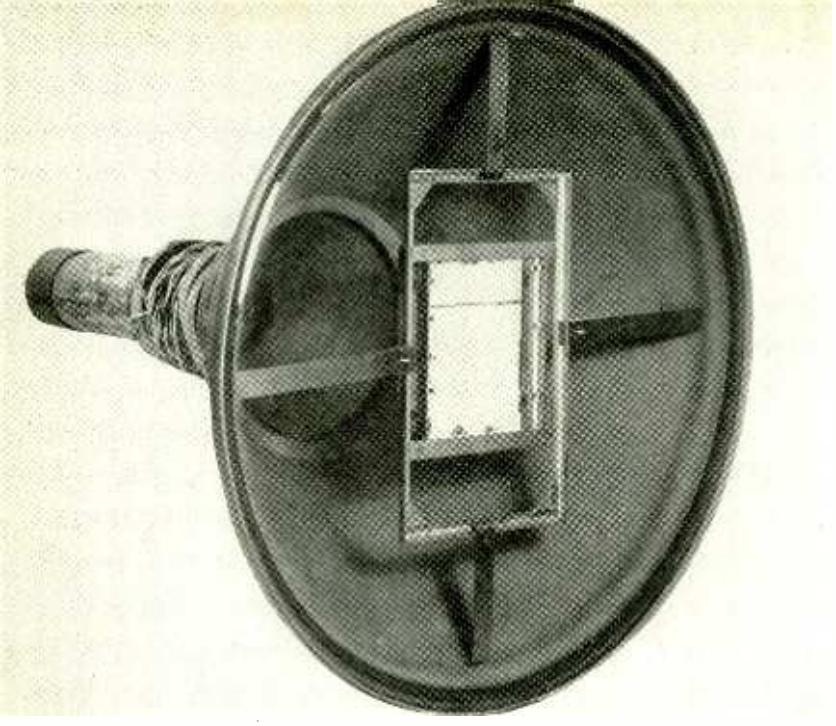



**Fig. 5: Arrangement similar to that shown in Fig. 4 which increases the flexibility of the unit and makes possible the design of all of the coupling loop types listed**

A device has been designed which makes possible adjustment of the reactance of a coil to the range of values encountered in coupling to a

(*Continued on page* 57)



Working model of color cathode ray tube with 9 x 12 cm. screen composed of 0.5mm phosphor bands fluorescing in 3 primary colors

# Experimental

By C. S. SZEGHO
*The Rauland Corp.*
*Chicago 41, Ill.*

IN a color television system it is the presentation device which ultimately is of decisive importance. If color is to become as widespread as black and white television is today, the presentation device must satisfy all or the greatest possible number of the following criteria:

1—It should operate wholly electronically.

2—Be suitable for direct view and projection television.

3—The picture size which it can reproduce should not be limited but should include all sizes encountered in monochrome television.

4—In the absence of standardization on transmitting practice, it should be equally applicable to the field, line and dot sequential systems and to simultaneous color systems. Even if a sequential system is adopted for home television, it is possible that simultaneous color transmissions will prove more practicable and will be used in order to achieve the increased light output needed for large screens in commercial installations. Local conversion of the sequential signal into simultaneous color signals with the aid of storage tubes or the like, can be visualized.

5—It should be a single tube.

6—The reproduction in natural color should not be derived by optical registry of a plurality of primary color images.

7—The colors should not depend on scanning registry or scanning linearity.

8—Its brightness should not be limited by poor utilization of the screen area or by the use of color filters of high light absorption.

9—The resolution possibilities must be adequate for a 525-line picture.

10—It must be suitable for reception of monochrome transmissions.

11—It must be simple to construct so that it can be mass produced in an efficient manufacturing process.

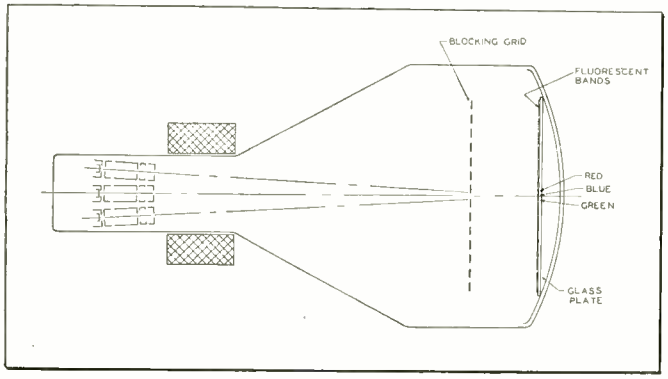
A critical survey of the numerous suggestions for presentation devices in the patent literature revealed that a scheme described by the French[1] patent #866,065 shows greatest promise, if modifications suggested by Sam H. Kaplan are incorporated.

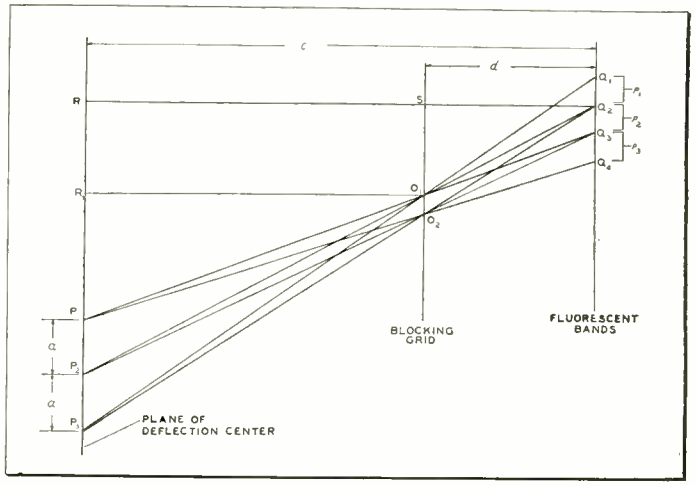
## Construction Features

Fig. 1 illustrates the construction of such a 3-color tube. The cathode-ray tube has 3 electron guns and a blocking grid so placed between the guns and the fluorescent screen that as a result of parallax effects the grid permits the electrons from only one gun to strike any particular color portion of the screen. The fluorescent screen consists of successive bands fluorescing in the three primary colors. The grid of each gun is controlled by one of the primary color signals, either simultaneously or in sequence. The three electron beams are deflected by one conventional deflection system and the distance from the center of deflection to the fluorescent screen is properly related to the distance from the parallax grid to the screen,

Fig. 1: (Left) Three gun color cathode ray tube employing a parallax grid consisting of bars parallel with fluorescent bands

Fig. 2: (Right) Diagram showing the similar triangles that are set up by three beams passing through a gap in the parallax grid



# Tri-Color Cathode Ray Tube

## *Operating principles and design notes for a tube based on the parallax grid structure*

to the width of the fluorescent bands and to the openings in the grid. The geometrical principle on which the parallax effect is based is illustrated in Fig. 2.

A simple theorem of ray sections cut out by parallel lines describes these principles. Proof and all the necessary formula can be derived from the relationship of similar triangles. Let w denote the width $O_1O_2$ of the gaps in the mask and consequently, 2w the width of the bars. Let "a" signify the distance between the center of deflection of each ray $P_1,P_2,P_3$ as measured in a plane parallel to the mask. If straight lines are drawn from $P_1,P_2$ and $P_3$ through points $O_1,O_2$, sections $Q_1Q_2$, $Q_2Q_3$ and $Q_3Q_4$ will be cut out ont line parallel to the mask and at the distance d from it. These sections will be the widths $p_1,p_2,p_3$ of the fluorescent bands. The distance between the fluorescent bands and the center of deflection will be called c.

It has to be shown that $p_1,p_2,p_3$ are equal, that is, that the width p of the fluorescent band does not change with increasing deflection. From oblique triangles $Q_2Q_3P_2$, $O_1O_2P_2$ and from right triangles $P_2RQ_2$, $O_1SQ_2$ we can immediately see that:

$$p_2/w = (P_2Q_2)/(P_2O_1)$$
$$(P_2Q_2)/(P_2O_1) = c/(c-d)$$

From these:

$$p_2/w = c/(c-d)$$

As it can be found by the same reasoning that $p_1$, $p_3$ are also equal to the same quantity, we arrive at the general relationship.

$$P = wc/(c-d) \quad \text{.....1)}$$

From similar triangles $P_1P_2O_1$ and $O_1Q_3Q_4$ one can see that

$$a/p = (O_1P_2)/(O_1Q_2)$$

and from right angle triangles $P_2RQ_2$ and $O_1SQ_2$ that

$$(O_1P_2)/(Q_1Q_2) = (c-d)/d$$

From these it follows that

$$a = p(c-d)/d \quad \text{.....2)}$$

In order to insure that the three beams concurrently paint information relating to the same picture point, they must converge in the same point on the fluorescent screen and this can be most conveniently achieved by tilting the guns. The guns can be arranged in one line but it is preferred to position them in a delta arrangement, as disclosed by Kaplan. To avoid moire effects he arranges the fluorescent bands perpendicular to the direction of scanning but, of course, the scheme works independently of any angular relationship. The parallax grid can be placed at several discrete distances from the screen, which can be determined from the following equation:

$$d = \frac{n\,p\,c}{a + n\,p} \quad \text{.....3)}$$

where n is a small integral number not divisible by 3

The smallest distance d will be the preferred one.

This tube can operate with one gun instead of three if a sequential transmission system is used. It is only necessary to place the beams successively into positions which correspond to the positions shown for the individual beams of the three-gun arrangement.

To prove the feasibility of the scheme, a continuously pumped scaled-up model cathode-ray tube was built. Phosphor bands .020-in. wide were deposited on a flat glass plate and a metal mask was made from strip stock and placed in a frame at the proper distance from the screen. In this version the tube had 3 electrostatically focused guns as shown on Fig. 1. To accommodate these, the diameter of the neck had to be increased to 2 in. and a special deflection yoke used. In a second version, also built, the tube had one gun and was magnetically focused and deflected. To switch colors, a 2-coil magnetic shift assembly was used situated between the focusing and scanning coils. Two opposing magnetic fields were set up by these coils to maintain the same convergence angle above and below the axis of the tube. The color switching proved satisfactory in both cases. Experiments thus far indicate that most of the requirements for a successful color tube enumerated above can be fulfilled.

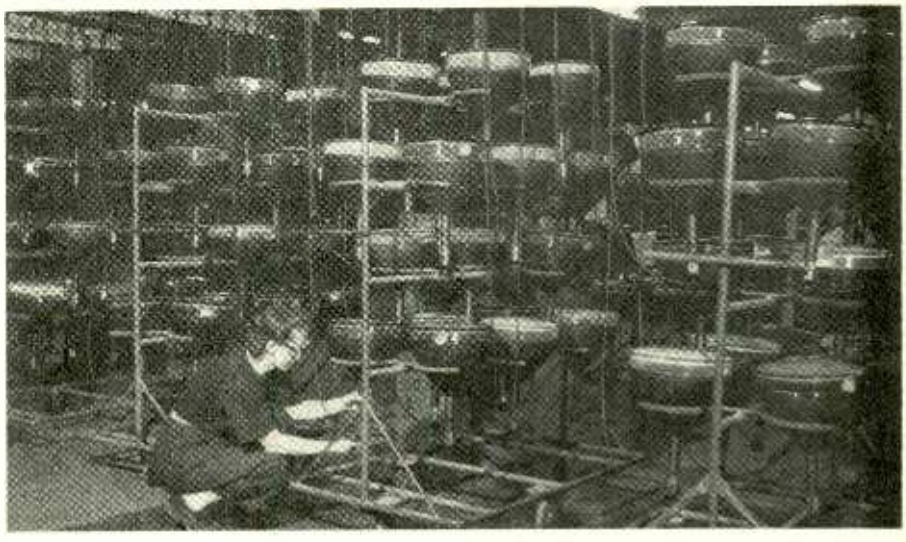
I am indebted to Sam H. Kaplan for permission to publish features of his 3-color tube.

### REFERENCES

1. Fernseh Aktiengesellschaft French Pat. #866,065, issued June 16, 1941. Convention date Germany, July 11, 1938.

2. **Tele-Tech,** June 1950 p. 30.

### SYLVANIA CONCENTRATES ON LARGER CR TUBES



**Aging racks in the Sylvania Electric plant at Ottawa, Ohio where hundreds of large screen picture tubes are seasoned daily. In the seasoning process the tubes remain on the racks for one hour while the heater voltage is varied in steps from 1½ to 12 volts at 15 to 20 minutes per step. The plant is now producing 16-in. and 19-in. tube sizes and will be prepared to meet demand for 24-in. tube sizes in the fall.**

# Noise Generators and

## *Discussion of noise factor measurements and the limiting sensitivities*

*By I. J. MELMAN, Chief of Advanced Development and Television Research Air King Products Co., Brooklyn 32, N. Y.*

*PART THREE OF THREE PARTS*

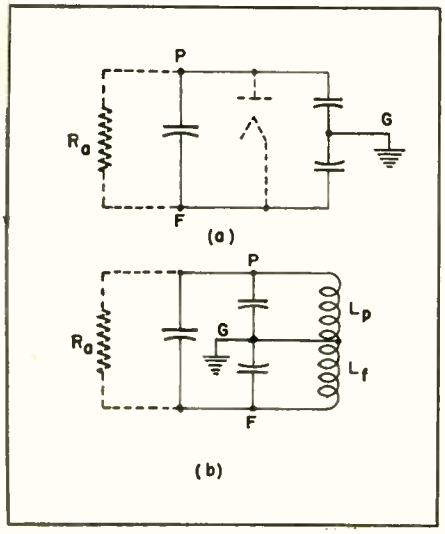
### Balanced Noise Generator

FIGS. 6 and 12 are a circuit diagram and a photograph of the balanced noise generator which incorporates a noise diode and power-supply chasis. Noise factor measurements in db are read directly on the meter scale which is calibrated in db (for 300 ohms) and in milliamperes. The noise-diode (Sylvanis 5722) output is wired to a bakelite wafer-type octal tube socket into which transmission lines of any value may be inserted, as illustrated in Figs. 6 and 9. Two views of the noise generator with the front panel removed are given in Figs. 13 and 14. The resonating coils observed in Fig. 14 are mounted on a standard three-gang bakelite 11-point rotary switch.

The noise-diode capacitances before installation of the resonating coils are shown in Fig. 15 a. $C_{pf}$ includes the plate-to-filament capacitance inherent in the tube, socket, and wiring. For frequencies at which the reactance of $C_{pf}$, for a given $R_a$, is not negligible, resonating coils must be used to maintain a resistive output.

Various arrangements may be used to resonate the shunting capacitance and also to obtain a balanced output. Fig. 15b is the equivalent circuit of the arrangement used in Fig. 6. When the plate-to-ground and the filament-to-ground capacitances are approximately equal, $L_f$ is approximately equal to $L_p$. In the circuit of Fig. 6 the filament coil $L_f$ is divided into two parallel compo-

Fig. 15: Noise diode output reactances



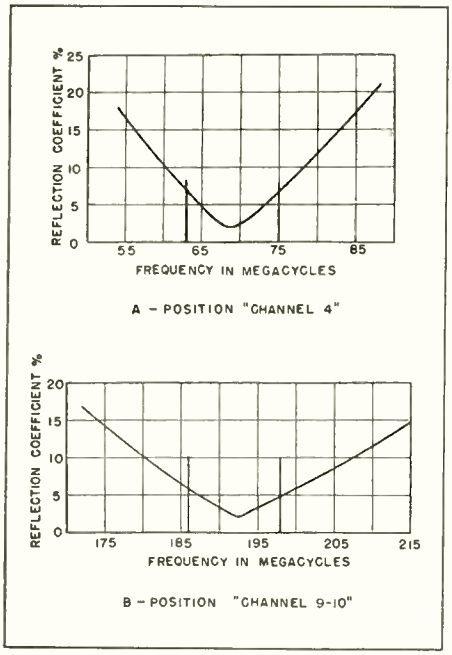




Fig. 16: Reflection coefficient of balanced noise generator for 300-ohm line

nents each of which has twice the inductance $L_f$. Since two switch wafers are used to obtain $L_f$, the capacitance $C_{fg}$ is greater than $C_{pg}$ and each of the coils on the filament wafers is therefore less than twice the inductance of its corresponding plate coil. The noise diode tube is mounted in a thin wafer-type bakelite socket chosen for its low capacitance. The grounding lug on the center post of the socket is removed.

The technique used for adjusting the coils is the "panoramic" or "long line" method[10] in which the reflection coefficient over the desired frequency range is observed on an oscilloscope. The 300-ohm transmission line is plugged into the noise generator, and the coils are adjusted so that minimum reflection occurs at the desired center frequency for each position of the band switch. Point A of Fig. 6 is alternately grounded and ungrounded and the effect on the pattern is noted. If the frequency of minimum reflection shifts, the plate and filament coils should be adjusted until there is no change in the pattern when point A is ungrounded.

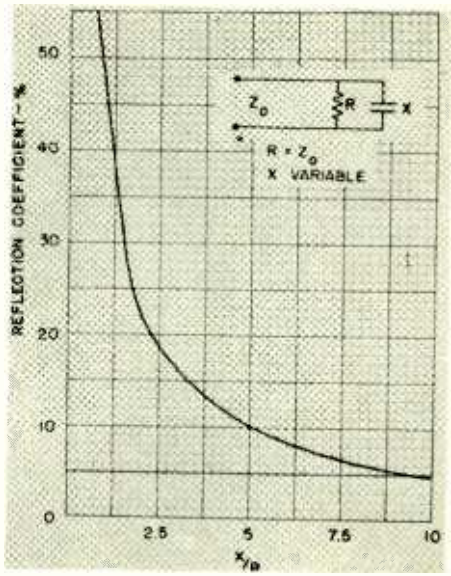



Fig. 17: Graph of reflection coefficients of shunt reactance across generator output

Other means of adjusting the coils may be employed if appropriate precautions are taken. Should a grid dip meter or other resonant indicating instrument be used, the capacitances of the terminating resistors, which are removed for the measurment, must be included. The approximate coil data for the physical configuration shown in Fig. 14 are given in Table I. The coil data are given only for the television and FM frequencies. For frequencies below 50 MC self-resonant chokes may be placed on each of the switch wafers.

The four 75-ohm resistors placed at the output terminals add only one-fourth the capacity of a single resistor, and also make possible the

# Measuring Technics

## of receivers for TV, FM, and communication service

use of a center tap for unbalanced lines as shown in Fig. 9. At 200 MC molded carbon resistors have been satisfactory in these relatively low values. The thin bakelite output socket has the lowest capacity of the several terminations which were tried and lends itself conveniently to plug-in units and pads. Fig. 9 illustrates the connections for a 100-ohm balanced line and for a 75-ohm coaxial line. Two 150-ohm resistors may be used in the output circuit if arrangements other than those shown in Fig 11 are desired.

### Impedance Matching at Generator

When the television tuner does not match the transmission line for which it was intended, the noise generator must present a very good match to the line over the desired frequency range. The greater the range of mismatch encountered at the receiver the greater the care that must be exercised in the design of the noise generator.

The reflection coefficient versus frequency for a 300-ohm line terminated by the noise generator is plotted (solid lines) in Fig. 16 for positions "Channel 4" and "Channels 9-10" of the selector switch. Fig. 17 is a plot of the calculated reflection coefficient versus the ratio (X)/(R) of the shunt reactance to load resistance which terminates the transmission line. The resistance R is constant and is equal to the characteristic impedance of the line, $Z_o$ With the aid of Fig. 17 the shunt reactance across the generator output, at any frequency, can

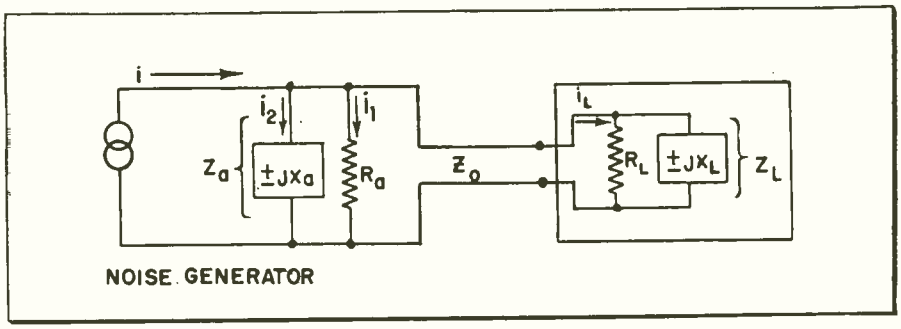



Fig. 18: Equivalent circuit, transmission line between noise generator and receiver

be determined from the reflection coefficient. As an example, in Fig. 16a, the minimum reflection is 2% at 69 MC. However, at 88 MC the reflection coefficient is 21%. From Fig. 17, a reflection coefficient of 21% corresponds to X/R = 2, or for a 300-ohm line X = 600 ohms. This method can also be used to check the plate-to-filament capacity of the diode, as well as other circuit capacities.

For a receiver that is well-matched to a 300-ohm transmission line, a reactance of 600 ohms across the noise generator termination of 300 ohms will give an error of 6% (0.25db) in the noise factor reading. This error will generally increase when the receiver input is not matched.

When a transmission line is used between the noise generator and the receiver, (Fig. 18) the possible error is greater with increasing mismatch at the receiver and the error will vary with line length. For the condition of 600 ohms reactance across the 300-ohm generator resistance, as the mismatch at the receiver becomes very severe the error may (depending on line length) increase from 6% to as high as 64% (2.2db). A spread of 4.4 db in the noise factor reading may be obtained as the line length is varied in this case of severe mismatch at the receiver.

When the generator is perfectly matched to the transmission line, then no matter how bad the match at the receiver, the potential at the receiver input terminals is independent of line length for the short lengths used, where the attenuation is negligible. When the generator impedance does not match the transmission line impedance, the error in noise factor reading is expressed by Eq. (8a):[11]

$$m = \left| \frac{(Z_o + Z_L)(Z_a + Z_o) + (Z_o - Z_L)(Z_a - Z_o)\, e^{-2jBl}}{2Z_a (Z_o + Z_L)} \right|^2 - 1 \quad \ldots\ldots (8a)$$

$Z_o$=line impedance; $Z_a$=generator impedance; $Z_L$ = receiver or load impedance; $l$ = transmission line length; B=transmission line phase shift constant (the attenuation $\alpha$ is assumed negligible).

In terms of the reflection coefficient at the receiver $k_l$, and at the generator, $k_a$, m may be calculated from Eq. (8b):

$$m = \left| (1 - k_L k_a e^{-2jBl}) \frac{(Z_a + Z_o)}{(2Z_a)} \right|^2 - 1 \quad \ldots (8b)$$

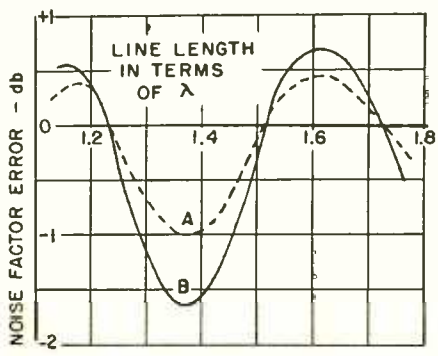
The maximum errors with a variation in line length are:

$$m = \left| (1 - |k_L k_a|) \frac{(Z_a + Z_o)}{(2Z_a)} \right|^2 - 1 \quad \ldots\ldots (8c)$$

$$m = \left| (1 + |k_L k_a|) \frac{(Z_a + Z_o)}{(2Z_a)} \right|^2 - 1 \quad \ldots\ldots (8d)$$

Eq. (8b) is illustrated by Fig. 19 which is a plot of the noise factor error in db versus transmission line length when mismatch is present at the generator and at the receiver. The receiver in this case was a commercial receiver designed for 300-ohm transmission line. The line length axis includes 18 inches of line between the receiver input terminals and the tuner input. The reflection coefficient at the receiver input was 43% on Channel 13 at which these measurements were taken. Curve A was obtained with the generator selector switch on position "9-10"—Curve B was obtained with the switch on position

Fig. 19: Plot of noise factor error in db vs. transmission line length when mismatch is present at the receiver and the generator



"7-8". With the generator switch on position "13" no variation in reading was obtained as the line length was varied.

To eliminate the above sources of error in noise factor measurement the noise generator output circuit covers only two television channels for each switch position. The generator shunt reactance within this narrow frequency range is sufficiently high to have negligible effect on the noise factor readings. From Figs. 16 and 17 the reactance at the limits of a 12-MC bandwidth is calculated to be approximately 2400 ohms. On either of the two channels within this 12 MC bandwidth, the maximum error from this source is less than 0.35 db, for any length of transmission line and for complete mismatch at the receiver. (Assuming negligible transmission-line loss).

Should only two switch positions be used for the 300-ohm output; one for Channels 2-6 and the other for Channels 7-13 the error for the outer channels (i.e. channels 2 and 6, 7 and 13) could be between 0.25 db and 2.2 db, depending on line length and receiver mismatch.

The "300-ohm" lines in use today vary in impedance from 270 ohms to 330 ohms, but the average is about 290 ohms.

A difference of 5% between the line impedance and the generator impedance (assuming no reactance component across the generator) may produce an error between 0 and 10% (0.4 db) depending on line length and mismatch at the receiver.

## Meter Calibration

The db readings for a 300-ohm input which were drawn on the meter face adjacent to the regular milliampere scale are shown in Table II. Because of the crowding of the db scale at the low end when a linear d-c meter is used, the scale is only marked down to 10 db. For readings approaching 10 db the meter is switched to the 0-3 ma scale and the noise factor is obtained by subtracting 10 db from the db scale reading.

When a 75-ohm line is used the noise factor is obtained by subtracting 6 db from the db scale reading.

## Power Supply

The power supply gives the maximum plate potential for the noise factor readings, consistent with the maximum tube ratings. Since the noise diode is being operated under temperature-limited conditions, the d-c anode supply voltage need not be well regulated or particularly well filtered. The variation of the plate supply potential with the diode current results in economy of design and possibly a slight improvement in accuracy. A family of curves obtained from a 5722 tube is given in Fig. 20. The parameters for 5 watts and 3.5 watts plate dissipation are drawn across these curves. The operating plate potential versus plate current curve of the noise generator is also given in Fig. 20.

The diode plate current is sensitive to small changes in filament current and care should be exercised to keep the rheostat and other filament circuit contacts clean. For certain applications where very fine settings of the diode current are desired, a second rheostat of lower value gives a vernier setting.

If the diode filament is being operated with a.c. from the power line, line-voltage fluctuations will produce erratic changes in the anode current making it difficult to obtain accurate measurement. In such locations it may be desirable to regu-

(Continued on page 61)

TABLE II

Db scale for 300 ohm input ($F_{db}=10 \log 20\ IR_a$)

| $F_{db}$ | $F_{power\ ratio}$ | $I_d$ (ma) |
|---|---|---|
| 10 | 10 | 1.67 |
| 11 | 12.59 | 2.10 |
| 12 | 15.85 | 2.64 |
| 13 | 19.95 | 3.32 |
| 14 | 25.12 | 4.18 |
| 15 | 31.62 | 5.27 |
| 16 | 39.81 | 6.64 |
| 17 | 50.12 | 8.35 |
| 18 | 63.10 | 10.5 |
| 19 | 19.43 | 13.2 |
| 20 | 100 | 16.7 |
| 21 | 125.9 | 21.0 |
| 22 | 158.5 | 26.4 |

TABLE III

| Frequency Range | No. Turns of Tuning Coil |
|---|---|
| 0.5 to 100 MC | no coil |
| 120 to 160 MC | 5 turns ⅞", ¼" coil form |
| 174 to 216 MC | 2" long, no. 16 wire |
| 210 to 250 MC | 1½" long wire braid |

TABLE IV

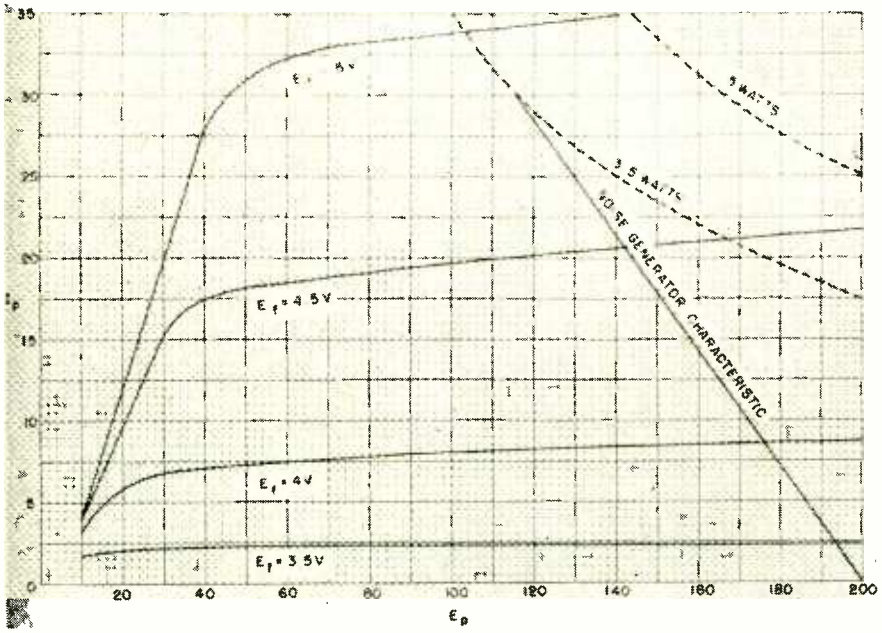
Noise Factor Measurements of a Popular TV Receiver

| Channel | Noise Factor | Reflection Coefficient of Input Circuit |
|---|---|---|
| 2 | 11.0 db | 22% |
| 3 | 10.5 " | 14 |
| 4 | 10.6 " | 11 |
| 5 | 11.2 " | 17 |
| 6 | 11.4 " | 19 |
| 7 | 16.2 " | 46 |
| 8 | 16.2 " | 50 |
| 9 | 16.5 " | 48 |
| 10 | 16.0 " | 45 |
| 11 | 16.2 " | 49 |
| 12 | 16.0 " | 41 |
| 13 | 15.9 " | 43 |

TABLE V

| F-db | $E_a$—microvolts ($R_a$=300 ohms) Commun. Receiver Bandwidth 10 KC | Television Receiver Bandwidth 3 MC | Television Receiver Bandwidth 4 MC |
|---|---|---|---|
| 3 | 3.2 | 107 | 124 |
| 6 | 4.3 | 152 | 175 |
| 9 | 6.2 | 216 | 248 |
| 12 | 8.7 | 304 | 350 |
| 15 | 12.3 | 430 | 495 |
| 18 | 17.5 | 608 | 701 |
| 21 | 24.6 | 852 | 984 |

Fig. 20: Characteristics of a 5722 tube and the $I_p$ $E_p$ curve of noise generator



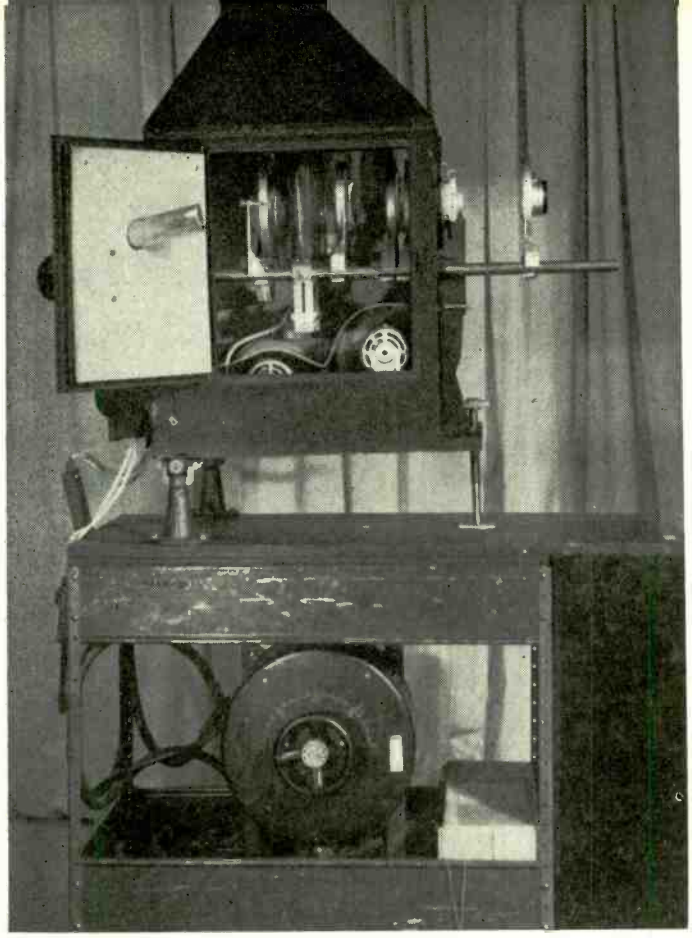


Fig. 1: Original Bodde P-55 slide projector used a 5 kw lamp and 6-in. f 3.5 projection lens. Later a 4.8 in. lens was used

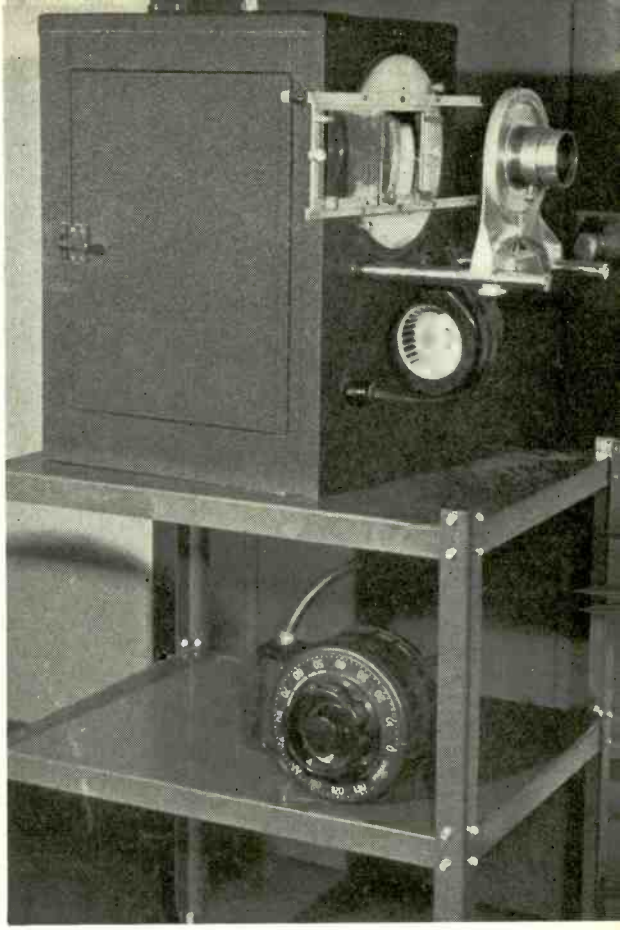


Fig. 2: Latest Bodde slide projector using a 2 kw lamp. Overvolting lamp at 150 volts obtains 100 foot-candles

# Process Screen Projection

PART ONE OF TWO PARTS

## *Motion picture technics developed for television production*

*By R. A. LYNN and E. P. BERTERO*
*Staff Engineer — Development Engineer*
*National Broadcasting Co., 30 Rockefeller Plaza, New York City*

ONE of the TV problems on which attention is now focussed, is that pertaining to background scenic effects. Proper scenery is necessary to afford satisfactory eye appeal in any studio show. To expedite matters, television adopted the method of creating scenic effects in the manner established by the legitimate stage. This consisted of covering the entire space behind the stage setting with such items as paintings, photomurals, drapes or built up wooden props.

Use of this type of background scenery presents certain objections. Its creation requires time. It is not flexible from the standpoint of handling or storing. An investment of from $200 to $400 is required for a photomural.

Some of these objections would be less important if the background material could be re-used a sufficient number of times to spread the investment over a number of shows. In the case of the legitimate theater this can be done. In television, however, the background material has to be expended to avoid monotonous repetition. There are times, however, when scenes which are re-used create a storage problem during the time they are held over.

Background projection, the system whereby a scene, either movie or still, is projected onto a translucent screen, appeared to offer a solution. The cameras and audience are located on the side of the screen opposite to the projector. The actors and supporting foreground material are located between the camera and translucent screen.

Certain minimum requirements must be met for satisfactory background projection. First, sufficient projected illumination must appear on the screen. It must be realized that the live actors in front of the screen will be illuminated by foreground lighting. It is inevitable that some of this lighting will spill over onto the projection screen and tend to reduce the contrast between highlights and shadows of the projected scenic effect. We have determined that at least 2000 lumens are necessary to meet all ordinary requirements. This 2000 lumens is equivalent to approximately 20 foot candles of illumination falling upon a 9 x 12 screen. Less light is available when a photographic slide is inserted — the denser the slide, the less the light. It must also be realized that although the projection screen is translucent considerable light is absorbed by it. Present white screens have a transmission of approximately 70 per cent. This means that the actual light available for pickup by the television camera sometimes runs as low as 5 foot candles.

Engineers experienced in the field

of motion picture photography may consider that the amount of light available is so low as to be useless. However, the system works, although care must be exercised to avoid excessive amounts of spill light. The resulting picture sometimes appears to the studio audience to be washed out to the point of being almost indistinguishable. This is especially true to the audience located off to the side of the screen. Nevertheless, the television camera, located approximately on a direct line through the screen to the projector, picks up a usable picture. It should be remembered, also, that successful operation under conditions of low light levels is credited to the sensitivity of the 5820 image orthicon camera tube, which is used in NBC.

Another requirement for the system is that the throw distance should be maintained as short as possible. To achieve a short throw distance a short focal length lens must be used. Unless carefully designed, the shorter focal length lenses are inclined to give poor resolution in the corners of the picture. Satisfactory results were obtained from a lens of 4.8 inch focal length and with a speed of f 3.5. This requires a throw distance of 18 feet 10 inches when using the standard 3¼ x 4 in. theater slide masked to 2¼ x 3 in. Unmasked slides (i.e., 3 x 3¾ in.) give a 3 ft. 10 in. reduction in throw distance.

This projector shown in Fig. 1 is a Bodde type P-55 using a 5 kw type T incandescent lamp. The optical-condenser system consists of a reflector, meniscus lens, two plano-convex lenses and a heat absorbing filter. A projection lens of FL 6 in. f 3.5 was supplied with the unit. Resolution and speed were satisfactory; however, to shorten the throw distance an FL 4.8 inches lens was used.

## Cooling the Lamp Housing

The heat generated by the 5 kw is intense. Of the two blowers located within the lamp housing one directs the air around the lamp bulb and thence up the stack, the other cools the heat filter, condensers and slide. Heat shields are installed above the blower motors to protect them from direct radiation from the lamp bulb. A third blower located outside of the housing cools the lamp bulb to prevent blistering the envelope.

With a new lamp and with careful adjustments of the condenser lens system it is possible to obtain approximately 5000 lumens, (this is 47 footcandles on the 9 x 12 ft. screen). At least 2000 lumens are required. Thus a new lamp gives a good margin of safety. Blackening of the bulb causes the illumination to decrease and care must be exercised to see that it does not remain in service beyond the point of minimum light requirements.

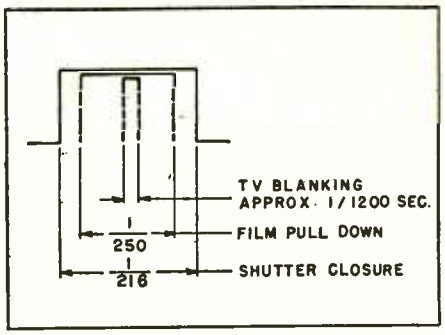


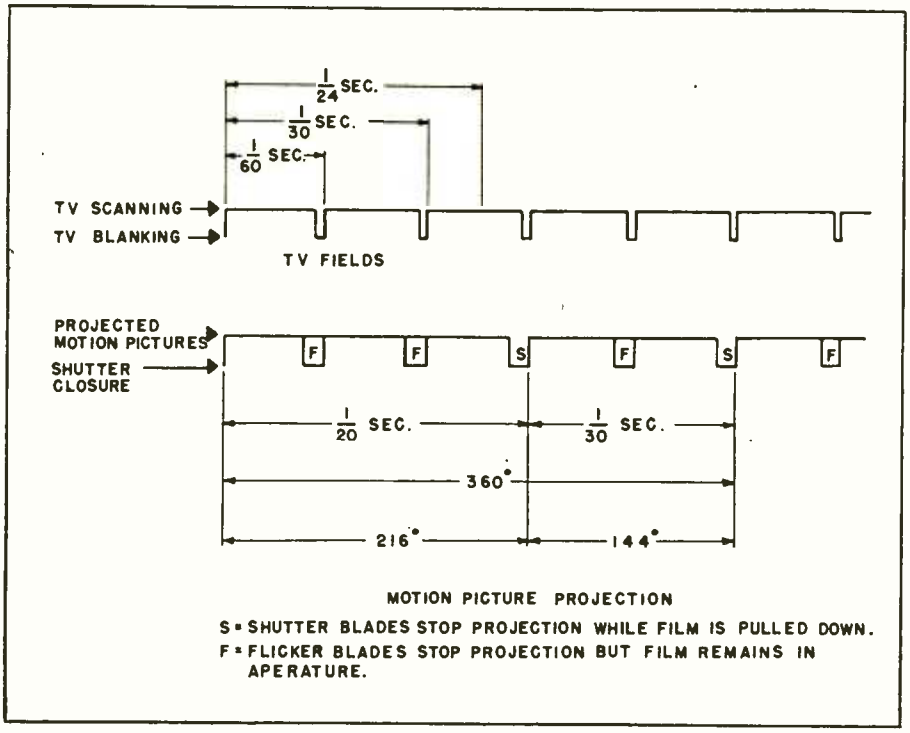

Fig. 3. Typical TV film pulldown sequence

The life of the lamp bulb, based on "burn-out", is rated at 75 hours, however the lamps are generally relegated to preliminary rehearsal purposes at the end of 35 hours to avoid possible burn-outs while on the air.

More recently a Bodde projector utilizing a 2 kw bulb was obtained and is shown in Fig. 2. To obtain greater light the bulb is operated at 150 volts instead of its rated 115 volts. Both the light and the heat outputs are very intense at this over-voltage. 100 foot candles of light are incident on the 9 x 12 ft. screen. This is equivalent to approximately 11,000 lumens. The 4 x 5 in. slides are of single thickness. Although strains due to uneven heating are thus reduced, a new hazard — that of scratching the emulsion during handling—is introduced. Compared to the 3¼ x 4 in. slide, however, less magnification is required to enlarge them to fill the 9 x 12 ft. screen. This requires a shorter projection distance. However, greater demands are placed on the projection lens in that it must have a greater covering power to avoid deterioration of resolution in the corners of the picture.

Heat absorbing glass is not used, this avoids a 30 per cent loss of light. However, this additional heat must be dissipated by some means. The fact that the slide is only single thickness and that there is a strong air blast directed on it is expected to prevent cracking.

Fig. 4. Time relationships involved in rapid pulldown and scanning in Holmes high speed projector. The operation of shutter of fig. 5 is apparent from this diagram




## Optical Background Projection of Motion Pictures

The use of optically projected stills was very successful for many NBC productions. However, productions could be greatly enhanced if the background scenery were animated. Rear projection of motion pictures is by no means new, the film industry having used this type

of effect for many years. However, the system employed by the moviemakers must be modified before it can be used in the television industry because of problems peculiar only to television. Besides the usual considerations of limited studio space, ease and quietness of operation in a live television studio, and portability of equipment, motion picture rear projection introduces other problems.

The first decisions pertained to the film size. The motion picture industry uses 35mm film to advantage since their studios were built to accommodate this system. An investigation of the rules and regulations pertaining to the use of 35mm film in a New York City studio shows many problems, such as fireproof rooms, vents to the outside atmosphere, flameproof lamp enclosures, restrictions on the quantity and storage of film, restrictions on an audience, etc., which make it almost impossible to introduce this system into existing studios. By contrast, 16mm film which is made only on a safety base is not burdened with the restrictions imposed on the former.

### 24 vs. 30 Frames

Another problem arose due to the fact that motion pictures are based on a 24 frame per second system, while television is based on 30 frames per second. Some experiments were conducted with 30 frames per second motion pictures. Although it would be possible to use such a system, it imposed the necessity of creating a library of films photographed at the non-standard rate of 30 frames per second. This non-standard film would be restricted to use to background projection. The alternative of using regular 24 frame material speeded up to 30 frames per second on projection was discarded since this would speed up all action by a factor of 5/4. It was therefore decided to concentrate efforts on obtaining a unit with an intermittent with a 3-2 ratio. This means that a motion picture frame is pulled into the aperture and remains there for 1/20 second. During this time the television beam scans 3 complete fields. The projector shutter then closes, pulldown is applied very rapidly, and the next motion picture frame remains in the aperture for 1/30 of a second while the television scanning beam scans two fields. The cycle is then repeated. It will be noted that the average speed of the motion picture film is 24 frames per second although individual successive frames have rates of 30 per second and 20 per second.

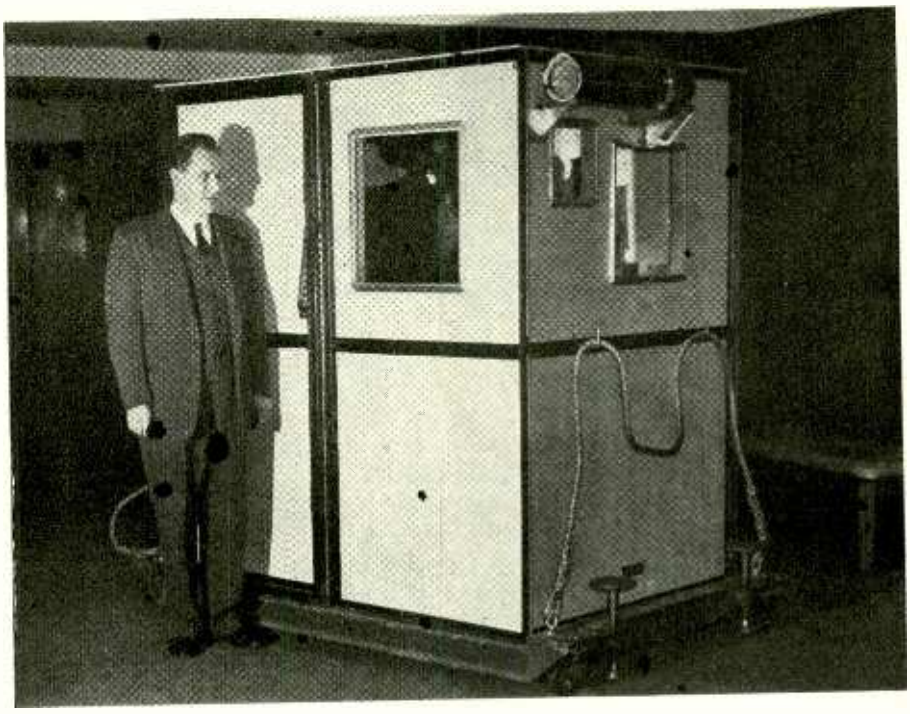


Fig. 5. Complete booth with exhaust and ventilating system, and water filter for arclamp exhaust. Projection can be either via front or side windows depending on throw

The principle of the 3-2 system has already been utilized by the television industry for televising film with an associated iconoscope pickup tube. In this case projection takes place during blanking of the television signal, the sensitive surface of the iconoscope storing the image until it is scanned off by the scanning beam. During the scanning process the motion picture projector shutter is closed and a new motion picture frame pulled into position. Thus a relatively long time is available for film pulldown.

*Part Two will appear in the August issue.*

# FCC Chairman Coy Promotes FM to RMA

Addressing the Radio-TV Manufacturers Association at Chicago, June 8, Hon. Wayne Coy, Chairman FCC spoke as follows:

"FM's superiority over AM is as unchallenged as ever — freedom from static, noise and fading; with day and night operation and high fidelity and with many more high power stations of uniform range so that competition must be on the basis not of power but of programming.

"With FM we can give American communities more local stations to serve their local needs; and stations that will reach far, far beyond their present AM stations with a clear, loud signal and with stations that aren't blacked out a sunset.

"It is a startling but true fact that a Class B FM station can cover from 300 to 500 times the area now served by many local channel AM stations at night.

### FM's Difficulties

"FM has had a rough time.

"Only a handful of broadcasters are showing a profit or are near a profit status. They complain that networks treat FM as a stepchild; that they refuse to affiliate with FM stations even though FM stations provide additional coverage, particularly at night; that networks have never provided proper, high-fidelity inter-city network lines. And they complain that manufacturers have not produced easy-to-tune, stable and cheap FM receivers; that manufacturers are so preoccupied with television that there is a substantial unmet demand for FM receivers in many communities.

"The FM members of the National Association of Broadcasters have asked manufacturers to install FM tuners in all television sets. The circuitry of FM is such that it can be added to the TV set at comparatively small cost. In TV sets that have continuous tuning the cost would be negligible.

"This would mean that FM set production could ride TV piggy-bank up the ladder of success. Every television market would, therefore, automatically become an FM market. At this stage of television's development when daytime service is limited, such an arrangement would make it convenient for the set owner to snap on the FM when television is not on the air. Whenever a manufacturer sells a TV-only set as the principal receiver in the home he is slamming a door on aural radio."

# WASHINGTON
## News Letter

**Latest Radio and Communications News Developments Summarized by TELE-TECH's Washington Bureau**

**FCC APPROVAL LIKELY FOR BROAD BAND**—The Bell Telephone Laboratories' proposal for the allocation of 470-500 MC for broad band mobile telephony was presented in convincing style by a quartet of top A.T. & T. and Bell Laboratories officials, spearheaded by Bell Laboratories President Oliver E. Buckley, to the FCC in mid-June and there were rather definite indications that the Commission may approve such a system and assignment of spectrum space because of the scarcity of mobile radio frequencies in present 30-44 and 152-162 MC bands. The Bell Laboratories through the "father" of the Broad Band system plan, Transmission Engineering Director George W. Gilman, together with the backing of A.T. & T. Radio Engineer Francis M. Ryan, brought out how the projected 100-multichannel system would greatly conserve frequencies and would provide better service to the mobile telephone users. Dr. Buckley, one of the nation's noted communications-radio scientists, endorsed the plan without equivocation because advance experimentation and tests (some 40,000 measurements) by his Laboratories staff had been entirely convincing that this space was the best for Broad Band mobile telephony. The four Commissioners also demonstrated that they were cognizant of the needs for additional frequency space for mobile radio, even though fast-growing but still rather in the "basement" of development and usage.

**TELEVISION FIGHTS BROAD BAND**—Television feels with the phenomenal growth of video popularity that it has a right to the 30 MC which the telephone companies want for their broad-band mobile telephone system, and is putting up a stiff contest. The attack which may be its strongest during the September gen eral TV allocations hearings has brought out that television has a prospect of 10 million sets by the end of this year with a 50 million audience potential compared with a few hundred thousand mobile telephone users and that there is a danger of serious interference to TV transmitters and receivers in the No. 1 UHF band. DuMont Laboratories Research Director Thomas Goldsmith, ABC TV Vice President Frank Marx, and Philco TV Chief Engineer Bingley have informed the Commission how badly adequate frequency space for television is required, especially in the densely populated Eastern Seaboard and Middle West.

**INDUSTRIAL PREPAREDNESS PLANS STEP UP**—Substantial increase in the Munitions Board and Armed Services Industrial Preparedness procurement programs to medium-sized and small radio-electronic manufacturing companies has been projected for the present governmental fiscal year which began July 1. Under this plan, of course, manufacturing companies are given rather large-sized procurement orders by the Army Signal Corps, Navy BuShips Electronics Division and the Air Force Material Command so that the companies can establish prototype engineering plans and staffs and assembly lines of production which would be swung into full force in event of a war emergency. The subject of stepping up the Industrial Preparedness program and contracts is to be an important topic of discussion at the next meeting of the Electronics Equipment Industry Advisory Committee to the Munitions Board and National Security Resources Board which may be called to assemble with some 29 leading end-equipment and component manufacturer members during mid-July.

**STERLING RENAMING TO FCC EXCELLENT**—Recognition of the radio engineering profession, fortunately for the FCC and the radio industry, was given by President Truman in his reappointment for another seven-year term of Commissioner George E. Sterling, amateur since 1908 and veteran of government radio service since 1923. He has been a Fellow of the IRE for many years and is author of one of the nation's outstanding radio textbooks, *The Radio Manual,* now in its fourth edition. By the time of the publication of TELE-TECH, Commissioner Sterling will have certainly been confirmed by the Senate. In every field of radio, broadcasting, television, communications, and mobile, the Commissioner has had a comprehensive background so that the President correctly rewarded in his renaming of the FCC member an expert and meritorious public official.

**DISASTER COMMUNICATIONS SYSTEM**—The National Security Resources Board is completing its Civil Defense program for the nation in which radio—broadcasting, television, mobile—will be key elements of communicating with the public in the case of atomic bombing or guided missiles attacks. The final blueprint may not be announced publicly until late summer or September. Meanwhile, the radio services and engineers of the country—amateurs, broadcasters, police and fire radio services, telephone companies, aviation radio organizations, etc.—have commenced under the auspices of the FCC the planning of a "Disaster Radiocommunications Service" throughout the nation. The plan was initiated by one of the two FCC engineer-Commissioners, E. M. Webster. It is known that this blueprint will be the main concept of the uses and value of radio in Civil Defense.

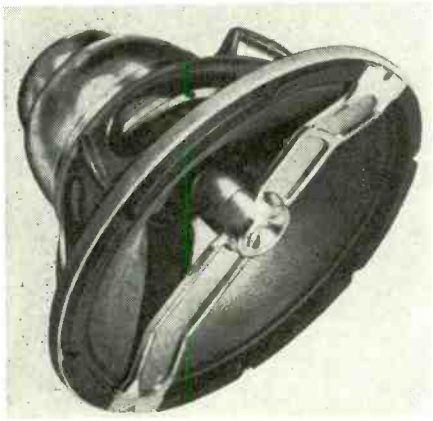
*National Press Building*
*Washington, D. C.*

*ROLAND C. DAVIES*
*Washington Editor*

# NEW EQUIPMENT for Designers and Engineers

### Loudspeaker

A new loudspeaker which spans the full frequency range of the ear consists of three distinct and separate loudspeaker units com-



bined in a single assembly no larger than a conventional 15-in. speaker. Known as the "Triaxial", the unit has a frequency response which extends to 18 KC with exceptional uniformity. An electrical crossover and control network, built into a separate chassis, divides the input into three bands of frequencies which are fed to the individual speakers.—**Jensen Manufacturing Co., 6601 South Laramie Ave., Chicago, Ill.**—TELE-TECH

### Audio Amplifier

Two new adaptations of the all-triode audio amplifiers (designed by Consumer's Research of Washington N. J.), CR-10-P and the CR-10-Q incorporate Peerless transformers. Prices are slightly higher than the original CR-10. The CR-10-P uses Peerless transformers throughout, including a Peerless output transformer of special design for this amplifier. The CR-10-Q has the Peerless S-240-Q output transformer with a frenquency response of ±1 db from 20 cps to 20 KC. There is less than 2% harmonic distortion at low output. Full power is delivered within 1 db from 40 to 10 KC. Output impedance is available for any load from 2 to 16 ohms.—**Sun Radio & Electronics Co., 122-124 Duane St., New York, N. Y.**—TELE-TECH

### Electrostatic Voltmeters

Operating on the attraction or repulsion between two electrical surfaces, a new electrostatic voltmeter can be used to measure high

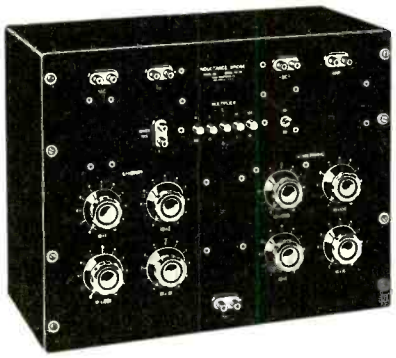
voltage outputs where no current can be drawn. Available in portable and panel types, it will measure static voltages, check the charge of capacitors, the potential of cathode ray tubes, and the operation of TV and radar circuits. The mirrored scale is 5 in. long with hand-drawn divisions. Accuracy is claimed to be 1% of full scale value. The portable type illustrated is furnished in single range; full scale from 120 v. to 12,000 v. and multi-ranges from 120/240 to 1000/3000/7500 v.—**Cole Instrument Co., 1320 South Grand Ave., Los Angeles 15, Calif.**—TELE-TECH

### Low Loss Capacitor

A line of vitreous enamel capacitors are being manufactured by laminating a low loss ceramic dielectric and metallic silver, then firing the structure to create a monolithic block containing the component. Ratings range from .68 μμf to 1000 μμf at 500 v. dc. The continuous nature of the rigid body imparts unusually stable temperature characteristics to the capacitors, and the materials insure losses equivalent to silver-mica at all frequencies. External connections are made to silver teminals with high temperature solders in order that the capacitors may be used at temperatures from —55° C to 200° C.—**Vitramon, Inc., Stepney, Conn.**—TELE-TECH

### Inductance Bridge

A new incremental inductance bridge (No. 1110) has been developed for testing communication and television components under



load conditions. It has an impedance range of 1 millihenry to 1000 henries in five scales. The inductance values are read directly from a four dial decade and multiplier switch. Range of this instrument can be extended to 10,000 henries through the use of an external resistance. Inductance accuracy is within ±1% through the frequency range from 60 to 1000 cps. For the largest multiplier at 1000 cps, the accuracy of the bridge is decreased to 2%.—**Freed Transformer Co., 1718-36 Weirfield St., Brooklyn 27, N. Y.**—TELE-TECH

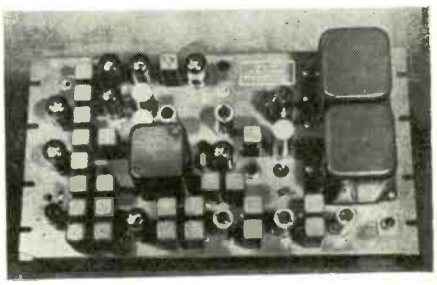
### Communications Recorder

Known as the "Audiolog", a new recording unit has been especially designed for logging and monitoring radio and phone communica-

tions. An hour of speech or code communications can be recorded on a thin, flexible, reusable sleeve of magnetic material, thus eliminating the usual spooling or reeling. The flexible sleeves can be telescoped so that a 24-hour log can be filed as a compact unit. The re-usable sleeves do not deteriorate with repeated playbacks, and tests indicate they will retain the recording indefinitely. Separate recording and playback heads move longitudinally across the drum holding the recording sleeve, and are so arranged that any recorded portion may be played back while recording is in progress. Recording and playback heads are equipped with inexpensive polepieces, which can be quickly replaced like phonograph needles when worn.—**Audiolog Corp., 440 Peralta Ave., San Leandro, Calif.**—TELE-TECH

### FM Relay Receiver

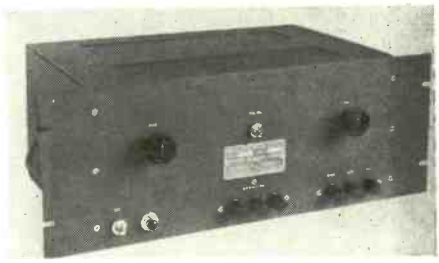
Model 772 FM relay receiver is a rack-mounted single-frequency crystal-controlled double i-f superheterodyne which has been



developed for the 88 to 108 MC band. Distortion between 50 cps and 15 KC is less than .5% and sensitivity noise factor is better than 6 db. Units with a frequency range from 40 to 216 MC are available on special order. Power consumption is 85 watts and primary power requirements are 115 v., 50/60 cps, single phase.—**Radio Engineering Laboratories, Inc., 35-54 36th St., Long Island City, N. Y.**—TELE-TECH

### Power Supply

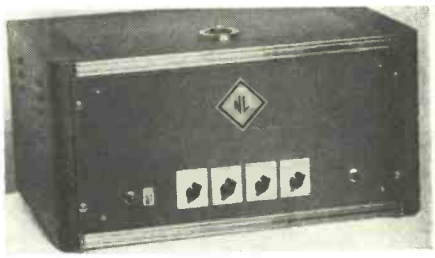
High and low voltage outputs can be obtained from the 205A regulated power supply. There are two high voltage outputs: 100-325



v. dc continuously variable without switching, 150 ma current; 0-150 v. dc continuously variable, 5 ma maximum current. Low voltage output is 6.3 v ac at 6 amps., center-tapped, unregulated. Regulation on the 100-235 v. output is within 1% from no load to any output voltage within rating. It is within 1% for line voltage variations from 105 to 125 v. at any output or load within ratings. The output of the 0-150 v section is regulated by a VR tube and is adjusted by a potentiometer of 25,000 ohms. The no load to full load regulation is within 1% at 150 v. and will depend upon the setting for all lower voltages.—**Electronic Measurements Co., Red Bank, New Jersey.**—TELE-TECH

### Frequency Standard

Model 105 frequency standard, complete with power supply, has a sine wave output (5 v. across 500 ohms) at 100, 10 and 1 KC,



and also at 100 cps. It has pulse outputs at the same frequencies. These pulses can be used as such or they can be used to generate harmonics in a radio receiver for frequency comparison. The 100-KC harmonics are good to over 100 MC, the 10-KC harmonics to approximately 30 MC and the 1 KC harmonics can be heard up to 2 MC. Frequency stability depends on the customer's requirements. The model 105 is one of a long line of units ranging from a 4½ x 4½ in. miniature to a 200-watt crystal controlled inverter.—**Ernst Norrman Laboratories, Williams Bay, Wis.**—TELE-TECH

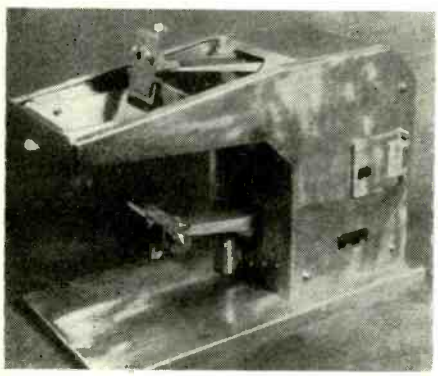
## *TV Waveform Monitor*

Model TO-1 television waveform monitor is a compact, portable instrument which has been developed for waveform analysis and

amplitude measurement of video signals in television circuits. It may also be used as a general purpose instrument in many applications because of its wide frequency response, high sensitivity, excellent synchronizing capability, precision calibrating circuits, and unusually large symmetrical horizontal expansion. Visual presentation is on a 5-in. CR tube.—**Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, N. Y.**—TELE-TECH

## *Screen Process Printer*

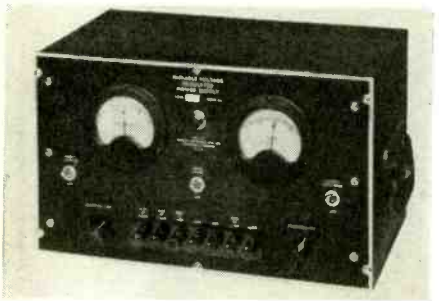
Model 20 screen process printer is a machine that automatically applies wiring and capacitors to cylinders up to 1¼ in. in dia-



meter. Screen sizes can be accommodated up to the dimensions of the 5 x 9 in. frame. Although the press is manually-operated by a single lever, all printing operations are automatic, including raising the work from load position to the screen, operation of the squeegee and movement of the screen coincident with the rotation of the work being printed. Massive aluminum-alloy, precision-type castings are used for the base and frame, combining lightness with strength and rigidity. All exposed parts are corrosion resistant.—**Mech-Tronic Equipment Co., P. O. Box 510, Silver Spring, Md.**—TELE-TECH

## *Regulated Power Supply*

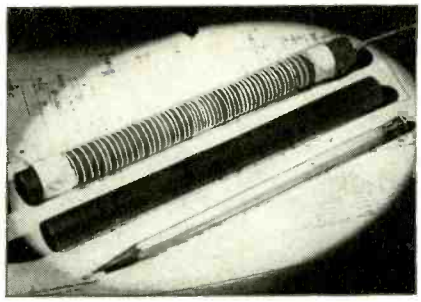
A flexible, continuously variable dc voltage output from 0 to 400 with 0.5% regulation at loads from 0 to 200 ma is provided by the



model A3 regulated power supply. Other outputs are: 400 v. dc unregulated, 0 to 150 v. dc variable and stabilized, and 6.3 v. ac at 5 amps. Output ripple voltage is less than 10 mv. Output impedance is less than 10 ohms dc, and less than 2 ohms from 20 cps to 50 KC. A 40 μf capacitor may be switched across the regulated output to accommodate large peak-current loads. Meters are provided to monitor the output voltages and current.—**Oregon Electronic Manufacturing Co., 206 S. W. Washington St., Portland 4, Ore.**—TELE-TECH

## *Metal-Core Antenna System*

Not much larger than a lead pencil, the "Croloy Radio Rod" coil serving as an antenna system not only improves reception but saves space in radio sets. Signal-to-noise ratio is greatly increased, thereby reducing objectionable man-made static or background noises. The Croloy rod or tube can be supplied in square rods and tubing, and also in fluted or serrated cross-sectional shapes for minimum contact with the wire winding. The material is manufactured in various lengths, and present cores average 7 to 8 in. long. With a single layer winding of insulated wire, the Croloy antenna assembly is used in place of the conventional outside antenna or the built-in loop. Signal pickup is considerably better than that of the usual air loop, or of the



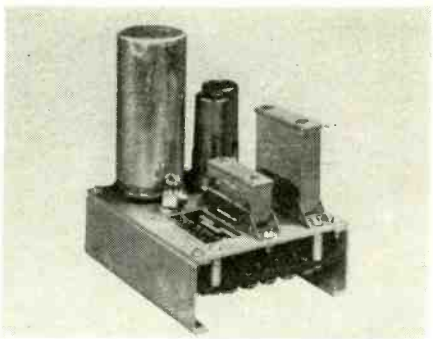
order of 2:1 at the low end of the broadcast band, and about equal at the high. Q's above 200 are easily obtainable with low cost solid wire.—**Henry L. Crowley & Co., Inc., 1 Central Ave., West Orange, N. J.**—TELE-TECH

## *Pneumatic Hand Tool*

New air-operated tool for crimping solderless terminals to wire combines the advantages of power press with the ease and flexibility of a hand tool. Detachable heads for the conventional side position crimping or "stub" (end) position crimping are provided. (A stub connection is used for positioned pigtail splices and requires end positioning of the tool when crimping.) A suspension loop is attached to the top of the tool to enable it to be supported from above, and a double set of handles and triggers provide unusual versatility of operation. When tool is supported the operator uses the side handle, but when it is being carried or lifted manually, the top handle and trigger are usually more convenient.—**Aircraft-Marine Products, Inc., 1616 North 4th St., Harrisburg, Pa.**—TELE-TECH

## *Frequency Standard*

Compact miniature construction of the 2001-2 frequency standard permits ready integration into basic equipment. JAN type



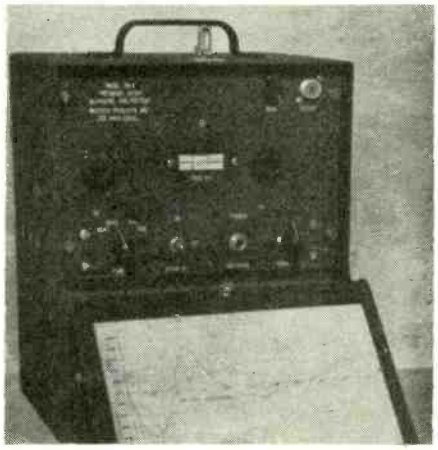
components facilitate operation under extreme conditions of temperature, humidity, vibration, etc., such as are encountered in military aircraft. Manufacturer claims it to be an accurate, stable source of any frequency between 200 and 1500cps. Dividers and multipliers are available for other frequencies. Temperature coefficient is better than 1 part per million C°. from 0 to 85° C. or better.—**American Time Products, Inc., 580 Fifth Ave., New York 19, N. Y.**—TELE-TECH

## *Tape & Film Degausser*

The Cinema No. 9205, for erasing sound and background noise from magnetic tape and films, has a powerful electro-magnetic field and degausses rolls up to 5400 ft. It includes large double inductors with individual fuses and heavy duty switch for use on table or bench. It weighs 33 lbs and is 12 x 14 x 3¾ in.—**Cinema Engineering Co., 1510 West Verdugo Ave., Burbank, Calif.**—TELE-TECH

## *Frequency Meter*

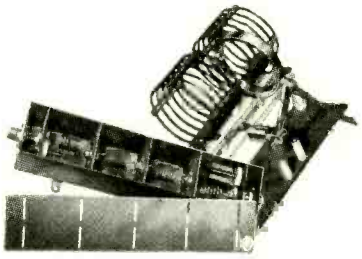
Frequency range of the FM-1 VHR frequency meter is from 20 to 480 MC. A special feature of the instrument is that it reads the



frequencies directly, without using a calibration book. It is guaranteed to be .005% within the temperature range of 32° to 120° F. Operation is from dry batteries (included within the carrying case) or from a regulated laboratory power supply. Provision is made to modulate the carrier at approximately 30% at 1 KC. Packed weight without batteries is 20 lbs.—**Gertsch Products, Inc., 11,846 Mississippi Ave., Los Angeles 25, Calif.**—TELE-TECH

## *TVI Filter-Link Combination*

A Faraday shielded link and a low pass filter are the components in a new combination designed to counteract television inter-



ference caused by amateur radio transmission. Completely shielded, the Faraday link reduces harmonic or spurious signal radiations normally transferred by capacity coupling. The low pass filter, consisting essentially of two "m" derived end sections and three midsections of constant K type in separate, completely-sealed, copper compartments, prevents inductive transfer of unwanted frequencies from section to section. RF bypass capacitors in the K sections have resonant frequencies higher than 500 MC, thus eliminating resonance within TV bands. This combination provides suppression of harmonics above 50 MC, approximately 75 db or more, throughout the entire television band. Insertion loss is less than .25 db.—**Barker & Williamson, Inc., 237 Fairfield Ave., Upper Darby, Pa.**—TELE-TECH.

## *Tube Cap Connector*

A grid cap, a lead and a shot of low-loss polyethylene have been combined to provide a tube cap with 100% insulation. The plated

clip is designed for a long path of tension, based on surrounding the tube grid with a round surface made to close tolerance. Corona effects are eliminated by the consistently rounded clip. Perfect strain relief on the lead is also provided and lead length can be tailored to customer's specifications. The type 90 ISL fits standard ¼ in. diameter tube top; 91 ISL fits standard glass receiver type tubes with 23/64 in. diameter top.—**Alden Products Co., 117 North Main St., Brockton 64, Mass.**—TELE-TECH

# A Masterpiece

## COMPLEX, EFFICIENT . . . KESTER SOLDER MAKES IT POSSIBLE

Good fast work can only be done with the best materials. Kester Plastic Rosin-Core Solder and the more active Kester "Resin-Five" Core Solder, made only from newly mined grade A Tin and Virgin Lead, are formulated especially for TV, radio, and electrical work. Kester Solders flow better . . . handle easier . . . faster to use. These two Solders, which are available in the usual single-core type, can now also be had in a 3-core form.

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KESTER SOLDER

# The Position of

In this July issue of TELE-TECH magazine, the FM coverage of the United States by the 700 stations now on the air is well portrayed. All the listener needs for static-free, high quality reception is a receiver capable of giving genuine FM performance.

A growing awareness of the existence of this service manifested itself during the year by the demand for high quality component parts—tuners of high sensitivity, audio amplifiers of considerable power output and loud speakers capable of effectively handling that power. Due to the neglect of this demand by most of the established broadcast set suppliers, it has been met by sources outside the regular trade channels. Substantial businesses have been built up in the last two years in this field and volume is increasing.*

The broadcast industry will, however, for a long time to come, find the backbone of its service in the table model. The reader's attention is directed to two excellent examples of well-engineered FM table models shown elsewhere in this issue. The standard of performance of these sets with their high sensitivity, selectivity, solid limiting and freedom from drift, at a price in the lower half of the $100 bracket, sets a mark for the industry to equal. I believe the problem of the genuine FM table model at a reasonable price is now behind us and that people in the areas covered in the

*For an illuminating article on the growth of custom radio enterprises, see the March, 1950, issue (P. 91) of Atlantic Monthly magazine—"They Shall Have Music". See also, the June, 1950 issue of FM-TV Magazine for a further report on the growing market for custom FM sets.

This message covering the present status of FM is published in response to a suggestion by the Publishers of TELE-TECH.

# FM — 1950

map will have static-free service at reasonable cost.

In fields allied to home broadcasting, FM moved ahead in the new storecasting and transit radio services. Numerous polls have shown public acceptance and such opposition as was encountered delayed but failed to stop the progress of the system.

In communications, the mobile services are still expanding rapidly. Here the use of FM is universal. No one would even attempt to sell a Chief of Police AM equipment.

The New York-Chicago television relays now nearing completion will make use of FM; likewise other radio relay links now being installed. "Television sound" is of course FM although of a somewhat less perfect form than that of regular aural FM service.

Interconnection of FM stations by relaying has now reached state-wide proportions in numerous parts of the country. Multiplex transmission, a method of operation that is unique with FM, has begun to make its appearance in various applications. The next logical step in the development of high quality, static-free service appears to be the interconnection of FM stations on a national basis with the transmission of the full musical range.** Further development toward this end may be expected before the year's end.

**See "letter to the editor" on this subject in July, 1950, issue of Atlantic Monthly.

# TELE-TECH's NEWSCAST

## Dumont Stereo-TV for Handling Radioactive Materials

The Argonne National Laboratory announced in conjunction with the Allen B. DuMont Laboratories, Inc., that a new system of stereoscopic television has been developed for use in remote handling of radioactive materials.

The camera uses twin lenses which produce two images on the image orthicon mosaic. These are transmitted in the usual manner to the receiver. On the receiving tube the two images appear side by side in the same relative position as they were in on the camera mosaic. Two polarizing filters with their axes of polarization at right angles are placed in front of the two pictures. The observer wears a pair of polarized spectacles which function in a manner similar to the well known stereoscope. It is possible to eliminate the necessity for special spectacles by using two cathode-ray tubes and a half silvered mirror in addition to a pair of crossed polarizing mirrors.

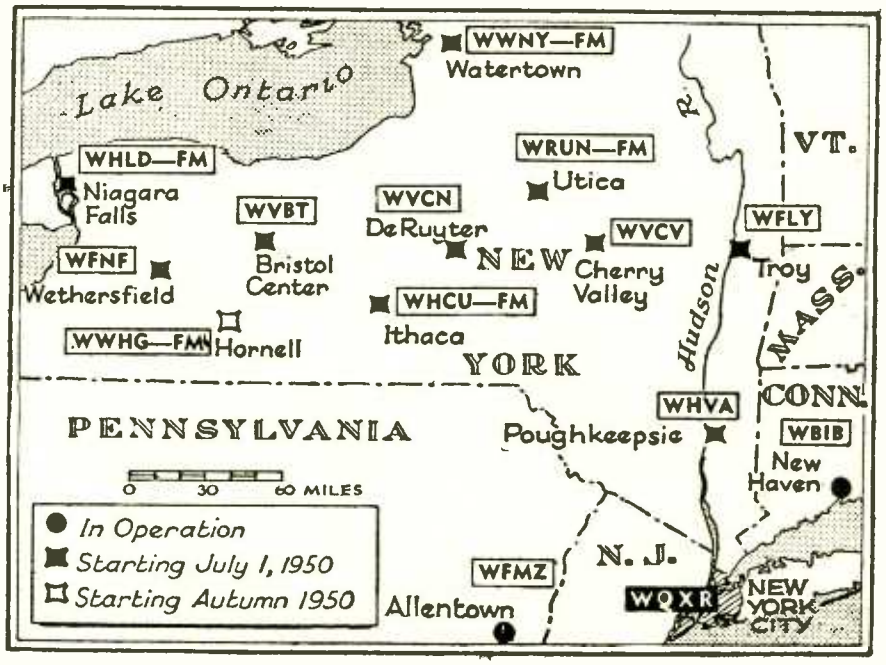
## Motorola Microwave Relay for Texas-Ohio Pipe Line

Motorola Inc., Chicago, has begun installation of an $800,000 microwave relay system for Mid-Valley Pine Line Co. which, when completed and placed in operation in September, will furnish telephone, teletype, and extension of mobile radio communications from Longview, Texas, to Lima, Ohio, a distance of approximately 1000 miles.

## GE Televises Hospital Surgery

A surgical operation at New York City's Bellevue Hospital was televised to the United Nations Building on June 19 under the co-sponsorship of International General Electric and E. R. Squibb & Sons. The same portable TV station which transmitted the operation from Bellevue to an antenna atop the Empire State Building for relaying to the UN building will be used on a tour of five Latin American countries this summer.

## OFF-AIR FM RELAY NET GOES INTO OPERATION




**WQXR-FM, owned by the New York Times, and broadcasting from New York City is now the key station of a new operation of the Rural Radio FM network. As may be seen from the accompanying map 11 stations will carry the station's Sunday and evening programs. Neither telephone lines nor special relay transmitters will be used to connect the stations. Since FM is substantially static and fading free each station will pickup the transmissions of the preceding station and rebroadcast it on its own different local frequency**

## RMA RE-ELECTS AUDIO MEN

**A. G. Schifino (left) of Stromberg-Carlson and Arie Liberman of Talk-A-Phone discuss plans for the coming year. They were re-elected chairman and director, respectively, of the Amplifier and Sound Equipment Div. of the RMA during the Association's annual convention at the Stevens Hotel, Chicago, June 5-8**

## Coming Events

**July 10-13 — National Association of Music Merchants,** Annual Convention, Palmer House, Chicago.

**July 24-26—Conference of Ionospheric Physics,** Pennsylvania State College, State College, Pa.

**August 27-September 1—Radio Parts Distributors Convention** (NEDA), Cleveland Auditorium, Cleveland, Ohio.

**August 28-31—Associated Police Communication Officers, Inc.,** National Conference, Hotel Hollenden, Cleveland, Ohio.

**September 13-15 — IRE West Coast Convention and 6th Annual Pacific Electronic Exhibit,** Municipal Auditorium, Long Beach, Calif.

**September 25-27—National Electronics Conference,** Edgewater Beach Hotel, Chicago, Ill.

**October 16-20—Society of Motion Picture & Television Engineers,** 68th Semi-Annual Convention, Lake Placid Club, Lake Placid, N. Y.

**October 23-27 — AIEE Fall General Meeting,** Oklahoma City, Oklahoma.

# Because Of 5 Outstanding Features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Long-Life Filament

Non-Emitting Grids

Input-Output Shielding

Low-Inductance Leads

## Eimac 4-125A tetrodes fill more key sockets than any other 125-watt tetrode.

The Eimac 4-125A is the heart of modern radio communication systems. Its dependability-of-performance has been proved over years of service in many thousand transmitters. It will be to your advantage to consider carefully the economy and circuit simplification the Eimac 4-125A offers.

As an example of Eimac 4-125A performance, two tubes in typical class-C telegraphy or FM telephony operation with less than 5 watts of grid-driving power will handle 1000 watts input; or, two 4-125A's in high-level modulated service will handle 750 watts input.

Take advantage of the engineering experience of America's foremost tetrode manufacturer . . . Eimac. Write for complete data on the 4-125A and other equally famous Eimac tetrodes.

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**The 4-125A is another Eimac contribution to electronic progress.**

# LETTERS . . .

### *Industrial Electronics Mere Drop in Bucket*

Editors, TELE-TECH:

From what we hear, see and read in this neck of the woods, your estimates of radio, TV and electronic output are far more realistic than those of your contemporary.

Our experience with Du Mont indicates that the industrial electronics field is a mere drop in the bucket compared with the radio-TV market. Du Mont this year will probably do about two-and-a-quarter to two-and-a-half million dollars in oscillographic equipment and industrial tubes. Meanwhile, the TV tube sales will probably reach twenty-two to twenty-five million dollars, and the TV sets should come close to fifty million dollars. These figures are estimates, of course, and perhaps colored with much wishful thinking. The transmitting equipment sales would account for about four million dollars in the year, but due to the continuous freeze I doubt that they will total more than a million or so, if the freeze should lift shortly.

Among all our clients the industrial electronic field is definitely a by-product of the huge radio-TV business. In the parts business particularly, the industrial-electronics customers usually call for small runs of close-tolerance items which, even with a relatively high markup, still don't add up to much in the year's total sales.

AUSTIN LESCARBOURA
*Croton-on-Hudson, N. Y.*

### *Columbia-Fairchild Recording with Heat*

Editors, TELE-TECH:

In the May, 1950, issue of TELE-TECH, page 19, under the subject of "Disc Recording with Heated Stylus", I am sorry that in carrying this item you failed to mention Columbia Records, Inc., which is actually responsible for this development and which Fairchild is simply marketing. I am sure that Fairchild is not to blame for this oversight since they have always been very careful to give Columbia Records, Inc., due credit for this outstanding development.

HOWARD A. CHINN
*Chief Audio-Video Engineer*
*Columbia Broadcasting System*
*485 Madison Ave.*
*New York 22, N. Y.*

### *"Tele-Data at Its Best"*

Editors, TELE-TECH:

The copies of TELE-TECH which reach this company monthly can be described only by a few words, "TELE-DATA AT ITS BEST". We here do not fail to read it from cover to cover. It always contains a world of material, keeping one abreast of the Tele picture in this country.

J. EDWARD TREFZ
*Amalgamated Electronics*
*Clinton Corners, N. Y.,*

# They climbed the world's tallest tower so you could see farther

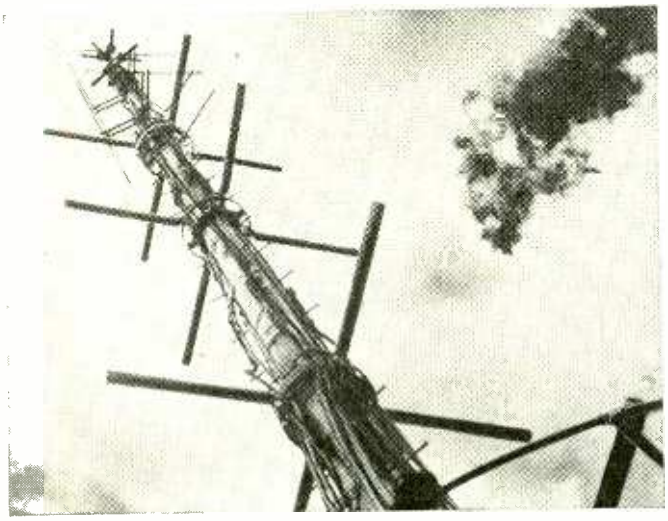
## Installation of NBC's television antennas has been a job for daring steeplejacks!

**No. 6 in a series outlining high points in television history**

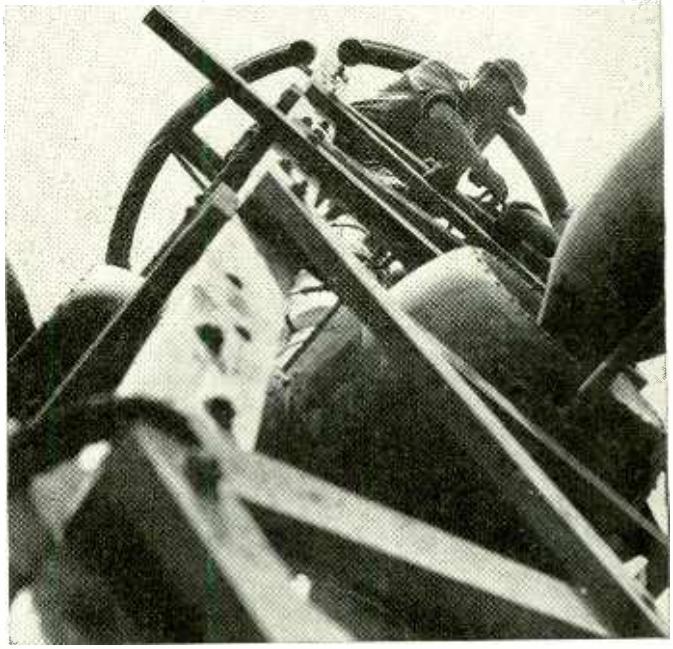
*Photos from the historical collection of RCA*

● Dwarfed ant-small by their height above Manhattan's streets, skilled and daring workmen—in 1931—offered New Yorkers a sight as exciting as the highwire act at a circus . . . but much more significant.

Task of these men, as they clambered about atop the tower of the Empire State Building—1250 feet in the air—was to install an antenna for experimental telecasts from NBC's television station. "Why did it have to be so high?" was a question on thousands of watchers' lips.



**A familiar sight** *on the New York skyline, NBC's television antenna—installed in 1946—was the successor to those erected in 1931, 1936 and 1938, and used by RCA and NBC to perfect television.*



**Steeplejacks at work** *on an NBC television antenna—1250 feet above the sidewalks of New York. Its height gives telecasts a wider range in the New York and New Jersey area.*

As might have been expected, with television an unfamiliar art, the average layman thought of it in relation to radio broadcasts, whose waves he knew could circle the globe. That telecasts were fundamentally limited by the line of the horizon was little known. To increase this limiting range, scientists, engineers, and technicians, sought the highest available vantage point.

With its antenna installed, this experimental television station was able to transmit pictures a distance of about 42 miles, and farther under highly favorable conditions. Receivers dotted around the New York area picked up the first telecasts, providing encouraging and instructive information to be studied by RCA's scientists.

Facts gathered in this period included new data on the behavior of very short waves, as well as how to handle them. New knowledge about interference was acquired, including the fact *that much of it was man-made* and therefore could be eliminated.

Other studies undertaken at the time included basic work on the "definition" most suitable for regular commercial telecasts. Definition as coarse as 60-lines was used in early days. Then came 341-line, and 441, until today's standard of 525-line definition was finally adopted.

That we may now, as a matter of course, see sharp, clear pictures on the screens of our home television receivers is in good part the result of experimental work initiated by RCA scientists, and carried out by NBC engineers since the erection of the first station in the Empire State Building. A share should also be credited to the steeplejacks who climbed to dizzy heights so that you could see farther!

**Radio Corporation of America**
*WORLD LEADER IN RADIO—FIRST IN TELEVISION*

# BOOKS

### Application of Electric Valve in Radio Receivers

*By Dr. B. G. Dammers, J. Haantjes, J. Otte and H. Van Suchtelen. Distributed by Elsevier Book Co., Inc., 215 Fourth Avenue, New York 3, N. Y. 416 pages. Published 1950.*

Volume IV of the Philips Technical Library of books on vacuum tubes deals specifically with r-f. and i-f. amplification in general applications of the tube to all stages of the receiver except the audio. It offers a comprehensive coverage of the problems involved in designing around vacuum tubes. In some cases the treatment is perhaps a little more detailed than general usage requires. However, a void in the series of texts treating this subject has been filled by the production of this book.

### Radio and Television Writing

*By Max Wylie, Published by Rinehart and Company, Inc., 232 Madison Avenue, New York 16, N. Y. 635 pages, price $6.50. Published April, 1950.*

This book deals with the mechanics of writing for the broadcast engineer's medium as well as audience measurement and research. Broadcast engineers who desire to progress in their calling will find the material in this book very helpful since a thorough understanding of the technics involved in programming their stations will often result in opportunities to participate in management operations.

### Questions and Answers in TV Engineering

*By Carter V. Rabinoff and Magdalena E. Wolbrecht. Published by Whittlesey House, 330 West 42 Street, New York 18, N. Y. 300 pages, Price $4.50. Published 1950.*

Coordinating technical facts in the field of TV and offering them in an easy-to-assimilate form, this book may be likened to many others on the market which provide data on mathematics for radio and electrical engineering. Questions based on typical TV engineering problems are posed in a manner similar to the form of the FCC License examinations; the answers are also given in detail so that reasons for assumptions are clearly shown. Probably will be helpful to the engineer in smaller stations far from the areas of TV operation who wishes to prepare for entry into the latter field.

## BOOKS RECEIVED

### Electronics—Principles and Applications

*By Ralph R. Wright. Published 1950 by the Ronald Press, 15 East 26th St., New York 10, N. Y. A basic text for electrical engineering students and physics majors. Only basic equations are included with derivations in few cases. 387 pages. Price, $5.50.*

### 40 Uses for Germanium Diodes

*By Electronics Div., Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y. Text is grouped in three sections which describe germanium diode applications in radio and television receivers; radio transmitters and amplifiers; and a wide range of instruments and supervisory devices. 47 pages. Price, $1.00.*

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## PERSONNEL

**William Sloat**, assistant chief engineer in charge of engineering, has resigned from WPIX, The New York News television station, to become chief engineer of television station KEYL, San Antonio, Texas. He joined WPIX in February, 1948 as as assistant chief engineer. Previously he was with WEW and WEW-FM, St. Louis.

**Edgar K. Wimpy** has been named director of quality control of Hytron Radio & Electronics Corp. He will direct development and application of methods for controlling the quality of incoming materials, parts assemblies and the finished product, as well as the approval and control of final test specifications.

**Howard T. Souther** has been named manager of Electro-Voice's new speaker division at Buchanan, Mich. He was formerly vice president of the Stephens Manufacturing Co.

Jensen Industries Inc., 329 South Wood St., Chicago 12, Ill. manufacturers of phonograph needles for commercial and home use, have announced the appointment of **Earl L. Olson** as chief engineer. An outstanding expert in all phases of sound engineering, he will be in complete charge of Jensen engineering and new development.

L. M. Clement

D. B. Nason

**L. M. Clement, formerly director of engineering of the Crosley Div., Avco Mfg. Corp., has been appointed technical adviser to the vice president and general manager. D. B. Nason has been placed in charge of research, development and engineering on TV and radio receivers**

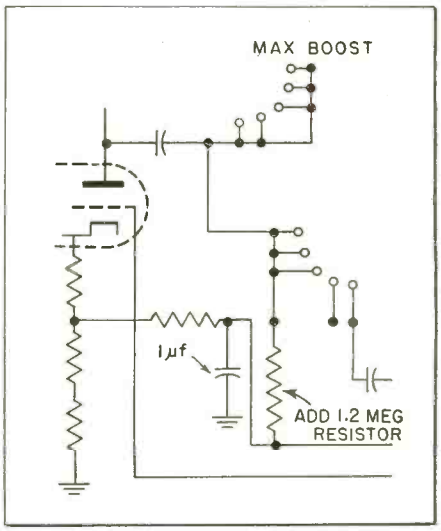
**R. E. Peterson,** vice president of Standard Coil Products Co., Inc. of Chicago, Los Angeles, and Bangor, Mich., has announced the opening of a new branch sales office at 1616 Walnut St., Philadelphia 3, Pa. **R. T. Pearson,** who has been direct factory representative for the past year and a half, has been appointed supervisor of the new branch which will serve TV set manu-

(*Continued on page* 57)



## Frequency Selective Negative Feedback

IN the article entitled "An Application of Frequency Selective Negative Feedback," which appeared in the December 1949 issue of TELE-TECH, a 1.2 megohm resistor was omitted in the schematic




diagram, Fig. 4. This resistor should be added between the bass switch at the paralleled switch points and the top point of the 1 μfd bypass capacitor. The resistor is needed to provide a d-c return for the grid of the output stage when the treble switch is in "boost" position. The accompanying diagram provided by Mr. T. J. Parker, co-author, indicates correct location of resistor.

# Speech Communications Conference at M. I. T.

FROM a scientific point of view, how is speech produced, transmitted, and understood? How efficient and effective is human speech as a means of communication?

Analysis and discussion of this problem were the order of business at a Speech Communication Conference, for which over 250 specialists in the fields of acoustics, electronics, mathematics, languages, linguistics, physiology, and psychology met last month in Huntington Hall at the Massachusetts Institute of Technology.

Papers were presented by distinguished guests from Germany and Switzerland as well as by specialists from throughout the United States. Prominent among the speakers were Dr. J. Dreyfus-Graf, Geneva, Switzerland; Dr. Martin Joos, department of German, University of Wisconsin; Dr. Paul Menzerath, Phonetisches Institut der Universität, Bonn, Germany; Professor O. F. Ranke, University of Erlangen, Germany; Dr. J. C. Steinberg, Bell Laboratories, Murray Hill, New Jersey; Dr. S. S. Stevens, director of the Psycho-Acoustic Laboratory, Harvard University; Dr. Norbert Wiener, professor of methematics, M.I.T.; and Professor J. Zwislocki, University Clinic for Ear, Nose and Throat, Basel, Switzerland.

Dr. H. K. Dunn of Bell Laboratories, Murray Hill, New Jersey, demonstrated an electrical vocal tract which, by adjustment of its controls, produced various vowel sounds. He described the implications of this device for the theory of vowel production.

The "sonograph," an instrument for translating speech sounds into symbols, was demonstrated by Dr. Dreyfus-Graf.

How the brain can select and listen attentively to one sound while suppressing undesired sounds of equal or greater strength coming from other directions, was described by Dr. W. C. Koch of Bell Laboratories, Murray Hill, New Jersey.

Dr. Ira J. Hirsh of the Harvard Psycho-Acoustic Laboratory reviewed work on speech intelligibility which indicates that hearing loss alone is not necessarily the critical factor in persons with impaired hearing. Studies of the inner ear, described by Professor Ranke, have established analogies between ocean waves on a seashore and sound waves within the human ear.

(*Continued from page 54*)

facturers in the states of Pennsylvania, upper New York, New Jersey, Delaware, Maryland, Washington, D. C., and surrounding territories, with the exception of Metropolitan New York and New England, which are represented by **P. R. Fixel**.

**John H. Ganzenhuber has been appointed vice president in charge of sales and product development of Standard Electronics Corp. wholly-owned subsidiary of Claude Neon, Inc. He was formerly manager of broadcast sales for Western Electric Co.**

**Marvin Hobbs, consulting radio engineer of Chicago, Ill., has been appointed deputy director of the Joint Electronics Committee of the Munitions Board. During the War he was with the War Production Board as head radio consultant on radio and radar**

## Horizontal Wipe

(*Continued from page 31*)

waveform "q". Replace V14 and remove V13. Adjust the potentiometer in the grid circuit of V14 so that the signal looks like waveform "q". Replace V14 and the signal should now look like waveform "r". Connect the oscilloscope at one of the video outputs. Adjust clipping control associated with V20 so that the base line is cleaned up as shown in waveform "s". The wipe control should now be varied from minimum to maximum to observe whether the wipe will span the two edges of the picture. The wipe control should allow the keying pulses to start from one blanking interval and go completely into the next blanking interval. The limit adjustment on the remote panel will adjust the wipe for proper operation.

If one video signal can be seen through the other video signal as though superimposition were taking place the potentiometers in the cathodes of V8 and V9 should be increased slightly.

The video amplifiers are adjusted by the sweeper-detector technic and should be made flat to 6-7 MC.

Acknowledgment is made to Mr. W. C. Bareham and the members of the Engineering Department of WBAL-TV for assistance in the construction and alignment of the wipe equipment and preparation of this article.

## R-F Coupling Loops

(*Continued from page 33*)

specific type of transmission line, either balanced or unbalanced. The design element is attached to one end of a sample piece of line, and the matched termination with a detector to the other end of the line, much as indicated in Fig. 4.

Use of an arrangement similar to that shown in Fig. 5 greatly increases the flexibility of the unit, as it makes possible design of all types of coupling loops mentioned here. The loop end of the cable terminates on a small frame carrying a calibrated variable capacitor and a set of binding posts as indicated. If the line is unbalanced, the rotor of the variable capacitor should be connected to the shield. The calibration on the capacitor shows the frequency at which a given capacitance setting will have the design reactance value. For 50 ohm coaxial cable, convenient design reactance values are 15 and 150 ohms. For 300 ohm cable, convenient values are 100 and 1000 ohms.

Any low power source of r-f magnetic field which can be tuned to known frequencies will serve as a source of excitation. The source is set to the design frequency chosen. The capacitor on the designer is tuned while the output of

## R-F Coupling Loop

(*Continued from page 57*)

the loop is observed. If the coil is of correct size, the designer capacitor will peak at the frequency of the source. If the coil is too small or too large, the capacitor frequency setting will be below or above the desired frequency, respectively. If no peaking is indicated, a change of connection to series from parallel, or vice versa, may permit a reading to be obtained. Otherwise, a change of frequency up or down by a factor of ten may bring the coil within measuring range, so the rule may be used. In general, where an impedance level having a known ratio to the design level is desired, design at a frequency bearing the proper relation to the final operating frequency yields the desired values.

Use of the series connection may be made where the design is intended for parallel operation at a frequency below the lowest parallel frequency. Where operation above the range of the series connection is desired, the parallel connection often can be used. Consequently (using nominal Q's of approximately three) the total range of frequencies for which a tuned loop may be designed with a given capacitor may be as high as 1000 to 1.

The limit frequencies to which a loop designer will give satisfactory operation is controlled primarily by circuit strays. These strays are chiefly capacitor inductance, inductor capacitance, and reactance between the capacitor and transmission line, and transmission line and its termination and detection unit. Of these, the capacitor inductance appears to be the most serious. Attempts at use of a designer at a frequency higher than the shorted resonant frequency of the design capacitor when set at maximum capacitance may lead to erroneous results. This frequency usually is in the range between 100 and 500 megacycles, depending on the capacitor chosen.

Use of the loop designer for untuned loops requires only knowledge of the nominal design Q of the instrument. If an untuned loop for use at 100 megacycles is required, a Q of three instrument would indicate the design frequency to be 33 megacycles in the parallel connection, or 300 megacycles in the series. Simplicity of equipment and use would favor operation at 33 megacycles, although the other frequency would be equally practi-

(*Continued on page 60*)

# BULLETINS

### *Turret Punch Press*

Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia 32, Pa. has issued a booklet describing the RA-41P turret punchpress for faster piercing operations. Designated bulletin 241, it contains descriptions of typical panel and chassis piercing jobs performed by the RA-41P

### *Radiographic Materials*

A new, 16-page catalogue of materials for industrial radiography, published by the Eastman Kodak Co., 343 State Street, Rochester 4, N. Y., describes films for use with x-ray equipment of varying kilovoltage and with specimens of varying thickness and density. Information on relative speeds and contrast of different x-ray film emulsions is provided in a handy chart to enable the radiographer to quickly select the particular material best suited to his needs.

### *Microwave Communications*

The Industrial Division of Philco Corp., Philadelphia, Pa., has made a booklet available on the subject of microwave communications systems. The basic components of the Philco system are illustrated and described.

### *Broadcast Equipment*

The Gray Research & Development Co., Inc., Hartford 1, Conn., is currently issuing its new 6-page catalog, "GRAY TV Broadcasting Equipment," describing the Gray TELOP, Camera Turrets, Multiplexer and other basic equipment designed for efficient and economical broadcasting procedures in TV stations. Described are other major pieces of Gray equipment, designed to minimize the overall TV station investment, such as the Gray Camera Turrets and the Gray Multiplexer.

### *Miniature Tube Guide*

The 4th edition of Hytron's Reference Guide for Miniature Electron Tubes just off the press. It lists all miniature tubes to date, regardless of make; 132 miniatures; 41 new tubes; 70 basing diagrams. Write Hytron Radio & Electronics Corp., Salem, Mass.

### *Mounting Bases*

Catalog No. 502, just issued by The Barry Corp., 1794 Sidney St., Cambridge 39, Mass., illustrates and describes unit-type air-damped BARRYMOUNTS and mounting bases used to protect radio equipment and other sensitive apparatus against shock and vibration encountered in aircraft applications. Listings include unit mounts and bases conforming to U. S. Government specifications.

### *Connectors*

A completely redesigned and revised 48 page engineering bulletin on the Cannon Electric types K and RK connector series has just been issued. This K3 edition covers the entire series, including RK and K aircraft firewall and pressurized fittings, also accessories such as dust caps, junction shells, bonding rings, etc. Copies are available from the factory, Cannon Electric Development Co., Division Cannon Manufacturing Corp., 3209 Humboldt Street, Los Angeles 31, Calif.

### *Plastic Molding Powders*

A new 16-page booklet on Plexiglas acrylic plastic molding powders has been published by Rohm & Haas Co., Philadelphia 5, Pa. Profusely illustrated with photographs of molded end products, many in full color, it covers the manufacturer's complete series of heat-resistant, medium-flow, and general-purpose formulations.

### *Transformer Design*

Transformer design and manufacturing services offered to industry for developing special components to meet usual operating requirements, are announced in bulletin 90-109, a new publication of Sperry Products, Inc., Danbury, Conn. Power, audio, pulse and blocking oscillator transformers; filter, audio, and high Q reactors; and net works are listed in the bulletin.

## R-F Coupling Loop

(*Continued from page* 58)

cal. Both the oscillator and the designer are operated at the new frequency chosen, for example 33 megacycles.

In some cases, it is desirable to be able to make a pickup or output loop operate efficiently with reduced total inductance. Eq. 4 indicates a useful approach to this. If the effective value of the $Z_o$ term can be reduced, reduction of $L_1$ with continued efficient operation is possible. Where narrow band operation can be accepted, this is accomplished by including an appropriate value of $C_1$ which will reduce the term $Z_o(1 - \omega^2 L_1 C_1)$ the desired amount.

This technic might be particularly useful at microwave frequencies. In such applications as wavemeter cavities, it is not desirable to have a coupling loop protrude into the cavity it is exciting. An ordinary coupling loop in this case may give insufficient coupling. Excitation often can be increased by locating the proper amount of fixed capacitance in the feed line adjacent to the loop structure. Wave guide to wavemeter couplings in three centimeter equipment make use of a coupling hole in the guide whose operation might be explained in this way.

Since the design of untuned and tuned couplers can be reduced to selection of an inductor set and adjustment of coupling, it would seem practical to make up coil sets offering good flexibility and simplicity for service replacements of unavailable coils and for laboratory and amateur experimental construction. Coil sets consisting of slug tuned tank coils and matching coupling coils would be convenient. The tank coils would be designed to make possible complete coverage of a given inductance range by tuning of the slugs. The coupling coils would match common line and tube impedances. These would be slid onto the tank coil form and adjusted to proper coupling. Cementing the coupling coil in place would complete the assembly.

In conclusion, the narrower bandwidth of the tuned loops and the capacitance loaded untuned loops must be weighed against the greater efficiency of the tuned loops. These facts, used with the usual mechanical and electrical restrictions, permit choice between tuned and untuned loops. Then the remaining factors discussed help in

choice of series or shunt tuning in the resonant tuned loop, or addition of shunt or series capacitance in the untuned case. Methods of controlling effectiveness by change of available parameters are studied.

A simple instrument is described, and its operation explained, which is a useful aid in design of both tuned and untuned loops. It is believed it will have wide usefulness to the laboratory worker and to the amateur and the experimenter.

## Noise Generator

(*Continued from page* 50)

late the line-voltage supply to the noise generator, or to use a storage battery to supply the filament heating current.

### Unbalanced Noise Generator

The unbalanced diode noise generator was originally designed for use primarily with unbalanced input circuits of communications receivers, but was later adapted to make measurements on balanced circuits. The simple equivalent circuit is shown in Fig. 4 and the final circuit in Fig. 7. Only one set of coils is required for the unbalanced

Fig. 21: Front of unbalanced noise generator

arrangement as compared to three for the balanced circuit. The same general design considerations discussed previously apply also the unbalanced generator. However, since lower output impedances are used with the unbalanced circuit (unbalanced transmission lines are usually of lower impedance than balanced lines) fewer switch positions are used to cover a given frequency range. Note also that although the power supply circuit is the same, B+ is returned to ground in this unit and the filament of the diode is returned to B—, so that no isolating capacitors are required in the output circuit.

Photographs of the unbalanced noise generator are shown in Figs. 21 and 22. The frequency selector switch is shown with four positions

## NOISE GENERATORS (Continued)

0.5 to 100 MC, 120 to 160 MC, 174 to 216 MC, and 210 to 250 MC. The first and third positions include the broadcast television and FM frequencies, the second and fourth positions include the higher frequency amateur bands. The number of turns for each coil (for configuration shown in Fig. 22) is given in Table III.

The arrangement for measuring a balanced circuit with the unbalanced generator is shown in Fig. 23. This type of noise-generator output termination was checked against the balanced noise generator using receivers that were poorly matched to the transmission line. In the region of 50 to 90 MC the difference in noise factor measurement was generally within 1 db. In the region 175 to 215 MC the difference between the two generators was usually within 1.5 db.

If it is suspected that the arrangement of Fig. 23 does not give a good balanced input to the measured circuit (i.e., low ground return impedance), then a half-wave matching transformer may be conveniently used for frequencies above 50 MC. Two such half-wave reentrant transformers were built (for 69 and 195 MC) using 75-ohm coaxial line and connected as shown in Figs. 24 and 25. However, when using the matching transformer the frequency range is narrowed, and for a given accuracy the same number of frequency selector switch positions as in the balanced amplifier must be used. A separate transformer is also required for each switch position.

Fig. 22: Switch tuner of unbalanced unit

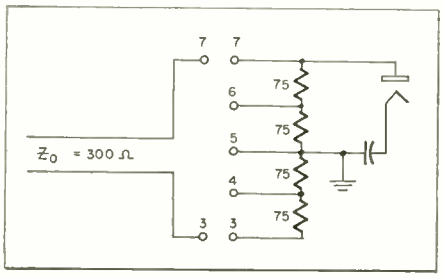



Fig. 23: Connections for balanced measurement with the unbalanced output circuit

The meter scale for the unbalanced generator was marked to read directly in db for a 75-ohm input. It will still read directly in db with the arrangement of Fig. 23 for a 300-ohm line, or when the reentrant transformer is used to measure a balanced 300-ohm input.

The relative merits of the balanced and unbalanced noise generators may now be summarized. For applications which are limited only to unbalanced measurements the unbalanced noise generator is perfectly adequate (and easier to build). Where both balanced and unbalanced measurements will be performed the balanced generator is preferable since it is inherently more accurate for balanced work.

### Performance Data

Measurements on television receivers within the past eighteen months fall mainly in a range of noise factor values from 8 to 20

# TELE-TECH

## *Advertisers July 1950*



While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

## NOISE GENERATORS (Continued)

db, with a noticeable tendency for recent tuners to stay below 15 db for all channels. Some figures for a popular television receiver which show the variation from channel to channel are given in Table IV. The high-frequency channels generally have a higher noise factor than the lower frequencies.

Measurements on communications receivers varied from 5 db to more than 30 db. Noise factors above 30 db were often due to the inability of the antenna trimmer condenser to cover the range. A noise factor as low as 2 db (at 14 MC) was obtained with an experimental preamplifier preceding a communications receiver. When working with noise factors as low as 5 db, the noise generator seems to be the easiest and most accurate means of making any further improvements on the circuit.

It is often useful to convert the noise factor to minimum signal voltage required at the *antenna terminals*. This minimum usable signal will of course depend on the required signal-to-noise ratio. Table V lists the carrier signal strengths required at the *antenna terminals* to produce a signal-to-rms-noise voltage ratio of 10 to 1 (20 db) for various noise factors and bandwidths, and an antenna impedance of 300 ohms.

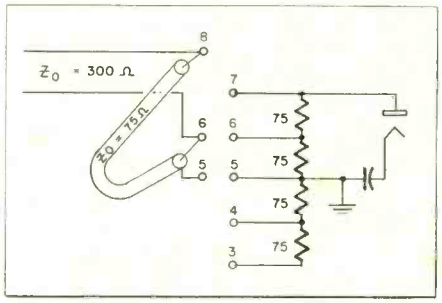



Fig. 24: Circuit of λ/2 matching transformer

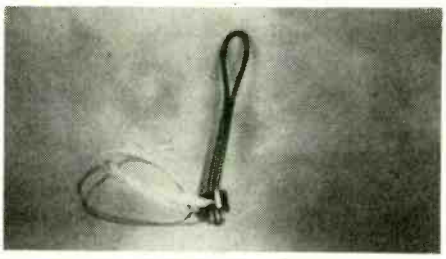


Fig. 25: λ/2 matching transformer (195 MC)

The values in Table IV are calculated from,

$$E_n\ (uv) = K \times S/N \Big/ \sqrt{0.016 \times F \times R\ (\text{ohms}) \times \triangle f\ (\text{cps})}$$

where K=ratio of the response on the flat part of the receiver passband characteristic to the response at the carrier frequency, and is generally 2 for television receivers and 1 for communication receivers; S/N=signal-to-noise ratio (voltage); F=noise factor; △f=bandwidth with respect to the top of a flat response characteristic (noise bandwidth with respect to video carrier is $\triangle fK^2$. See definition of bandwidth given previously).

When considering the effect of noise on video or audio intelligence it should be remembered that the peak noise voltage is large compared with its r-m-s value. As an approximation the average peak value is sometimes considered to be 4.5 times the r-m-s value. Thus, a 20-db ratio between signal and r-m-s noise is actually only a 10-db ratio between peak signal and peak noise, and it is the peak value which is very often the consideration in television work.

*Appendices I, II and III to this paper will be published in the August issue.*

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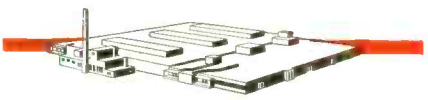

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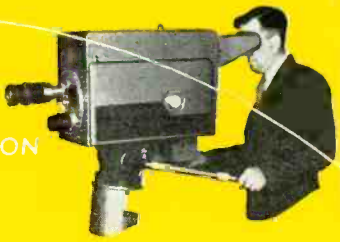

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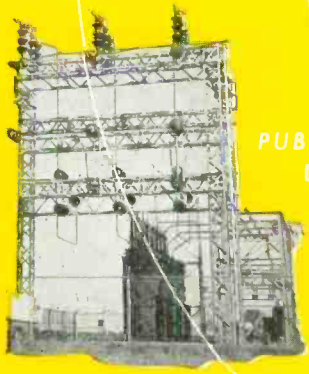

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