# TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

March • 1948

Television Trends: Practice—Developments—Engineering

What's Ahead in TV Receiver Engineering? • Kinescope

Plant Geared for Mass Output • Big Picture Practices

New Viewing Tube for Color TV • How a Television Station Handles Remotes • Film Resistor Characteristics

Conveyor and Test Systems Speed Television Receiver Assembly • IRE Convention and Radio Engineering Show

*Special Television - IRE Issue*

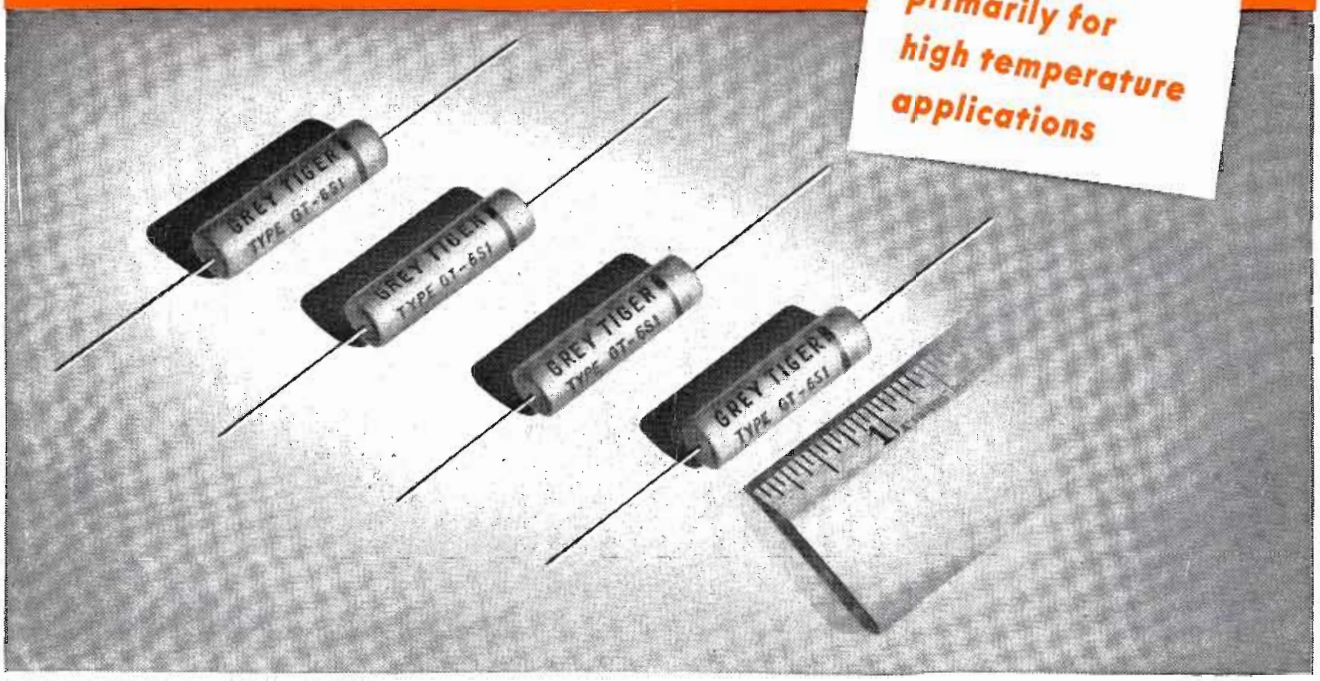
CALDWELL-CLEMENTS, INC.

# Now another C-D first!

## NEW HIGH TEMPERATURE PAPER TUBULAR CAPACITOR

# TYPE GT "GREY TIGER"

**Designed primarily for high temperature applications**




C-D's new "Vikane" impregnated tubular capacitor—Type GT "Grey Tiger"—has won wide industry acclaim. "Remarkable durability"—the unanimous decision after many rigid laboratory tests. Write for samples today. Cornell-Dubilier Electric Corporation, Dept. J-3, South Plainfield, New Jersey. Other plants in New Bedford, Worcester and Brookline, Massachusetts; and Providence, Rhode Island.

- new "Vikane" impregnation assures extra long life at high operating temperatures,
- new moisture seal and tube impregnation designed to withstand temperatures to 100°C.,
- high insulation resistance: at 25°C. above 10,000 megohms per unit or 2,000 megohms per mfd.,
- low power factor; averages .35% at 1,000 cycles,
- eliminates need for stocking high and low temperature units,
- excellent capacity stability over wide temperature range,
- excellent electrical stability over life of unit,
- available in all commercial capacity and voltage ratings for maximum flexibility,
- one line to meet all your production requirements—whether for high or low temperature and humidity applications.

### "GREY TIGER"
**Capacity and DC Voltage Ranges**

| Capacity Mfd. | 100 Volts | 200 Volts | 400 Volts | 600 Volts | 1,000 Volts | 1,600 Volts |
|---|---|---|---|---|---|---|
| .001 | | | | GT-6D1 | GT-10D1 | GT-16D1 |
| .002 | | | | GT-6D2 | GT-10D2 | GT-16D2 |
| .003 | | | | GT-6D3 | GT-10D3 | GT-16D3 |
| .005 | | | GT-4D5 | GT-6D5 | GT-10D5 | GT-16D5 |
| .01 | | | GT-4S1 | GT-6S1 | GT-10S1 | GT-16S1 |
| .02 | | | GT-4S2 | GT-6S2 | GT-10S2 | GT-16S2 |
| .03 | | GT-2S3 | GT-4S3 | GT-6S3 | GT-10S3 | GT-16S3 |
| .05 | GT-1S5 | GT-2S5 | GT-4S5 | GT-6S5 | GT-10S5 | GT-16S5 |
| .10 | GT-1P1 | GT-2P1 | GT-4P1 | GT-6P1 | GT-10P1 | |
| .15 | GT-1P15 | GT-2P15 | GT-4P15 | GT-6P15 | GT-10P15 | |
| .25 | GT-1P25 | GT-2P25 | GT-4P25 | GT-6P25 | | |
| .50 | GT-1P5 | GT-2P5 | GT-4P5 | GT-6P5 | | |
| 1.0 | GT-1W1 | GT-2W1 | GT-4W1 | | | |

1910 1948

MICA • PAPER
DYKANOL
AND ELECTROLYTIC
CAPACITORS

**CORNELL-DUBILIER**
WORLD'S LARGEST MANUFACTURER OF
**CAPACITORS**

CORNELL-DUBILIER ELECTRIC CORPORATION, Department J-3
SOUTH PLAINFIELD, NEW JERSEY

GENTLEMEN: Please send Bulletin Number NB116 describing type GT tubulars ☐
Catalog Number 200 ☐

Name..... Title.....
Firm.....
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# TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

Formerly the TELE-communications TECH-nical Section of ELECTRONIC INDUSTRIES

MARCH, 1948


Editorial Contents




**CALDWELL-CLEMENTS, INC., Publication Office, Orange, Conn., Editorial and Executive Offices 480 Lexington Avenue, New York 17, N. Y., Tel. Plaza 3-1340**

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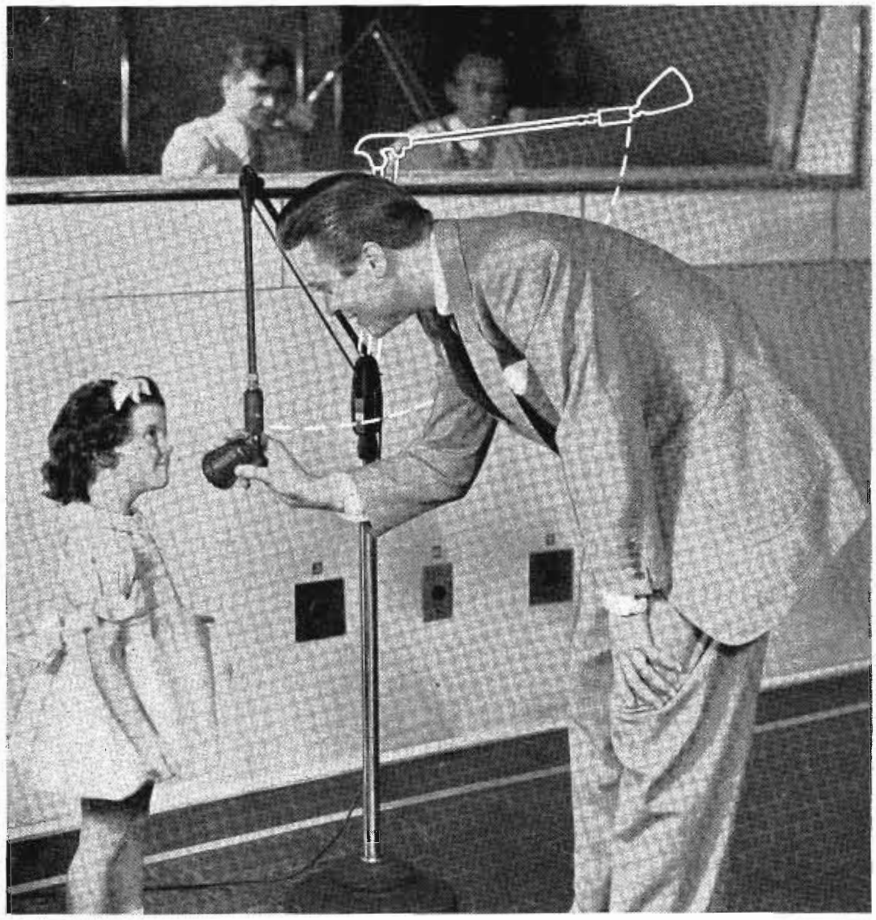
# *Handiest* MIKE ARRANGEMENT YOU'VE EVER SEEN




MOVES FREELY INTO ANY POSITION AND STAYS PUT—*WITHOUT LOCKING*

**CHOICE OF 2 BASES**

UNIVERSAL

With this combination base the Dazor may be clamped or screwed to any surface —horizontal, sloping or vertical.

PEDESTAL

This base, a portable floor-type fixture, is equipped with rubber pads to absorb shock.

From up there to down here is just one *s-w-e-e-p.*

When your microphone is mounted on the Dazor *Floating* Arm, you get the flexibility of a hand instrument without the weight of holding one. A touch of the fingers *floats* the mike from the tall to the short speaker, from announcer to soloist, from interviewer to guest. Once it's placed, the mike remains in that position without fastening of any kind, due to a patented enclosed spring force.

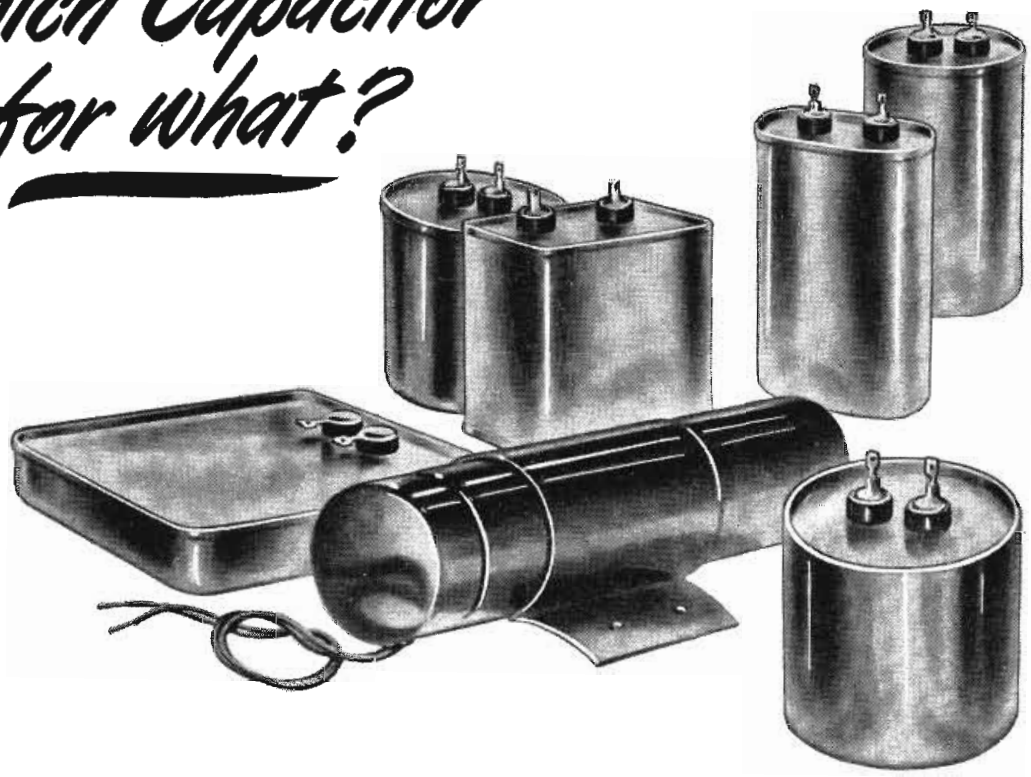
The Dazor pedestal model, illustrated above, extends the reach of the emcee in the studio, auditorium or night club . . . gives him the welcome feeling that he is free from mechanical chores . . . keeps him on top of the program. A universal model, fastened to table, desk or speakers' stand, provides similar assurance for the individual broadcaster or small group.

Plane, train and police dispatchers —who want hands free for writing, typing or chart operations—lose no time with mikes that are readied or pushed back in an instant. In addition to supporting the microphone of your choice, the Dazor *Floating* Arm can be individualized to meet any space or mounting limitations peculiar to your layout.

**Phone Your Dazor Distributor** for details. If you wish the name of this helpful supplier, write Dazor Manufacturing Corp., 4481-87 Duncan Ave., St. Louis 10, Mo. *In Canada* address inquiries to Amalgamated Electric Corporation Limited, Toronto 6, Ontario.

# DAZOR FLOATING ARM FOR MICROPHONES

# which Capacitor for what?



These capacitors are identical, electrically. The different case styles were, most of them, developed for specific applications. However, since the capacitors *are* electrically the same, it is perfectly practical to use them interchangeably—to use a ballast capacitor on a motor, or a motor capacitor with a sign transformer.

We have made just such proposals at times—and have frequently been able to help manufacturers solve an unusual mounting or space problem, and cut their capacitor costs by recommending a unit not normally thought of for the application.

The capacitor that *you* should use of course depends on your own problem. For assistance in any specific case, get in touch with the nearest G-E Apparatus Office, or write *General Electric Company, Pittsfield, Massachusetts.*

**GENERAL ELECTRIC**

407-151

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

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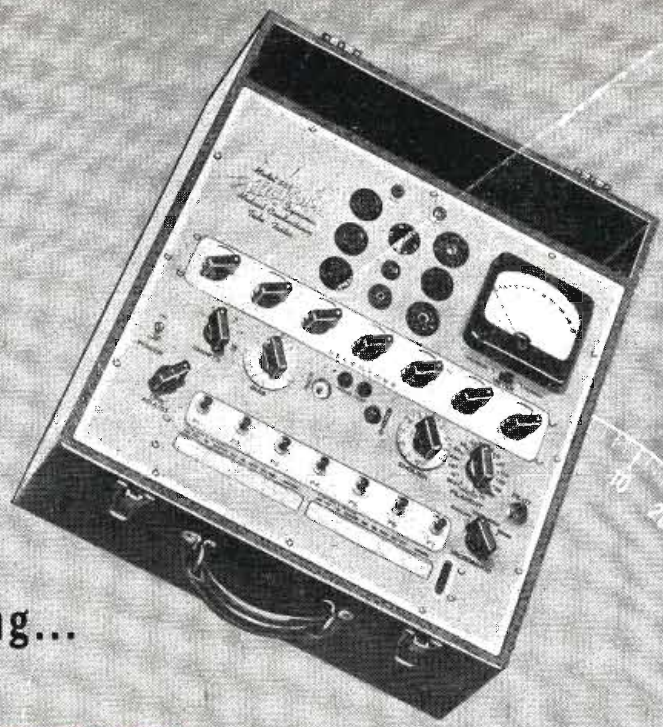
When
High Accuracy
and
Stability
mean
everything...



# DRIVER-HARRIS ELECTRICAL ALLOYS

The fundamental role performed by precision resistors in the testing of radio tubes—to certify performance, check loss of characteristics and necessity for replacement—demands that only resistance materials of the highest electrical stability be used in their construction.

For this reason, the precision bobbins employed by Hickok in its quality tube testers are wound with Driver-Harris MANGANIN, ADVANCE*, and NICHROME*.

D-H Manganin, for example, is ideally suited for use where extreme accuracy must be obtained without error due to temperature change or voltage generated by thermal e.m.f. against copper. Advance, in its finer sizes, has a negligible temperature coefficient of resistance combined with high resistivity, making it extremely useful for winding precision resistors which must retain stable resistance values over a wide temperature range. Nichrome and Nichrome V enable large values of resistance to be wound on very small bobbins.

If your resistors demand high electrical stability, sensitivity and permanence, why not be guided by the example of Hickok and have Driver-Harris supply the electrical resistance wire you need. Send us your specifications.


SPECIAL PURPOSE ALLOYS SINCE 1899 — D/H — TRADE MARK REG. U. S. PAT. OFF.

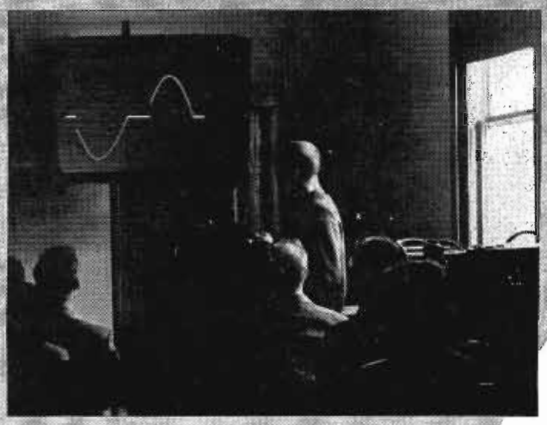
## *Driver-Harris* COMPANY

HARRISON • NEW JERSEY

BRANCHES: Chicago • Detroit • Cleveland • Los Angeles • San Francisco • Seattle

*Manufactured and Sold in Canada by*
The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

*T. M. Reg. U. S. Pat. Off.

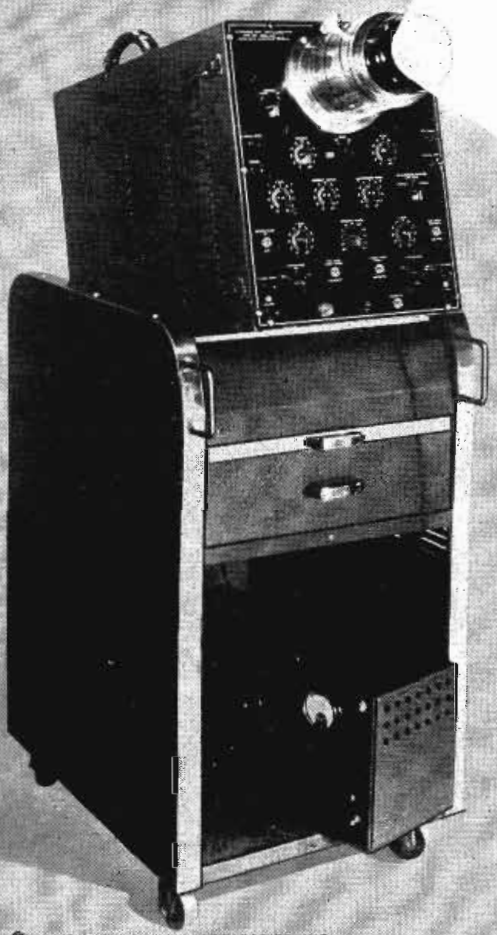


When projection lenses are available, you can project the oscillogram in a *well-lighted* room with *perfect* visibility, as in this unretouched photograph. Note open window.

# PHOTOGRAPHS, PROJECTIONS, HIGH-SPEED TRANSIENTS ARE *Clear*

if it's a

# DU MONT Type 247-A CATHODE-RAY OSCILLOGRAPH



Modified from the Type 247, this new Du Mont Type 247-A is such a startling success that phenomena hitherto totally invisible can now be *easily* seen. Such modification extends the range of the instrument tremendously in the field of transient studies or high-speed photographic applications.

The modification utilizes the new Type 5RP Cathode-Ray Tube operable at voltages up to 30 KV, producing sufficient brilliance for direct projection, if required.

Other features are: automatic beam blanking; choice of single or continuous sweep; sweep rates available from .5 cps to 50,000 cps; Z-axis amplifier with choice of output polarity; soundly engineered electrical and mechanical design.

***Further details on request.***



**DUMONT** *Precision Electronics & Television*

ALLEN B. DuMONT LABORATORIES, INC., PASSAIC, NEW JERSEY • *CABLE ADDRESS:* ALBEEDU, PASSAIC, N. J., U. S. A.


FOR all products to be made by drawing, stamping and similar sheet metal operations, Revere sheet and strip of copper or brass offer maximum ease of fabrication. Not only are these metals naturally ductile, but they benefit further from the metallurgical skill which Revere has gained in 147 years of experience.

In composition, mechanical properties, grain size, dimensions and finish, you will find Revere metals highly uniform. They enable you to set up economical production methods and adhere to them. They can help you produce better products at faster production rates, with less scrap and fewer rejects.

Revere copper, brass and bronze lend themselves readily to the widest variety of finishing operations—polishing, lacquering, electro-plating. With these superior materials it is easy to make radio shields and similar products beautiful as well as serviceable.

That is why wise buyers place their orders with Revere for such mill products as—*Copper and Copper Alloys:* Sheet and Plate, Roll and Strip, Rod and Bar, Tube and Pipe, Extruded Shapes, Forgings—*Aluminum Alloys:* Tubing, Extruded Shapes, Forgings—*Magnesium Alloys:* Extruded Shapes, Forgings—*Steel:* Electric Welded Steel Tube. We solicit your orders for these materials.

**REVERE**

**COPPER AND BRASS INCORPORATED**

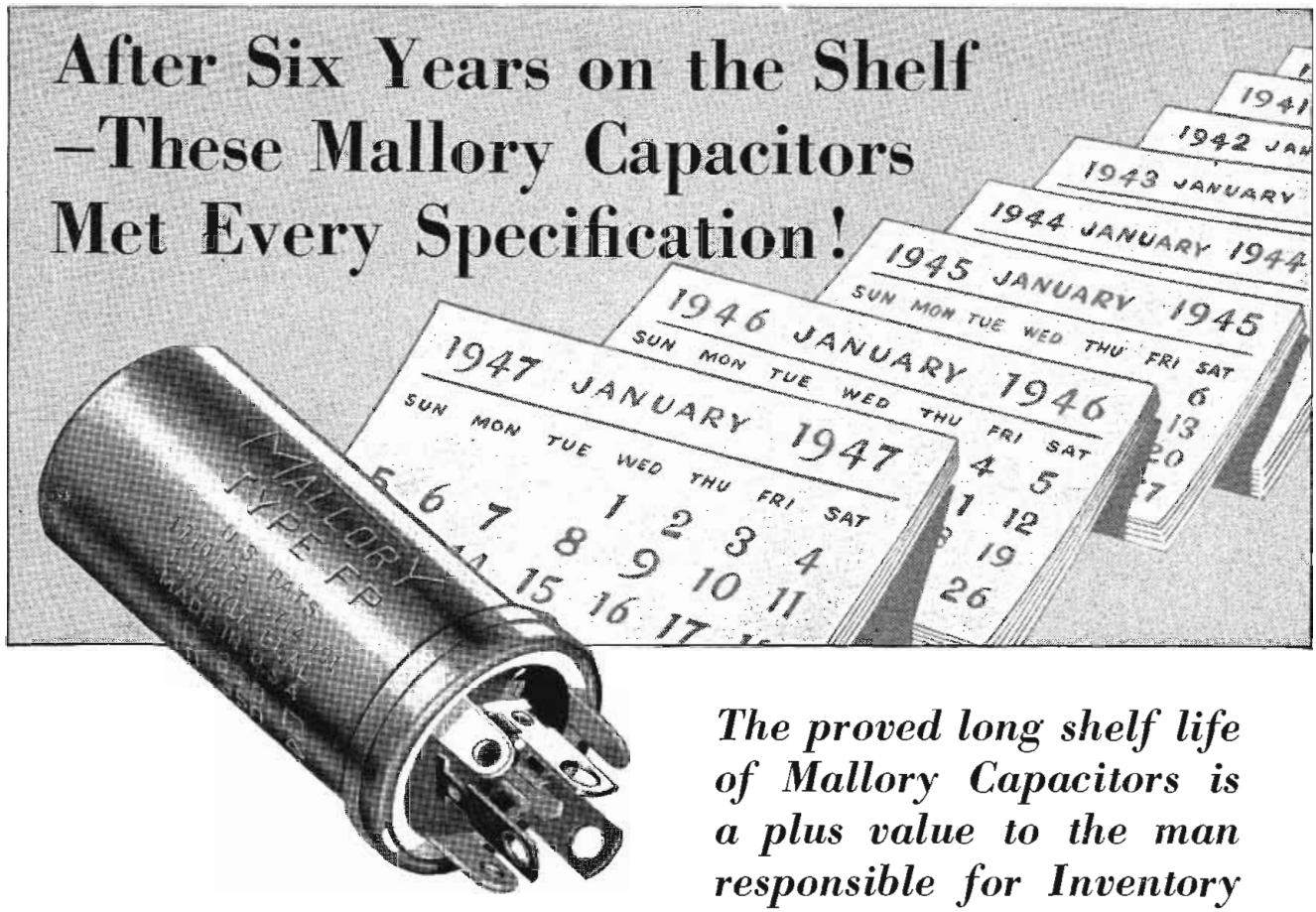
*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

*Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.*

*Sales Offices in Principal Cities, Distributors Everywhere*

# After Six Years on the Shelf —These Mallory Capacitors Met Every Specification!




***The proved long shelf life of Mallory Capacitors is a plus value to the man responsible for Inventory***


When you buy capacitors it's a relief to know that, should your production program change, the stock on hand may be held without becoming useless through deterioration. Mallory Capacitors have proved on many occasions that they can take long periods of storage without loss of efficiency.

We recently tested capacitors for several customers* who had shelved them for up to six years. All proved ready to use without re-aging. None took more than seven minutes to reach the leakage limit of new units. All characteristics were within the limits of new-unit inspection.

Such quality is added protection for the man who specifies Mallory Capacitors. Such quality is invariably built into Mallory Approved Precision Products.

**Names on request.*

***Yours for the asking!***

Everything you want to know about Mallory electrolytic capacitors—types, sizes, electrical characteristics—even data on test measurements and mounting hardware!

**Visit us at Booths 84, 85, 86**
**I. R. E. Show**
**Grand Central Palace**
**New York**
**March 22-25**

***BUY MALLORY ASSURED QUALITY AT REGULAR PRICE LEVELS***

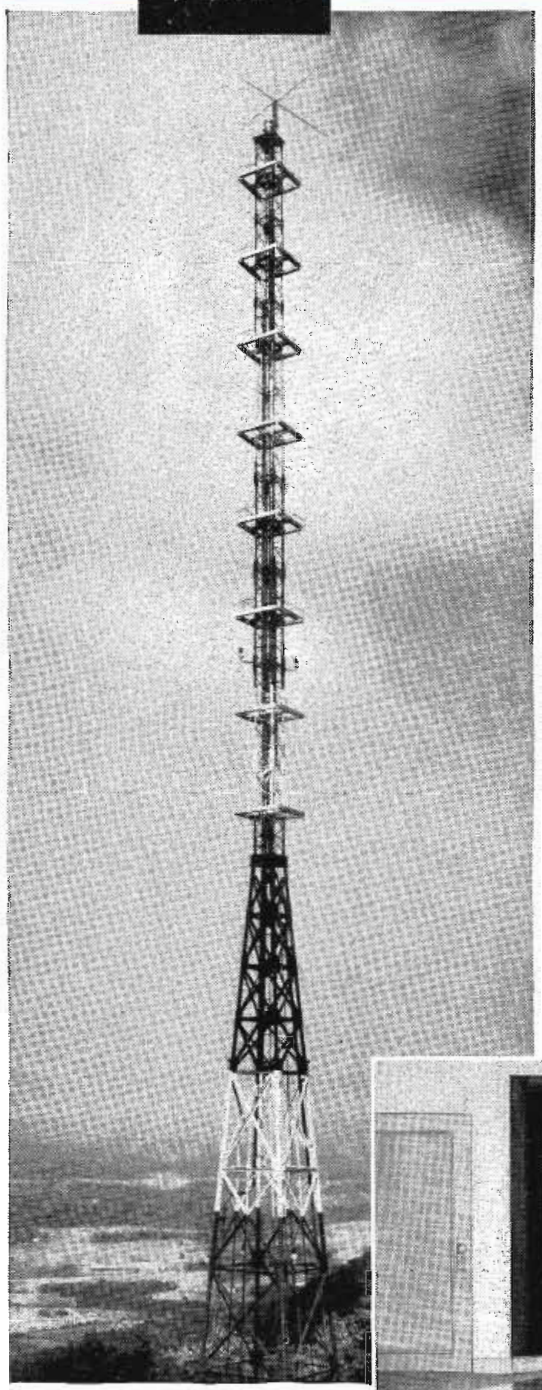
P. R. MALLORY & CO. Inc.

**MALLORY CAPACITORS**

**(ELECTROLYTIC, Oil and WAX)**

**P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA**

# for FM COVERAGE and PERFORMANCE



## you can't beat Federal's COMPLETE "ONE-PACKAGE" STATION

A broadcast station that's FM by Federal all the way—from microphone to antenna—offers *three exclusive features* that assure maximum coverage at minimum operating cost, and maximum performance with minimum maintenance expense.

### 1. FEDERAL'S SQUARE-LOOP ANTENNA!

The coverage of an FM station depends primarily on the effective strength of the radiated signal. And Federal's 8-Element, Square-Loop Antenna gives an effective radiated power *more than 8 times* the transmitter rating. Actual installations have repeatedly *proved* its ability to give outstanding coverage—and to withstand high winds and heavy icing loads.

### 2. FEDERAL'S HIGH-FIDELITY TRANSMITTER!

All Federal FM transmitters feature the exclusive "Frequematic*" modulator — for outstanding fidelity and performance. Maintains center-frequency stability within 0.001% — reduces signal-to-noise ratio to 5600-to-1 — uses simple all-electronic circuits with standard receiver tubes — easy to align, simple to maintain.

### 3. FEDERAL ENGINEERING ALL THE WAY!

Complete FM by Federal means FM at its best, with all components precision engineered to work together. Transmitter console, studio console, transcription units, power supplies — everything from microphone to antenna—designed and coordinated for maximum over-all performance and economy.

When planning your new FM station, remember these exclusive advantages. And if you want to get on the air *fast*, Federal can now make your complete installation in record time! For further information, write to Federal, Dept. B666.

*Trade Mark

With this Federal 8-Element Square-Loop Antenna, now on the air at Station WMRC-FM, Greenville, South Carolina, listeners more than 200 miles away—including cities in 6 different states—report excellent reception. Lower photo shows WMRC's transmitter room, with Federal 10-Kw transmitter, console, monitor speaker and power supply.


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

## Federal Telephone and Radio Corporation

100 KINGSLAND ROAD, CLIFTON, NEW JERSEY

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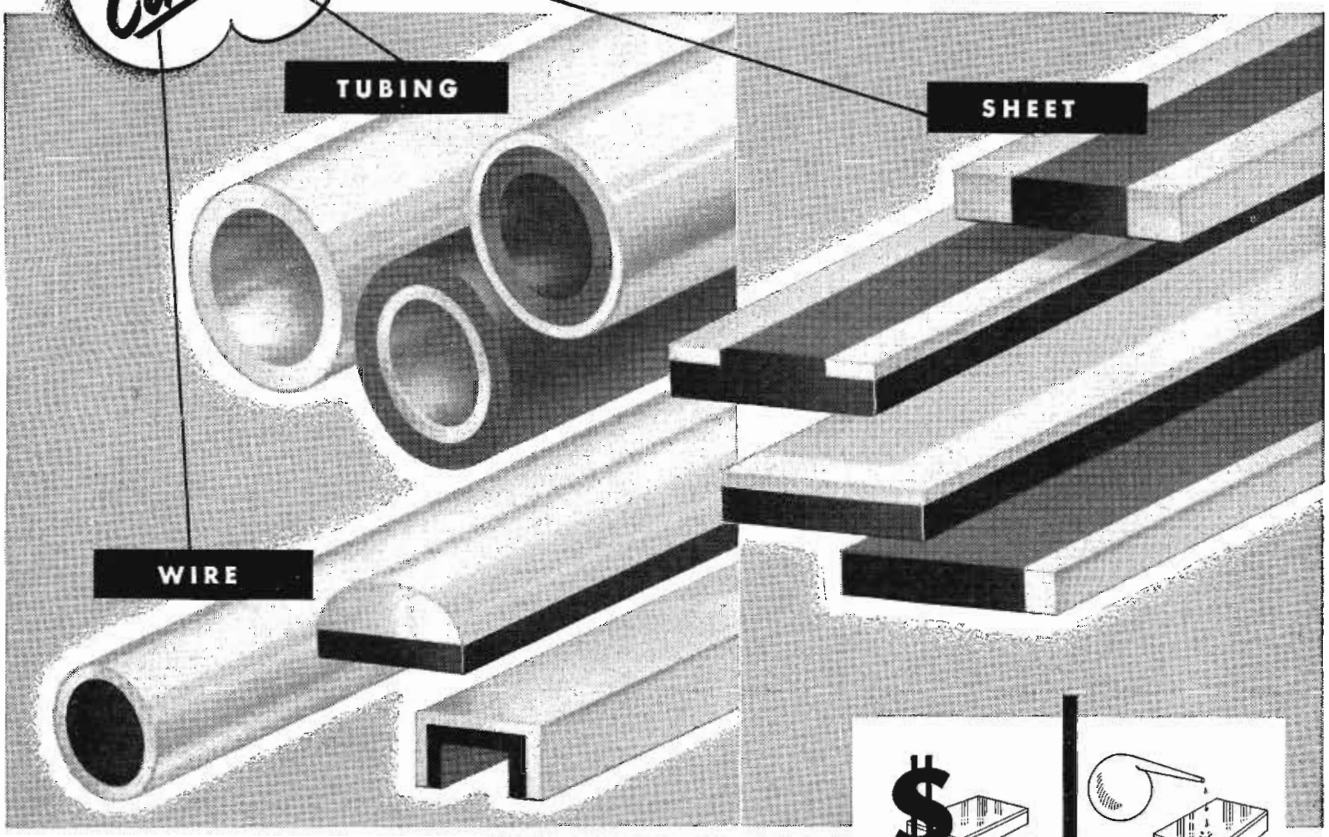
Here's a Way to CUT COSTS

# Yet Maintain High Performance Quality



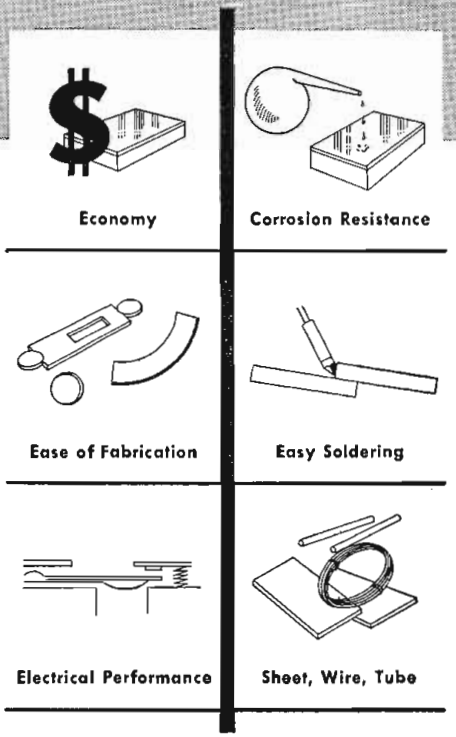

## . . . use GENERAL PLATE Laminated Metals

The versatility of General Plate Laminated Metals enables you to simplify designs, cut costs and maintain precious metal performance such as exceptional electrical conductivity, corrosion resistance and long operating life.

Here's how — by permanently bonding a thin layer of precious metal to relatively inexpensive base metal, General Plate Laminated Metal gives you all the advantages of precious metal performance at a fraction of the cost of solid precious metal. In addition, the base metal adds strength, while the combination is more workable, easier to fabricate, easier to solder, braze or weld.

General Plate Laminated Metal is ideal for use in such equipment as: electrical contacts, chemical apparatus, radar and radio equipment, mobile equipment and instruments.

Base to base metal combinations providing physical and structural properties not found in single base metals are also available. General Plate Engineers will gladly help you with your problems. Write:




## GENERAL PLATE DIVISION

*of Metals & Controls Corporation*

**ATTLEBORO, MASSACHUSETTS**

50 Church St., New York, N.Y. • 205 W. Wacker Drive, Chicago, Ill.
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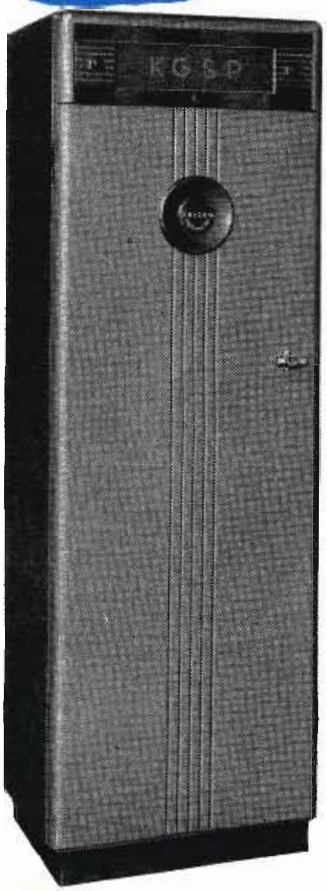
# Check ✓ these specifications for 152-162 Mc-FM Radiophone Communication Systems



## by PHILCO the leader

## • specifications

| RECEIVER | 152-162 Megacycles |
|---|---|
| Dimensions | 8¼x12x19¼" |
| Sensitivity | 0-.5 microvolts for full audio output |
| Selectivity | Band width 40KC at 6 Db down.<br>Adjacent channel (60KC) —60 Db minimum.<br>Alternate channel (120KC) —106 Db minimum. |
| Spurious response | —60 Db minimum. |
| Squelch | 0.3 microvolts minimum<br>6.0 microvolts maximum |
| Power supply | Synchronous vibrator |
| Frequency range | 152-162 megacycles |
| **TRANSMITTER** | |
| Modulation characteristics | ±20KC at 3,000 cycles equal 100% |
| Frequency stability | ±.005% |
| Spurious emission | —60 Db minimum |
| Power supply | Dynamotor |
| Antenna relay | Built-in for transmit-receive operation |
| Temperature range for normal operation | —30° C to 60° C |

- Philco Radiophone Systems are Available for Operation on All Frequencies Assigned for Mobile Communication.
- Free Engineering Consultation Service.
- Nationwide Service Organization.

MAIL COUPON TODAY FOR FULL DETAILS ➡

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**INDUSTRIAL DIVISION**

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**Dept. K-8, Industrial Division**
**Philco Corporation**
**C and Tioga Streets**
**Philadelphia 34, Penna.**

Gentlemen:

Please send me information about the new PHILCO FM Radiophone Communication System.

NAME_____

ADDRESS_____

CITY_____

# THE Seeburg "S"

## A CHANGER TO GIVE YOU IMPORTANT COMPETITIVE ADVANTAGES

Check the design and engineering features of the new Model "S"—most recent addition to the Seeburg line of record changers. Although *moderately priced,* it possesses most of the features found only in more expensive mechanisms.

To manufacturers of table models and popularly priced consoles, the Model "S" will assure improved performance . . . increased sales appeal . . . ready acceptance by dealers and their customers.

Plan now to give your radio-phonograph combinations these important competitive advantages with the new, *moderately priced* Model "S"—a changer that is Seeburg quality throughout.

### MODEL "S" FEATURES

- Sturdy, single-post changer
- Modern styling — smart, shield-shaped base
- Lightweight tone arm
- Automatic shut-off after last record is played
- Recessed turntable
- Strong, quiet motor assures constant turntable speed
- Plays twelve 10-inch or ten 12-inch records. May also be set for manual play
- Shock-mounted center spindle for minimum center hole wear of records — record load stacked in horizontal position

Seeburg

RECORD CHANGERS ★ MUSIC SYSTEMS

J. P. SEEBURG CORPORATION
1500 N. Dayton St., Chicago 22

*Model "L"*

*Model "K"*

# note the New Look in Power Transformers

Typical Motorola FM two-way radiotelephone receiver utilizing *Sealed in Steel* Chicago Transformers.

## With CT's Famous *Sealed in Steel* Construction

The clean, streamlined appearance and compactness of CT's new *Sealed in Steel* construction contribute immeasurably to the trim, precision-like effect of any electronic equipment.

In addition, CT Transformers provide "steel wall" protection against atmospheric moisture, efficient magnetic and electro-static shielding, unsurpassed strength and rigidity to withstand shock and vibration, and unusual convenience of mounting.

Two base styles are available for most of the units in this catalog line, one with clearly identified solder lugs in a phenolic terminal board, the other with RMA color coded leads, stripped and tinned for easy soldering.

The design of these new power transformers assures maximum performance with minimum physical size and minimum temperature rise in accordance with RMA standards.

The wide range of carefully selected ratings achieves maximum flexibility of application, close matching with today's preferred types of tubes, and conformance with all industry standards.

**Write direct for catalog illustrating, describing and listing the complete line, or contact your nearest radio parts jobber at once.**

## PLATE AND FILAMENT SUPPLY TRANSFORMERS

*Primary 117 Volts, 50-60 Cycles*

| Catalog Number | HIGH VOLTAGE SECONDARY A.C. Volts | D.C. Ma. | D.C. Volts Output | FILAMENTS Rectifier Volts | Amps. | No. 1 Volts | Amps. | No. 2 Volts | Amps. |
|---|---|---|---|---|---|---|---|---|---|
| **For CAPACITOR INPUT SYSTEMS** | | | | | | | | | |
| PC-55 | 270-0-270 | 55 | 260 | 5 | 2 | 6.3CT 2 | ..... | | |
| PC-70 | 335-0-335 | 70 | 320 | 5 | 2 | 6.3CT 3 | ..... | | |
| PC-85 | 330-0-330 | 85 | 320 | 5 | 2 | 6.3CT 3 | ..... | | |
| PC-105 | 345-0-345 | 105 | 320 | 5 | 2 | 6.3CT 3.5 | ..... | | |
| PC-120 | 375-0-375 | 120 | 380 | 5 | 3 | 6.3CT 4 | ..... | | |
| PC-150 | 370-0-370 | 150 | 390 | 5 | 3 | 6.3CT 4 | | 6.3CT 1 | |
| PC-200 | 385-0-385 | 200 | 390 | 5 | 3 | 6.3CT 4.5 | | 6.3CT 1 | |
| **For REACTOR INPUT SYSTEMS** | | | | | | | | | |
| PR-55 | 350-0-350 | 55 | 260 | 5 | 2 | 6.3CT 2 | ..... | | |
| PR-70 | 425-0-425 | 70 | 320 | 5 | 2 | 6.3CT 3 | ..... | | |
| PR-85 | 440-0-440 | 85 | 325 | 5 | 2 | 6.3CT 3 | ..... | | |
| PR-105 | 445-0-445 | 105 | 325 | 5 | 2 | 6.3CT 3.5 | ..... | | |
| PR-120 | 500-0-500 | 120 | 400 | 5 | 3 | 6.3CT 4 | ..... | | |
| PR-150 | 505-0-505 | 150 | 400 | 5 | 3 | 6.3CT 4 | | 6.3CT 1 | |
| PR-200 | 520-0-520 | 200 | 410 | 5 | 3 | 6.3CT 4.5 | | 6.3CT 1 | |
| PR-300 | 550-370-75-0 -75-370-550 | 300 | 425 | 5 | 6 | 6.3CT 5 | | 6.3CT 1 | |

Also available in the *Sealed in Steel* constructions:

**FILTER REACTORS** with current ratings to match power transformers above.

**FILAMENT TRANSFORMERS** to meet a wide range of modern tube requirements.

**AUDIO TRANSFORMERS** — Input, Output, Driver, and Modulation — that provide uniformly high fidelity response in three frequency ranges: 30-15,000 cycles, 50-10,000 cycles, and 200-3,500 cycles.

# CHICAGO TRANSFORMER

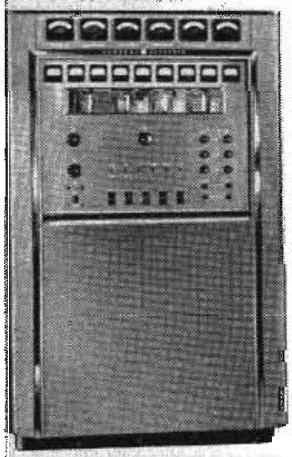
DIVISION OF ESSEX WIRE CORPORATION

3501 ADDISON STREET • CHICAGO 18, ILLINOIS

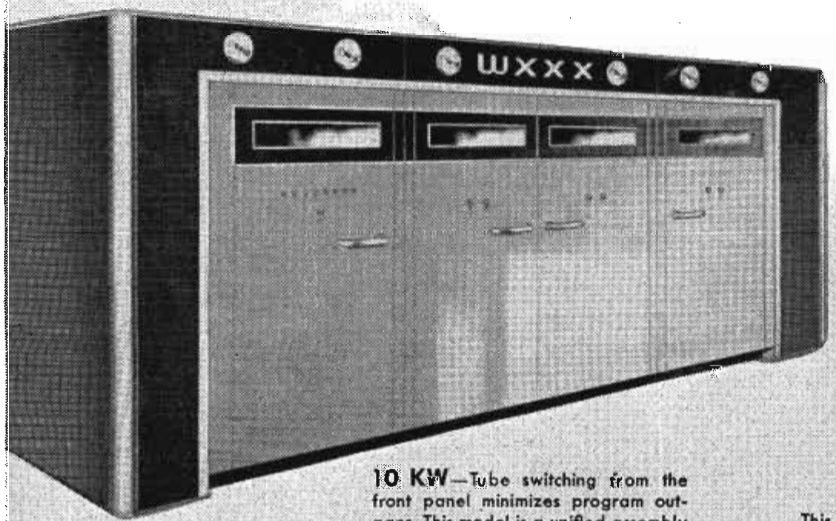

**50 KW**—One of the larger members of the G-E transmitter family. Note wide doors, providing full accessibility for "walk-in" maintenance. Like all high-power G-E transmitters, this model uses transformers filled with a non-inflammable liquid. This eliminates necessity for fireproof vault and lowers installation costs and insurance.

# POWER for every

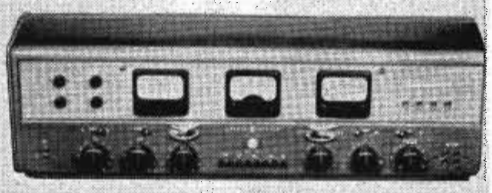
# General Electric's complete new line of AM TRANSMITTERS— now in production



**1 KW**—Compactness is an outstanding quality of this sturdy equipment. Reliable, high-standard performance makes it an ideal transmitter in its power class. Now in stock and ready for *immediate delivery*.



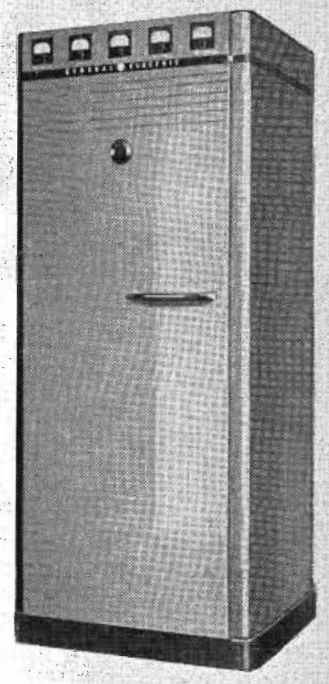

**10 KW**—Tube switching from the front panel minimizes program outages. This model is a unified assembly of exciter-modulator, power amplifier, and rectifier-control units.



**TRANSMITTER-CONTROL CONSOLE**

This versatile unit can be used to control a transmitter of any power rating. The de luxe version includes a separate clock panel for timing transmitter interruptions; also, an executive type desk and chair of matching color.

# broadcast need!



**250 Watt**—Highest quality performance at lowest operating cost—you profit both ways with this 250-watt AM transmitter. Simplified circuits. Numbers and types of tubes minimized. *Immediate delivery from stock.*

HERE are five outstanding AM units that will help you profit from your station investment. Featuring lower cost per hour of broadcast service, these transmitters are built to one high standard of quality, backed by one source of responsibility. Every detail of this completely new line reflects the unequaled engineering and operating experience of the General Electric Company.*

The G-E line of broadcast equipment covers all your station needs—transmitters from 250 watts to 50,000 watts, complete studio equipment, the AM station monitor and accessory units to fit every requirement.

Whether you are planning a new station or modernizing an existing one, take a big step in the right direction by calling your nearby General Electric broadcast representative (see list below), or write to Transmitter Division, General Electric Co., Electronics Park, Syracuse, N. Y.

*G.E. built its first commercial broadcast transmitter in 1922. Since that time the company has produced broadcast transmitters whose combined power ratings total over 2,500,000 watts.


**5 KW**—An exclusive G-E feature of this transmitter is the spare tube switching of all high-power stages from front panel. Air-cooled throughout, as are all G-E standard broadcast transmitters.

**ATLANTA 3, GA.**
187 Spring Street
Walnut 9767

**BOSTON 1, MASS.**
140 Federal Street
Hubbard 1800

**CHICAGO 54, ILL.**
1122 Merchandise Mart
Whitehall 3915

**CINCINNATI 2, OHIO**
215 W. 3rd Street
Parkway 3431

**DALLAS 2, TEXAS**
1801 N. Lamar Street
LD 224

**DENVER 2, COLO.**
650 17th Street
Keystone 7171

**KANSAS CITY 6, MO.**
106 W. 14th Street
Victor 9745

**CLEVELAND 4, OHIO**
710 Williamson Bldg.
Euclid & Public Square
Superior 6822

**LOS ANGELES 14, CALIF.**
Suite 1300-1301
Security Title Insurance Bldg.
530 West Sixth Street
Trinity 3417

**MINNEAPOLIS 2, MINN.**
12 Sixth Street
Main 2541

**NEW YORK 22, N. Y.**
570 Lexington Avenue
Wickersham 2-1311

**PHILADELPHIA 2, PA.**
1405 Locust Street
Pennypacker 5-9000

**SAN FRANCISCO 4, CALIF.**
235 Montgomery Street
Douglas 3740

**SCHENECTADY, N. Y.**
Bldg. 267, Rm. 105
Schenectady 4-2211

**SEATTLE 4, WASH.**
10 Second Avenue
Main 7100

**WASHINGTON 5, D. C.**
806 15th Street N. W.
Executive 3600

**SYRACUSE 1, N. Y.**—Syracuse 6-4411

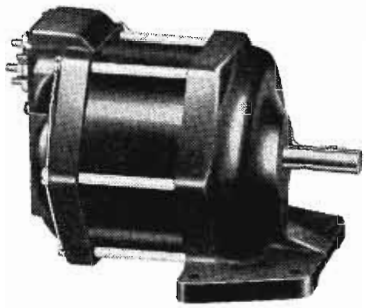
LEADER IN RADIO, TELEVISION AND ELECTRONICS

**GENERAL ELECTRIC**

160-F10-6814

# For precise, positive linkage between instrumentation and control

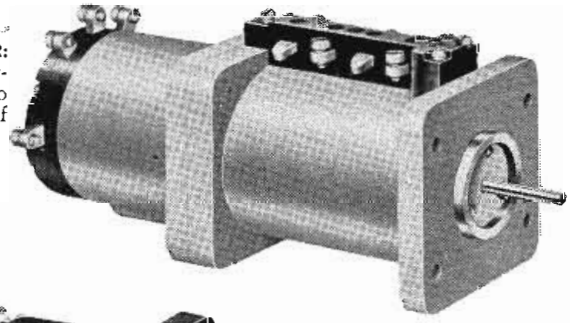
**INDUCTION GENERATOR:** when fed from AC source produces voltage proportional to speed of rotation. Used in circuits as velocity control component.



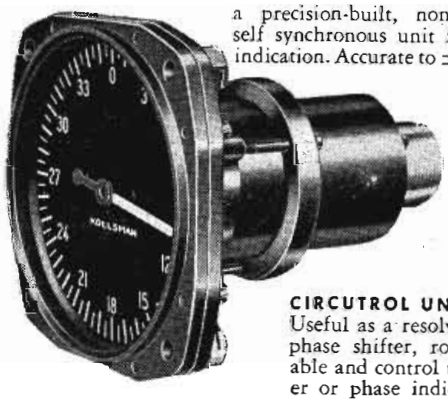
**PERMANENT MAGNET GENERATOR:** designed as AC potential source. Produces sinusoidal wave form with harmonic content under 2%.

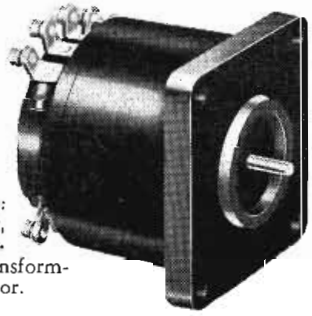
**INDUCTION GENERATOR:** type designed particularly for use where low residual voltage is required.

**MOTOR DRIVEN INDUCTION GENERATOR:** powered by 2-phase, low-inertia induction motor. Used as fast reversing servo motor where maximum stall torques of less than 7 oz. in. are required.

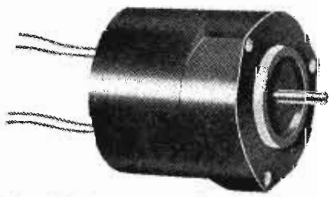


**TELETORQUE UNIT — below left:** a precision-built, non-motoring, self synchronous unit for remote indication. Accurate to ± 1 degree.





**CIRCUTROL UNIT:** Useful as a resolver, phase shifter, rotatable and control transformer or phase indicator.



**INDUCTION MOTOR:** Low inertia, two-phase squirrel cage unit for use as precision servo motor.

## KOLLSMAN OFFERS A LINE OF SPECIAL PURPOSE AC UNITS

To meet the varying needs of the electronics engineer in linking instrumentation up to control, Kollsman offers a group of units with sufficiently varied functions to solve a wide range of control problems. In nearly every case, units are available for operation at various voltages and frequencies to fit widely diversified electronic control and remote indication applications. These Kollsman units are the outgrowth of long development in aircraft instrumentation and control and — more recently — Kollsman's considerable work in this field for naval and military applications. They are light in weight, compact, and highly precise, so that engineers working with exact quantities will find them reliable to a high degree. Complete data on any or all of these units may be had upon request. Kollsman Instrument Division, Square D Company, 80-08 45th Avenue, Elmhurst, N. Y.

## KOLLSMAN AIRCRAFT INSTRUMENTS

PRODUCT OF

SQUARE D COMPANY

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA

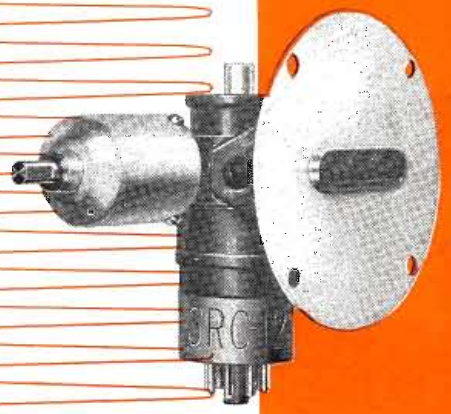
# *new klystron tubes*

## NOW AVAILABLE FOR MICROWAVE RELAYS

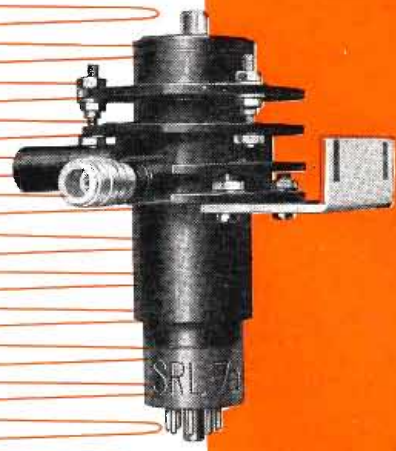
■ Four Sperry Reflex Klystron oscillators for microwave relay systems are now available for commercial use. These Klystrons can be used either as transmitting types or local oscillators. They can also be used in the laboratory as bench oscillators in the development of microwave relay systems.

■ With these new Klystron tubes, relay techniques are simplified and the mechanical problems associated with lower frequency relay links are overcome.

■ Other Sperry Klystrons are available in the frequency range from 500 to 12,000 megacycles. Our Industrial Department will gladly supply further information.




TYPE SRC-12,-20,-21
FREQUENCY 4400-5000 mc
POWER OUTPUT 5 WATTS MAX.




TYPE SRL-7a
FREQUENCY 1825-2100 mc
POWER OUTPUT 5 WATTS MAX.


TYPE 3K27
FREQUENCY 750-960 mc
POWER OUTPUT 1.5 WATTS MAX.

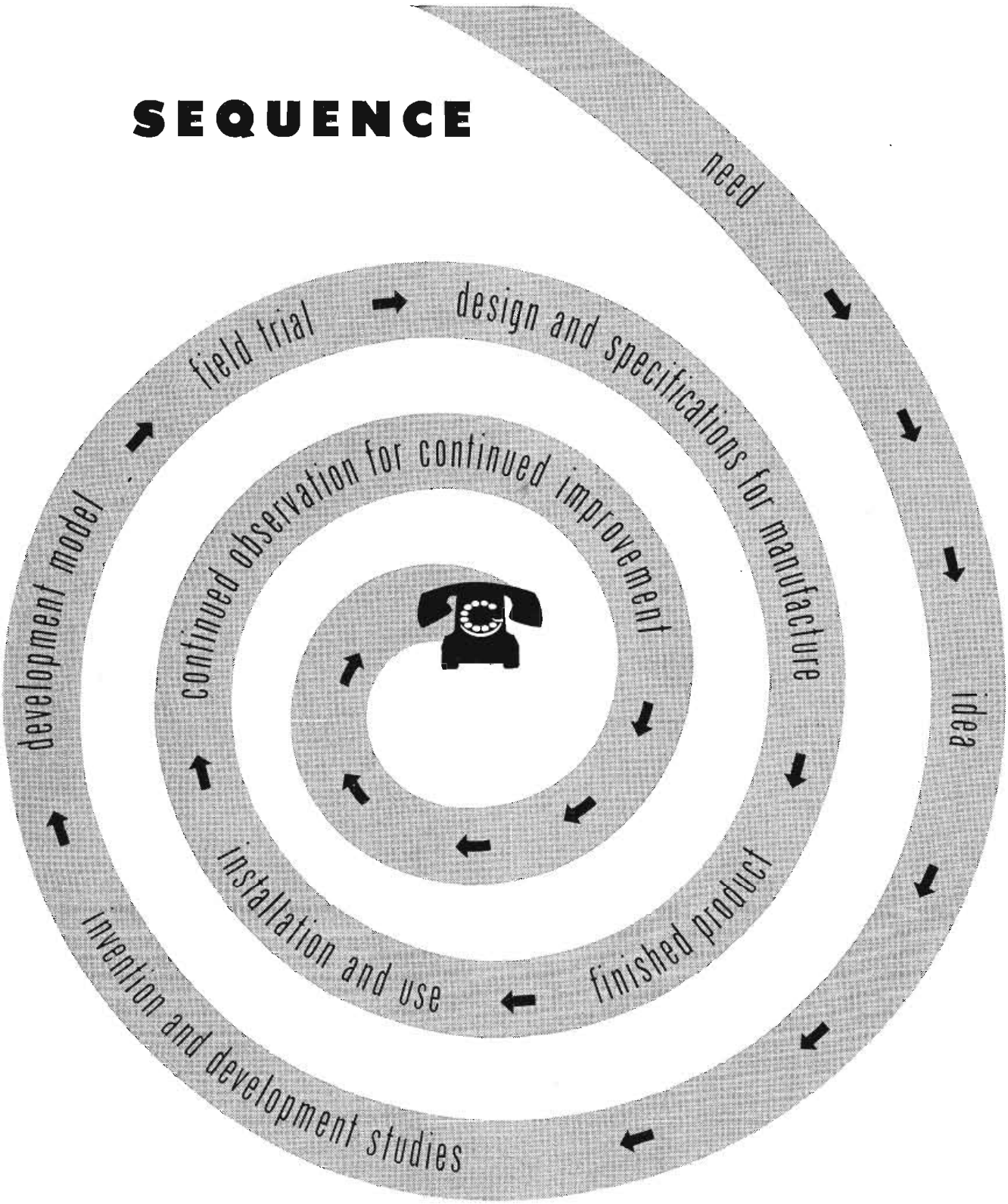

TYPE SRC-8 SERIES
FREQUENCY 5500-7800 mc*
POWER OUTPUT 4.5 WATTS MAX.

*The SRC-8 tubes are available in 100 megacycle steps except for 3 models, SRC-8A, SRC-8B, SRC-8C which are bench oscillators in 400 megacycle steps from 5850 to 7050.

**Sperry Gyroscope Company**
DIVISION OF THE SPERRY CORPORATION · GREAT NECK, NEW YORK
NEW YORK · CLEVELAND · NEW ORLEANS · LOS ANGELES · SAN FRANCISCO · SEATTLE

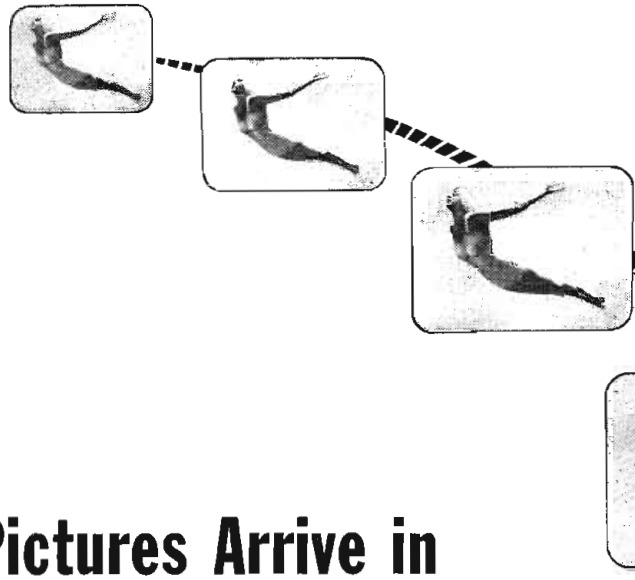
**VISIT THE SPERRY BOOTH AT THE I. R. E. SHOW**

# SEQUENCE

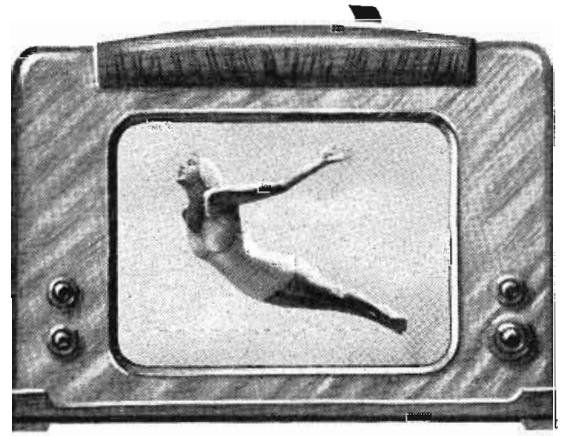



At Bell Telephone Laboratories, more than 2300 scientists, engineers, and their associates are continually exploring and inventing, devising and perfecting for improvements and economies in telephone service.

BELL TELEPHONE LABORATORIES



# The Pictures Arrive in PERFECT SHAPE Over ATV Lead-In Lines



LEAD-IN LINES play an important part in television and FM reception. To be sure of the best performance of your set, specify ATV* lines for your set.

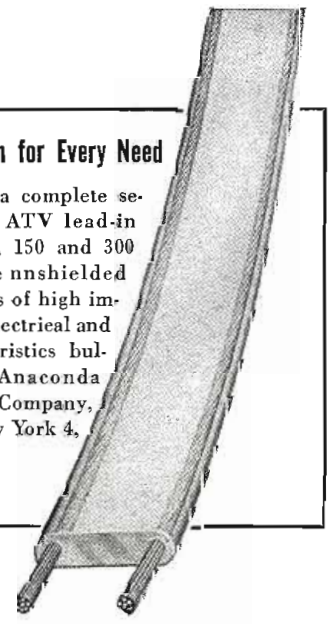
The effects of attenuation and impedance mismatch on FM and Television reception are minimized by Anaconda Type ATV lead-in lines.

The satin-smooth polyethylene insulation of Type ATV line sheds water readily, thus avoiding subsequent impedance discontinuities. This material also has exceptionally high resistance to corrosion. Count on Anaconda to solve your high-frequency transmission problems—with anything from a new-type lead-in line to the latest developopment in coaxial cables.

48447

### A Type ATV Lead-In for Every Need

Anaconda offers a complete selection of Type ATV lead-in lines for 75, 125, 150 and 300 ohms impedance nnshielded and shielded lines of high impedance. For an electrieal and physical characteristics bulletin, write to Anaconda Wire and Cable Company, 25 Broadway, New York 4, N. Y.



*An Anaconda Trade-Mark

ANACONDA

## Anaconda Wire and Cable Co.

**25 Broadway, New York 4, N. Y.**

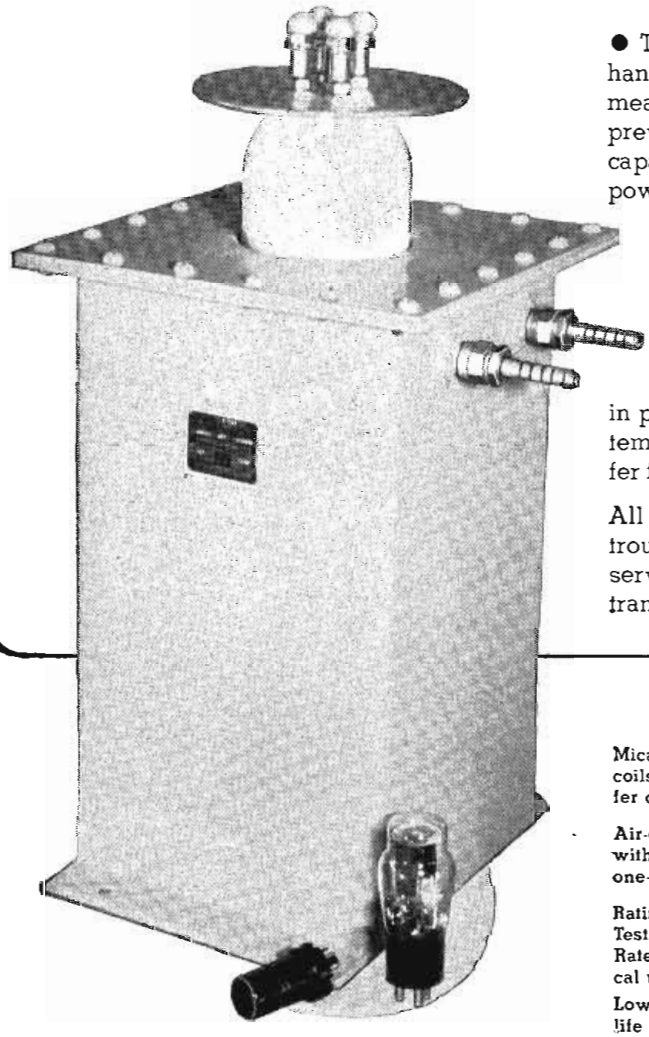
# BOOST KVA RATING BY FIVE OR MORE...

# CUT PRESENT SIZES OF POWER CAPACITORS...

## AEROVOX SERIES 1780

*Water-cooled*

# MICA CAPACITORS



● This new water-cooled oil-filled mica capacitor handles exceptional KVA loads for its size. This means that more power can be handled than with previous capacitors of similar size or, conversely, capacitor size can be greatly reduced for given power ratings.

Series 1780 capacitors attain their higher KVA ratings in two ways: (1) By exceptional design such as critical arrangement and location of sections; choice of materials; specially-plated parts; large cross-section of conductors; careful attention to details and true craftsmanship in production. (2) By the use of a water-cooling system so designed as to provide maximum heat transfer from capacitor section to cooling coils.

All in all, here is a sturdy, compact, hard-working, trouble-free mica capacitor for extra-heavy-duty service, such as induction furnaces and high-power transmitters.

**TECHNICAL DATA ON REQUEST**

*Featuring...*

Mica stacks in oil bath. Cooling coils in oil bath for efficient transfer of heat.

Air-cooled operation, 200 KVA; with water-cooling, 1000 KVA—a one-to-five ratio.

Ratings up to 25,000 volts A.C. Test. Capacitances up to .01 mfd. Rated loads up to 1000 KVA. Typical unit: 20,000 V. at .01 mfd.

Lower power factor (.01%). Long life and large factor of safety.

Provisions for making connections with high-current-capacity conductors. Four-stud terminal. Grounded case.

Heavy welded metal case, hermetically sealed. Exceptionally sturdy construction.

Series-parallel mica stack designed for uniform current distribution throughout.

Silver-plated hardware for minimum skin resistance. To minimize or eliminate corona, terminals are finished with large radii of curvature. Steatite insulator shaped to hold gradients below corona limits.

AEROVOX capacitors

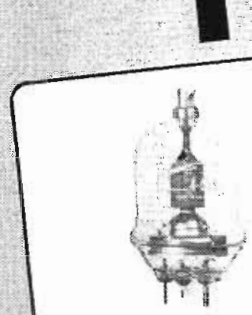
**FOR RADIO-ELECTRONIC AND INDUSTRIAL APPLICATIONS**

AEROVOX CORPORATION, NEW BEDFORD, MASS., U.S.A.

SALES OFFICES IN ALL PRINCIPAL CITIES • Export: 13 E. 40th St., New York 16, N. Y.

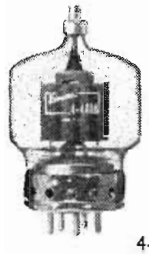
Cable: 'ARLAB' • In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.

# EIMAC TETRODES

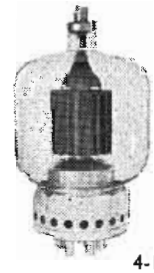











## PERFORMANCE LEADERS

⊙ THESE TUBES HAVE PYROVAC PLATES

### 4-65A

Tops for high power VHF mobile transmitters, type 4-65A is the smallest of the Eimac radiation cooled tetrodes. Conservatively rated at 65 watts plate-dissipation, the tube is but 4¼" high and 2" in diameter. The 4-65A is capable of operation over a wide voltage range, for instance at 600 plate volts one tube will provide 50 watts of power-output with less than 2 watts of grid drive. At 3000 plate volts a power-output of 265 watts is obtained.

### 4X100A

Designed for high frequency applications in which horizontal forced-air cooling would be an equipment design advantage. The characteristics of the 4X100A closely resemble those of the 4X150A except for slightly lower plate dissipation, 100 watts.

### 4X150A

An extremely compact tetrode of the air-cooled external anode type. Rated at 150 watts of plate dissipation it can be operated at maximum ratings up to 500-Mc. When operated as a doubler, the 4X150A is the standout answer to the STL (studio- transmitter-link) vacuum tube problem . . . excellent performance is had up to 1000-Mc.

### 4-125A

Forerunner of the Eimac tetrode line, the 4-125A is probably the most universally accepted power tetrode yet designed. Its Pyrovac plate and processed grids impart a high degree of operational stability, resistance to overloads and exceptionally long life. Rated at 125 watts plate dissipation, one 4-125A will handle 500 watts input with less than three watts of grid drive.

### 4-250A

Higher power version of the 4-125A, type 4-250A also incorporates a Pyrovac plate, and processed grids. In typical class-C operation one tube with 4000 plate volts will provide 1 kw of output power, with 2.5 watts of grid drive.

### 4-400A

Specifically created for FM broadcast service, two 4-400A tetrodes in typical operation, at frequencies in the 88-108 Mc FM broadcast band, will provide 1200 watts of useful output power, at 3500 plate volts, while the dissipation from the Pyrovac plate is considerably under the maximum rating of 400 watts per tube.

### 4X500A

A small, but high power VHF, external anode type tetrode, rated at 500 watts plate dissipation. The low driving power requirement presents obvious advantages to the equipment designer. Two tubes in a push-pull or parallel circuit provide over 1½ kw of useful output power with less than 25 watts of drive.

### 4-1000A

Currently the largest of the Eimac tetrodes, its pyrovac plate is rated at 1000 watts dissipation, the 4-1000A has the inherent characteristics of all Eimac tetrodes—dependability, stability, optimum performance and economy of operation. Type 4-1000A is ideally suited for high-level audio service as well as r-f applications.

Complete data on these tetrodes and other Eimac tube types may be had by writing direct.

**EITEL-McCULLOUGH, Inc.**
**191 San Mateo Ave.**
**San Bruno, California**

EXPORT AGENTS: Frazar & Hansen—301 Clay St.—San Francisco, Calif.

*Follow the Leaders to*

Eimac REG. U.S. PAT. OFF. TUBES

*The Power for R-F*

.022 .0047 .15 .033 .068

# Funny Numbers?

## . . . perhaps, but they are more evidence of SPRAGUE LEADERSHIP!

***New Phenolic-Molded Sprague Tubular Capacitors Produced in Decade Ranges and Color-Coded!***

With the recent introduction of its sensational new *molded* tubular capacitors, Sprague now announces standardized capacities, and color-coding for ready identification of these new units. For example, starting with the number 1, the next numbers in the 20% tolerance decade are 1.5, 2.2, 3.3, 4.7, 6.8 and on back to 10.

Established decade ranges and color-coding have proved their efficiency and acceptability in the resistor industry over a period of years. Now, for the first time, this same practice will allow capacitor manufacturers the many advantages of standardized production—advantages which we feel will be cumulative through the years.

In the firm conviction that these steps toward standardization will prove mutually beneficial, Sprague Electric Company solicits your cooperation and invites your inquiries for information, samples and application data concerning the new SPRAGUE MOLDED TUBULAR CAPACITORS. WRITE FOR ENGINEERING BULLETIN NO. 210 A.

### THE FIRST TRULY PRACTICAL PHENOLIC-MOLDED PAPER TUBULAR!

**Highly heat- and moisture-resistant • Non-inflammable • Conservatively rated for —40°C. to 85°C. operation • Small in size Completely insulated • Mechanically rugged Moderately priced.**

**SPRAGUE MOLDED TUBULAR CAPACITOR COLOR CODE**

| | | | Black | Brown | Red | Orange | Yellow | Green | Blue | Violet | Gray | White |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st BAND | Capacity in MMFD | First Significant Number | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2nd BAND | | Second Significant Number | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 3rd BAND | | Decimal Multiplier | | | 100 | 1000 | 10,000 | 100,000 | | | | |
| 4th BAND | TOLERANCE | | ±20% | | | ±30% | ±40% | ±5% | | | | ±10% |
| 5th BAND | RESERVED FOR ARMED SERVICES | | | | | | | | | | | |
| 6th BAND | Voltage in Hundreds (x 100) | First Significant Number | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 7th BAND | | Second Significant Number | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

**SPRAGUE ELECTRIC COMPANY North Adams, Mass.**

CAPACITORS **SPRAGUE** *KOOLOHM RESISTORS

*Trademark reg. U. S. Pat. Off.

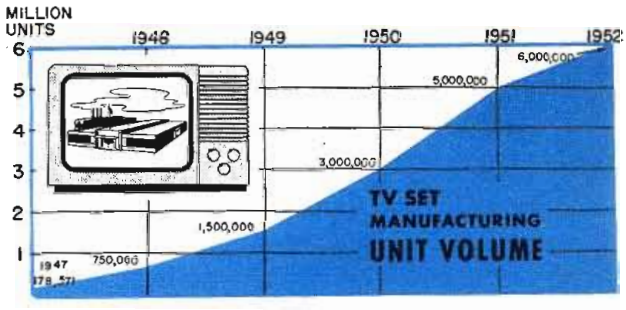
**PIONEERS OF ELECTRIC AND ELECTRONIC PROGRESS**

TELE-TECH
TELEVISION • TELECOMMUNICATIONS • RADIO

# TELEVISION TRENDS

## Present Practice • Coming Developments • Future Engineering

**CHALLENGE TO TV ENGINEERING**—Production of 178,531 television receivers in 1947 is a clear indication of the significant position television is assuming in the lives and development of our country. Our own estimate of the rise in receiver production over the next few years is shown in the chart on the right. There is every indication that television's growth will be paced by the engineers who have made this great medium of communications a reality. Engineering trends in television's further development are reviewed in the ideas and suggestions which follow:




**RECEIVER RADIATION**—Television reception is passing through the shake-down period with nearly 179,000 receivers in use. Comments of the public, however, show that work for the engineer is far from done. Of particular importance is the problem of re-radiation reduction. When widely sold, well (?) engineered sets deliver signals to the antenna of as much as two volts, how can an industry rightfully get indignant over interference produced by equipment used in other fields. We quote George Grammer, ARRL technical director, on this subject: ". . . many television receivers are of such poor circuit design and construction that they are notorious for radiating interference over a radius of several hundred feet, causing picture distortion in neighborhood television receivers. Lack of selectivity in television receivers has also made them vulnerable to image or shadow effect from nearby FM broadcast stations."

**NEUTRALIZING AMBIENT AND TELEVISION LIGHT**—The appearance of accessories and gadgets in any field is evidence of an enormous public interest in the particular subject or product. This is what is happening in television. Engineers are doing pretty well in handing most of the engineering details of receiver design, but the publics' whims are not always fully realized and accessories are beginning to appear on the scene. One of the latest is an accessory designed to mitigate the clash between ambient light and picture highlights on the face of the cathode-ray tube. This comes after engineers have spent many man-years of research in developing a brilliant white screen that can be viewed in a lighted room. Many viewers prefer to have the ambient light condition neutralized by a *neutral-density filter*. Even though the filter absorbs some of the light from the fluorescent screen the picture contrast may actually be improved because of the greater reduction in ambient light on the screen. Further, the filter takes the edge off the picture highlights. Ambient light must pass through the filter twice while television-picture details pass through only once, possibly improving contrast even though the overall brightness suffers. Smoked or color tinted filters passing 10 to 50% incident light may be used. They give the effect of looking at the picture through sun-glasses. (Apparently some people like this).

**LOCATING REFLECTION SOURCES** — In studying reflections, it is interesting to note that the speed of the spot in scanning across the screen of a 12-in. tube (assuming the blanked-out distance is equivalent to the area lost at the edge) is around 191,000 in. per second. An interesting rule for designers and installers to ob-

*(Continued on next page)*

serve about multiple paths is that a signal which reaches the input of a set over a second path one mile longer than the primary path will produce a ghost displaced one inch from the picture (on a screen 12 in. wide). Working backwards, this means that a displaced image with ⅛-in. offset is received over a path ⅛-mile longer. It makes no difference how this extra distance fits into the pattern. The extra path length is noted by the inch-per-mile rule of thumb, and a path can be traced on a city street map showing the probable location of the reflecting surface. This path is an ellipse having focal centers at the transmitting and receiving antennas.

**TIGHTER TOLERANCES NEEDED**—Recently a New York TV station transmitted a picture which had an annoying turnover on the left hand side of the screen. Several engineers who had seen this trouble discussed the problem with a staff member of the TV station in question. The fault is neither fully due to receiver characteristics or to the transmitter adjustments but to a combination of both. The fly-back interval of the horizontal sweep in some receivers extends a few tenths of a microsecond into the period when the blanking signal is effective. In this case a minor extension of the blanking pulse would wipe out the turnover. TV signal tolerances need to be tightened up and this is one point where the public would be quick to notice an improvement. Some line scanning designs do not show this particular effect and their owners are quick to point out the "deficiencies" in neighbors' sets that show a mirrored image at the left edge.

**IMPROVED QUALITY STILL UP TO RECEIVER DESIGNERS**—One of the old bug-a-boos—the worry that a 525-line scanning standard will not give adequate picture quality has been buried, we think, as receiver designers have brought up the circuit characteristics to the point where its detail fidelity approaches 525-line levels. There is still some space left for more improvements by designers of many of the current models. Pretty soon there is going to be much more agitation among viewers aimed at detail improvement in the transmitted signals. It is believed that sharper camera focusing, higher fidelity in the camera pickup tube and more experience by directors in avoiding "impossible" shots will go far here.

**INTERLOCKED SCANNING ON REMOTES**—Momentary loss of picture while the television station is switching between local and remote may be reduced by a technic called interlocked scanning. This requires that complete coincidence be maintained on a line, field and frame basis between remote pickup and local studio. Interlocked scanning will elininate the need to fade to dark screen while switching programs. We have noted a report of some current studios of this problem and a simple solution seems at hand. ("Interlocked Scanning" by DeBaun RCA Review, Dec. 47, pages 651-660).

**ARTIFICIAL SIGNAL CANCELS GHOSTS**—The condition of ghost images in installations in most metropolitan areas is not giving as much trouble as earlier studies suggested. While there may be a limit to what can be done by receiver designers to get around multiple images, there has been considerable thought given to the difficulty. One noteworthy example is the work of John Sanabria and his associates based on the theory that since reflections can be created in a receiver installation by circuit delay effects and mismatches, it should be possible to attenuate many of the multiple images by the superimposition of an artifically produced signal having the right amount of delay and attenuation. Very interesting demonstrations have been made by this group with a special "cable" box connected at one of several possible points in the receiver. The travel time down the "box" and back should equal the multiple image delay. We would like to see the plan worked against some of the full-grown ghosts around the New York area (rather than against the "anemic" ones found in Chicago) for a real test however.

**PRESENT STATUS OF DARK-TRACE TUBES**—References to the Skiatron (you may remember maybe that this is a cathode-ray tube whose electron beam makes a dark trace on the screen rather than a fluorescent one) frequently crop up. A screen in a dark-trace tube acts like a lantern slide in a projection system which would allow higher levels of illumination and possible magnification. Two factors however militate against the use of present-day dark-trace tubes, which give practically unlimited screen illumination: The best materials presently discovered for such a screen take too long to erase the picture, and the screen exhibits a lack of contrast due to an exponental decay of the dark trace. The principles involved are still of great interest but progress must await further findings by chemists and physicists.

We have noted with interest reports on some wartime German developments of these dark-trace tubes for radar display applications. Their Blauschrift tube patterned after the Scophony principles with a screen of

halogen crystals that forms a transparency through which light can be projected. The screen of these tubes, however, includes a self-contained heater that acts as a wipe off. This heat is introduced evenly by an evaporated film of tungsten thin enough to be essentially transparent and with about 100 ohms resistance across the sheet. This film nominally 10 ft. thick, is tapered to produce a more uniform thermal effect. Even with this applied heat (150 watts) about one minute is required to erase a pattern so that television applications of this effect are not in sight now. (E. S. Henning, Air Material Command, in ATI Technical Data Digest, Wright Field, Feb. 1, 1948).

**MONITORING STANDARDS**—A problem in standardization which we hope will be considered and solved soon will be that of keeping the dc levels in the studio signal for a given type of program reasonably consistent in all stations. Getting up to "diddle" a brilliance control gets to be monotonous, and receiver owners will some day discover that it would be unnecessary if stations would take pains to settle the problem among themselves and set their monitoring apparatus to an agreed standard or apply some sort of automatic level regulators.

**ARE DESIGN ENGINEERS HEP TO COMPONENT IMPROVEMENTS?**—Queried on what new specifications set manufacturers require for TV, one resistance maker said he developed some new high-frequency resistors but nobody has asked for them. The question is: Are more conventional components being used where fewer new ones would give electrical equivalence? In other words, is the design engineer rewriting specifications to which the parts manufacturer may gear his production for more efficient, less expensive TV receivers?

**TELEVISION CENTERS WITH MASTER TOWERS**—Work is continuing on the development of the master television tower which would provide a single transmitting location of substantial height for television (and other UHF) service. Such a tower has been described in these columns, may soon be a reality in New York City where the few existing skyscraper locations have already been reserved by pioneer stations. The New York tower, planned for a 2650 ft. height, would just about triple the height of the average TV antenna now used in this area. Its architectural planning is in the hands of Van Alen, designer of the Chrysler Building.

For even ordinary reception the problem of orienting each receiving antenna to point to the particular station desired is an unnecessary expense. The condition is exaggerated when new stations at other locations are put up. The additional signal strength resulting from the higher antenna would cut down gain requirements in each receiver, and thereby their costs.

The major engineering problems involved with this structure have been worked out, and the technical problems introduced by possible interaction of signals from many stations would be largely alleviated by allotting each station complete occupancy of a particular operation level where much of the station equipment is directly adjacent to its own radiation arrays.

**ANTENNA HEIGHT VS POWER**—What is probably the most extensive survey of television signal coverage ever undertaken is nearing completion by Dr. T. T. Goldsmith and associates at DuMont's. He is finding that rules based on a line-of-sight principle are not even a rough approximation of what can be expected in the matter of video reception possibilities. Excellent signal strengths were found in most locations in the circular area covered (having about a 50 mile radius) even behind rather important hills. Strangely, large buildings near the transmitter (such as Rockefeller Center in New York City, two blocks east of WABD) cause more damage by attenuating the signal in a relatively narrow sector extending west, than a relatively larger elevation closer to the receiver. WABD's higher power (about triple that of WNBT) helps, but does not completely make up for a somewhat lower antenna height, at least in many directions. The height vs power relation seems to be headed toward high antennas.

**FACTORS IN LOWER TV SET PRICES**—The trend towards lower-priced receivers will be facilitated by these factors: Contributions by engineers and circuit experts; new production methods which will adapt assembly procedures to the problems of making large complicated chassis; intensified competition.

**NEW CIRCUIT DESIGN COMING UP**—One of the accepted rules of television receiver design has been that a superheterodyne circuit was required. How else can two signals—sight and sound be tuned in with a single operation? However, with the current progress in the use of intercarrier modulation principles, TRF receiver circuits are possible. We are already hearing of 8 and 10-tube television receivers under consideration.

We do not wish to imply that fewer tubes mean cheaper sets. Usually the opposite might result. The radio designer's ideal 25 years ago was to get good reception on a one-tube receiver. It was not until this was proved a fallacy that prices began to come down. By using lots of tubes and rather commonplace and inexpensive circuit components in place of highly efficient, low-loss items, better sets also resulted. At present, for example, a six-tube video IF chain with simple stagger tuning may prove cheaper than a three-tube affair with elaborate band-pass coupling filters.

In a few years receiver-circuit layouts may settle down to one choice method but never before have engineers been confronted with so many alternate possibilities for solving a problem. The winner in the long run will be the company whose engineers can find that design first.

# WHAT'S AHEAD in TV Receiver Engineering?

By Dr. A. F. MURRAY, Consulting Editor, TELE-TECH Washington Bureau

**Public's demand for larger pictures, elimination of receiver radiation characteristics, lower cost sets pose some of the problems for TV engineers to solve**

TELEVISION is rolling along. Over $120 million of the public's money has been invested in receivers and the rate of such investment is increasing rapidly as more and more cities are being served by newly-installed transmitters. To keep television rolling it is necessary that the owners of receivers be kept satisfied with what they see on the screens of their sets. This calls not only for good programming but also demands that receiver performance and picture quality satisfy.

The engineer can do little about program quality, but picture quality on the receiver screen *is* his responsibility. Therefore, the television engineer must face squarely the task of improving picture fidelity within the framework of the present FCC monochrome standards.

The need for improvements in receiver engineering is dramatized in the examples of faulty or unsatisfactory home receiver reception given in the three cases elsewhere on these pages. Suggested improvements to be effected by television engineers are as follows:

HIGHER POWER. The most important improvement would be higher power at the transmitter. It is believed that the FCC now agrees that an increase from 5 kw to 50 kw would be highly advantageous to television service. It would override a large part of interference difficulties; it will aid sync stability at the receivers; it will lower the cost of receiving antennas; on the other hand it would mean larger investments in transmitters and more development work ahead of the transmitter tube engineers.

## *The Public Complains . . .*

**PICTURE QUALITY—INTERFERENCE: A television owner invites friends to watch the football game. Things start smoothly with the kick-off, but then ignition interference from an automobile "tears out" the picture and the play is lost. Later, the local FM station or harmonics from an amateur's station puts "patterns" across the screen. Later, when a clear picture emerges, a visitor asks, "What's going on across the field?" No one can tell because the resolution of the camera is not good enough.**

**Owners are not going to be satisfied with their receivers until they can get a picture quality comparable to 16 mm movies. More improvements to achieve this, such as the aluminum-backed, high-voltage cathode-ray tube are still desired.**

**UNIFORM TRANSMITTER ADJUSTMENT! The user of a television receiver living in New York City (or Los Angeles or in any other large city with more than one station) carefully makes all the necessary adjustments for signal reception from the station transmitting the test chart at the time. He is getting good results and seems happy. But later he switches to another station and gets poor reproduction results. Circles are no longer round, black blanking bars come into the picture and similar non-uniformities are noticed. Now he must try and readjust the set all over again.**

**The cure is in uniform transmitter adjustment. Formulation of rules on this subject by the FCC and cooperation between stations in observing rules would end this fault.**

**SYNC CONTROLS: TV comes to town. The radio dealer sets up the receiver and arranges a grand opening. Customers crowd the store and the show begins. But despite feverish knob twirling and fruitless checking, the best that can be "unveiled" is an unsynchronized, unrecognizable picture. Gradually the public fades and the consensus of opinion is "... when television pictures improve, I might buy a receiver." Later, a TV engineer drops by. He increases the gain control, readjusts the horizontal control knob—and a beautiful, steady picture results.**

**What improvements are needed? Trained demonstrators, naturally. But how about entirely removing the troublesome sync controls from the receiver?**

1947. Recent photograph of a viewing screen image. Tendency of the public is to compare its quality with that of a 16 mm movie film

195 ? What effect will new engineering developments have on viewing screens in the 1950s? TV is judged by picture quality

TV CAMERA IMPROVEMENTS. The transmitted picture must have more definition within the 525-line standard; more contrast and linear scanning (no distorted test chart circles). Camera tubes should be perfected so that they embody the resolution of the iconoscope without its shading difficulties; the sensitivity of the image orthicon without its fuzziness.

UNIFORM TRANSMITTER ADJUSTMENT. Variations in transmitter adjustments which affect synchronizing so seriously that receiver readjustment is needed when switching from transmitter to transmitter, can be overcome by adoption of uniform standards. There are no such standards at present, but the industry group on TV standards, sponsored jointly by RMA-RTPB, cooperating with the Engineering Department of the FCC could specify one. Such a device would also be used to observe departures from linear scanning and thus aid in keeping those test circles from degenerating into ellipses. (More accurate methods for doing this are available than merely observing the roundness of the circle on a standardized monitor c-r tube.)

The quality of synchronizing signals from remote pickup transmitters should be improved.

The quality of the transmitted picture in general should be raised to give more resolution by close attention to such points as: ample transmitter overall band-width, 5 mc if possible, over which the amplitude and phase response is satisfactory; freedom from loss of picture detail resulting from "noise" or unsteadiness of sync; and the overall Response Characteristic which shows the relation of Light Input to the Camera to rf Power Output, should be examined with care. The possibilities of improvement by "predistortion" lie ahead but standardization with receiver designers is first necessary.

*Dr. A. F. Murray, a consulting television engineer in Washington, D. C., has a long record in television engineering dating back to his association with RCA and Philco where he was instrumental in the early developments in electronics and television. His TV experience extends back to the days of the scanning disc. More recently, he served for 5 years in the communication and TV fields with OSRD during the recent war. He was also chairman of the RMA Committee for TV Standards for several years.*

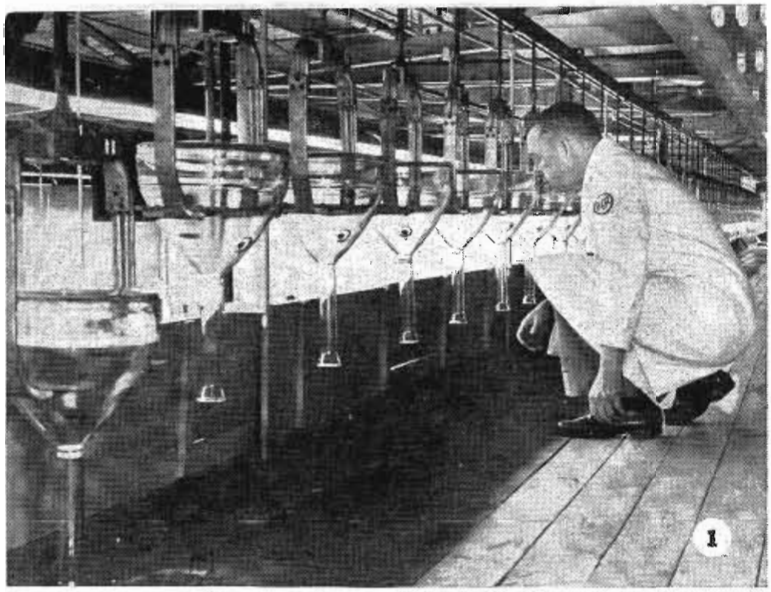
LOW-COST RECEIVERS. It is of prime importance to simplify and lower the cost of receivers. These two objects do not always go hand in hand. However, increased transmitter power will effect a reduction in the number of tubes, a simplification in sync circuits and a reduction in the total amplification required.

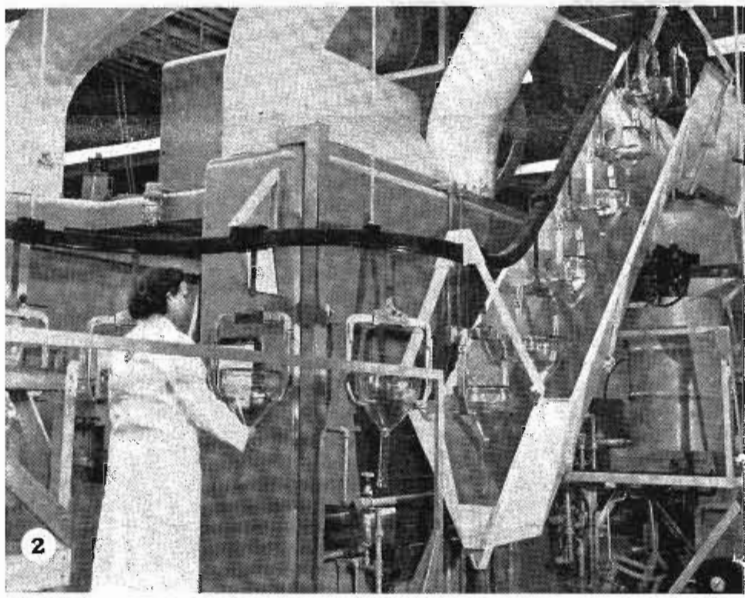
ELIMINATE V AND H CONTROLS. Vertical and horizontal sync controls should be made automatic or at least removed from the front of the set. It is realized this is asking for a lot, but it can be done.

PERMANENCE OF ADJUSTMENT. Scanning linearity should not only be improved but all circuit constants of the receiver should be of such quality and design that, once properly set at the factory, there will be no change, hence no deterioration of performance with time, temperature changes or normal use. Frequent visits of a service man to correct such "drifted" adjustments should not be required. Properly transmitted images of circles should not only be round but stay round day after day.

As an example, a high-grade projection receiver of a well-known make, in use in a friend's home for about a month had a radio tuner that had drifted 200 kc so that when it was tuned for best picture there was no sound! Those of us who have had to maintain the video and synchronizing circuits of a TV transmitter at peak performance know that it is a continuous job. It is even more difficult to secure permanence

(*Continued on page* 66)





# CRT Plant Geared

## RCA uses automatic equipment to speed-up production

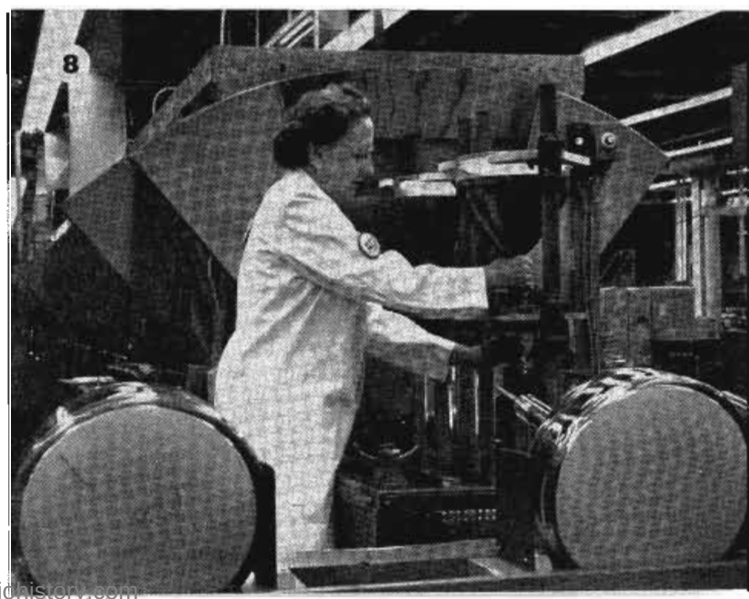
1. Conveyor lines hundreds of feet in length carry cathode-ray tubes from process to process in RCA's Lancaster plant with a minimum of handling.

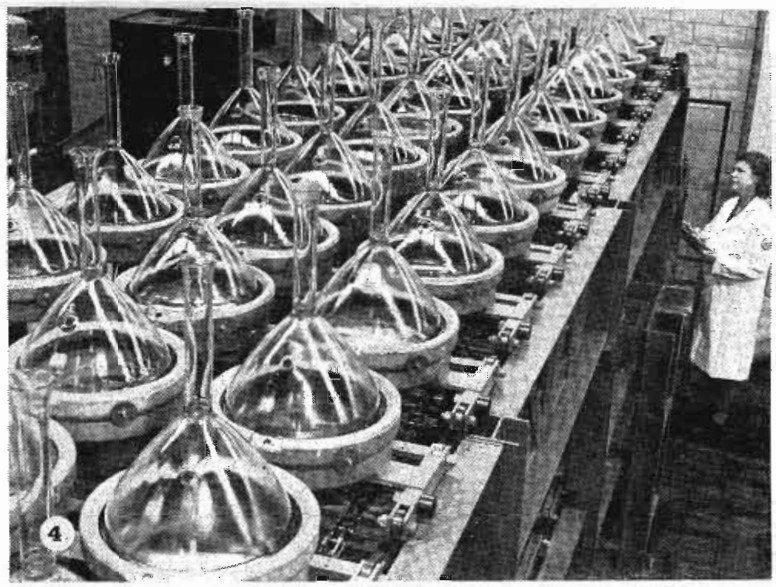
2. The tubes emerge from the "laundry" where the glass envelopes are washed in various cleansing solutions to remove all impurities from the glass.

3. Tubes are conveyed to the contact insertion machine where a hole about the size of a dime is melted through the glass of the tube by means of high-frequency heating and a metal contact button is inserted and sealed.

4. This specially designed machine termed the "settling belt" carries tubes slowly along so as not to disturb the luminescent coating in the tube.

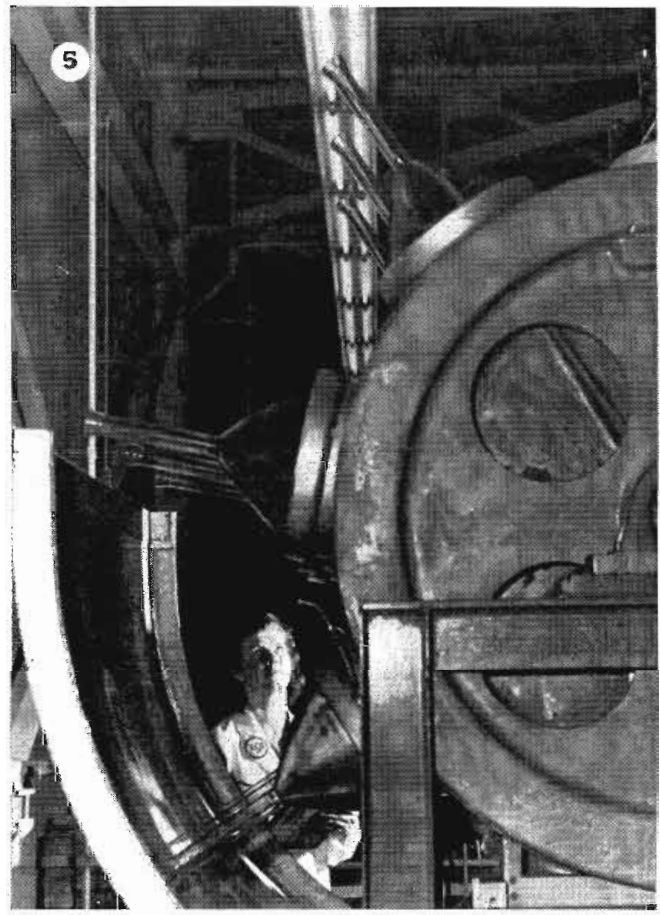
5. At the "spillway" end of the settling belt the watery part of the solution that deposits the luminescent face on the tubes is poured off slowly. The machine is cushioned with ball bearings to prevent vibration.



# for Mass Output

## of television viewing tubes at Lancaster, Pa., plant



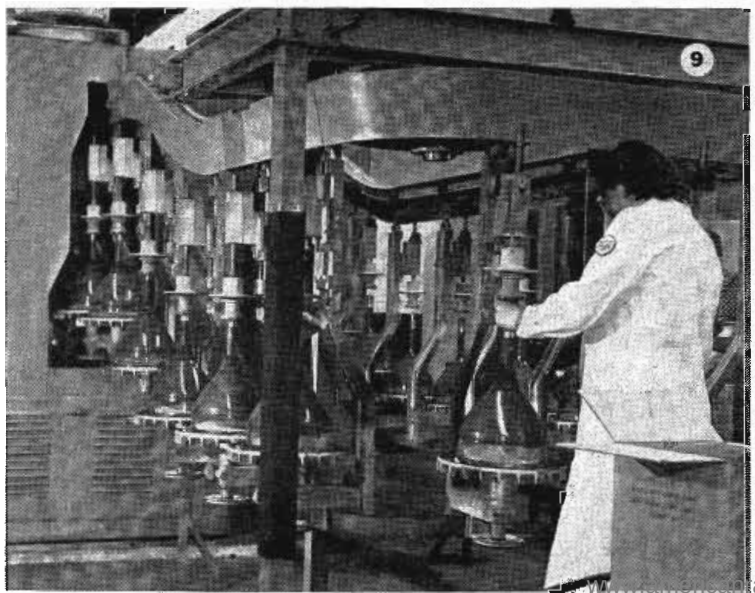
6. A black inside coating is applied to viewing tubes as shown. A long brush is inserted in tube which is whirled by a special machine. The black coating collects secondary electrons from the fluorescent screen.

7. Cathode-ray tubes moving out of the annealing machine where strains in the glass are removed by heating and then gradually lowering the temperature.

8. Tubes are automatically exhausted and pinched off at the end of the belt line where they are placed on another conveyor headed for the next process.

9. A conveyor belt of tubes on their way to get a black outside coating. Black coatings inside and out form a capacitor utilized in the set circuit.

10. General view of one corner of the RCA Lancaster plant showing cathode-ray tubes in racks between operations. Sealing machine in foreground. These production line technics have enabled RCA to increase CRT output many-fold.



# BIG PICTURE Practices

**Direct view, reflective and refractive projection and lens magnifiers are some of the methods in use and being developed by TV engineers to meet demands for larger pictures**

PREWAR ideas about big screen picture sizes in television receivers were generally limited to the 10 and 12 in. tubes. Today a survey of the public's thinking would probably place these sizes in the "small" picture category. This article surveys the present trend to larger pictures and reports what is being accomplished. Since there are several methods for getting larger pictures, competitive efforts to achieve this objective will probably result in bigger picture screens at relatively lower costs.

In all of the systems, a circular screen on a cathode-ray tube is the source of the picture which is viewed as a rectangle with a 4:3 ratio dimension. In most of the systems the pictures are enlarged to a point where the corners are cut off so that the resulting size is a little larger than theoretical value: height = 60% of screen diameter and width = 80%.

The two most common methods for getting larger pictures are by direct view and projection. It is interesting to note that of these two methods, the direct-view system has been likened to peering at an actual scene through a mirror and the projected system like looking at a picture of the scene. Highlights from room lights and windows are largely responsible for this difference.

## DIRECT-VIEW PICTURES

Several television groups have long advocated the use of large, direct-view cathode-ray tubes as a solution to the demand for home receivers giving pictures of suitable dimensions. DuMont has long produced receivers with 20-in. screens for the many users who claim the method greatly preferable to projection television. The advantages are claimed to be greater contrast range, highlight brilliance and clarity of picture detail when compared with a projection system with its losses in the optical elements which have unavoidable aberrations in mirrors and lenses and dispersion in translucent screens. The ultimate trend will depend upon the degree of engineering improvement in the systems and upon the relative costs of each.

In the case of direct view, disadvantages are higher cost blanks for the cathode-ray tube with added weight and greater difficulties in production in quantities. The gun electrodes are more massive although the focusing difficulties are substantially less and lower voltage operation is possible. All the light developed is useful since none is lost by surface reflections and absorption in the lenses and mirrors.

### METALLIC TUBE

A new development in direct-view tubes is under way at the Lancaster plant of RCA, where a metal-enveloped tube with a screen 16 in. in diameter has been developed. A sealing process has been perfected which will fuse the large glass discs to the metal "megaphone" that makes up the walls and neck of the

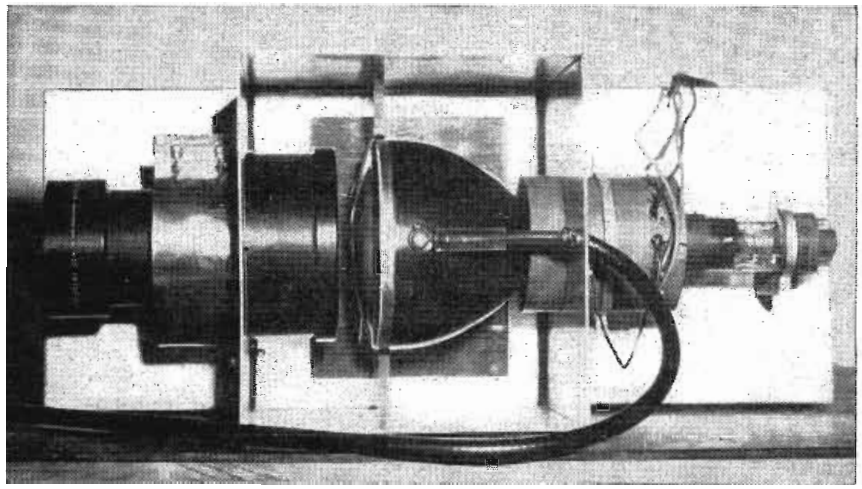
***TV Picture Trends? Try These for Size . . .***

- **Direct View Pictures**
- **The Metallic Tube**
- **Projection Pictures**
- **Norelco Projection**
- **Lens Magnifiers**
- **Theater Projection**

tube. This tube is being prepared for mass production technics in anticipation of the trend of home users to larger picture receivers.

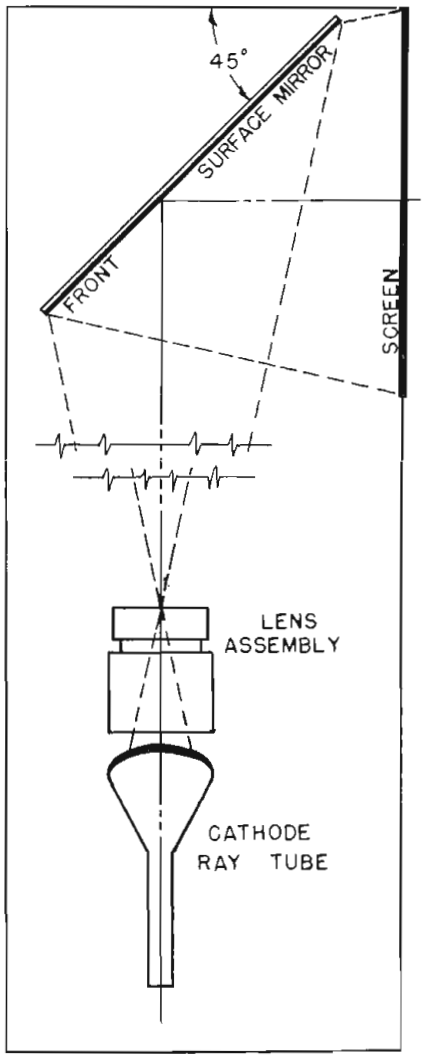
The new metal tube results from the perfecting of a process to vacuum-seal large areas of metal to glass. The 16-in. diameter face provides a picture area of 125 sq. in. The cone of the tube is metal, the neck and the face plates are glass. This 16-in. tube is expected to fill the growing demand for a size of picture midway between the popular 10-in. size direct-viewing picture and the larger projection picture.

As stated by L. W. Teegarden of RCA, "This is the first metal television kinescope ever developed and is the outgrowth of 13 years of research, development and production in metal receiving tubes by RCA."



**Need for a detached screen with refractive systems is avoided in the above optical system of U. S. Television, using a B&L lens assembly with C-R tube as shown above**

# PROJECTION PICTURES




**The f/1.9 lens assembly shown in diagram is rigidly mounted on chassis with the 5TP4 tube. (U. S. Television system)**

In contrast to the large direct-view tube, engineers interested in projection systems employ the small-diameter cathode-ray tube with a refractive lens of a type similar to those used in movie projectors.

By working with a small image the substantially reduced cost of such a lens places this method in the running with the highly efficient optical system afforded by the Schmidt arrangement. Much more is now known about high-intensity metallized screens and precision focusing of electron rays at high voltages, and so the lowered efficiency of the refractive lens with its greater loss of illumination can be made up with extra kilovolts on the anode.

What is gained is a less-elaborate optical mounting system where the precision of positioning of the mirror, lens, tube and screen (each must be aligned in three dimensions) in the Schmidt method is largely avoided. Table-top sets with projected images are possible with the user supplying his own screen and balancing picture size with brilliance according to his own desires. It is mentioned that the usual Schmidt lens system must be designed for a particular magnification, whereas with a refractive lens a fairly large range of screen sizes can be accommodated with only an axial adjustment of a lens, as with the usual film projector.

## UST REFRACTIVE SYSTEM

The U. S. Television Co. uses a lens in its projection system that has an optical path as shown in the accompanying drawing. This company's receivers have 15 x 20-in. and 22½ x 30-in. screens. The lens used is a Bausch & Lomb; its precision design has been laid out to utilize production expedients so that the cost can be brought down considerably. It is a five-element coated lens with an f/1.9 opening and a focal length of 5 in. It is being used by this company in conjunction with a tube of 5-in. screen diameter. Using a standard projection tube of 27 kv, it will give a highlight brightness of 17 ft. lamberts and a magnification of from 5 to 7½ times. The magnification of the system can be varied over fairly wide limits by simple movements of the lens position.

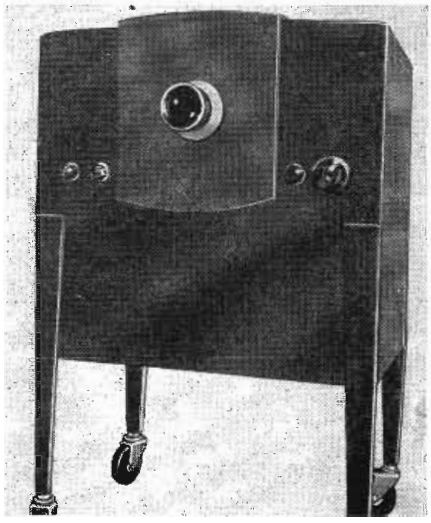
## FIRST-SURFACE SCREENS

For projection systems using refractive optical methods, the pipe-shaped tubes with first-surface screens have characteristics which are of much interest to designers concerned with projection set designs for tomorrow. The shape of the tube may be a handicap for use with present day Schmidt systems, but here again the ingenuity of de-

*(Continued on next page)*

signers may convert handicaps into advantages by, say, shaping the tube wall to that of a spherical mirror and locating the flat first-surface screen at the desired focal distance. This and other ingenious arrangements have been mentioned by Dr. Szegho and his staff at the Rauland Co.

The first-surface screen, which has long been the subject of research in this organization, along with metallized screens of the usual sort, has several useful features. The screen fluorescent material is deposited on a metal plate which is mounted normal to a viewing window but oblique to the electron stream. Some of the features are as follows: high thermal conductivity, because of the metal backing; low "sticking potential" for the same reason; insensitivity of the bulb to deflection distortion by touching the glass; greater leeway is possible in determining the fluorescent screen coating since the front-surface screen compromises between optimum thickness for fluorescent efficiency and translucency (in the ordinary tube the screen is viewed through the coating from the side opposite to that which is bombarded). Screens from 3 in. diameter and up have been developed, the larger sizes being suitable for theater screen projection. Also with no halation effects, good contrast is possible and some glass surface reflections are neutralized.



Vision-Master projection television receiver designed by Colonial Television Corp. of New York. This mobile unit projects a 7x9 ft. image

## BIG SCREEN PROJECTIONS

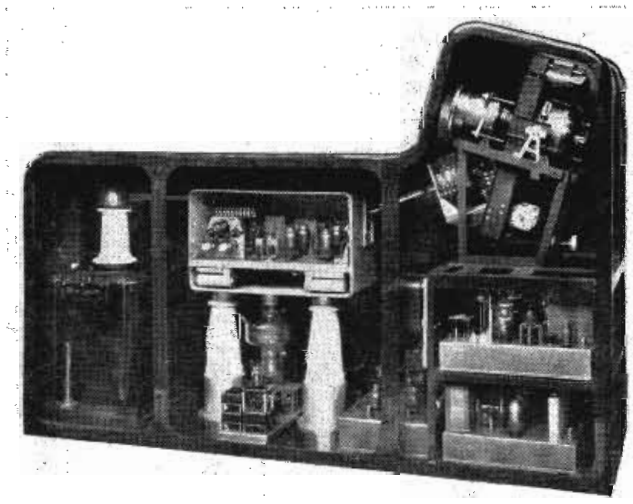
Even larger projection installations with refractive optics have been made in a number of instances. Noteworthy examples are the installations by Cage Projects Inc., (Upper Montclair, N. J.) where screens from 6 x 8 ft. to 7½ x 10 ft. are achieved by the use of a refractive optical system. The lens in a set-up to cover this larger screen has an effective focal length of 11 in. and a "speed" of f/2.3. The throw to the screen is around 30 ft. For this service, a specially designed cathode-ray tube has been developed that will handle the 100 kv anode potentials needed to give satisfactory highlight brilliance for a 75 sq. ft. coverage without sparking or corona.

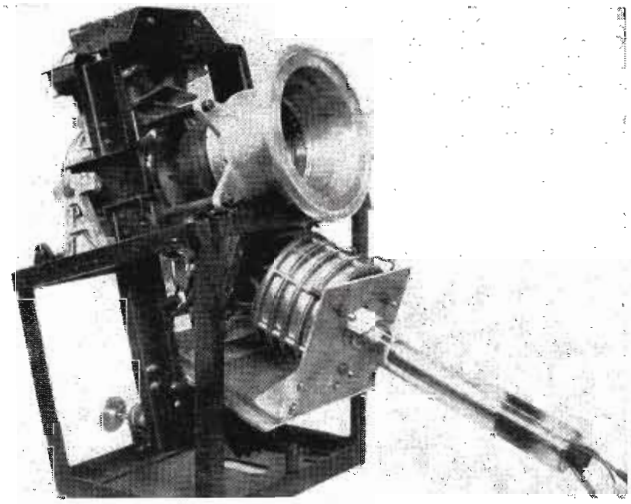
The field of refractive systems for television is fairly wide open to researches and it is expected that much more will be heard about this method of projection in the future. The use of contact lenses covering the face of the cathode-ray tube screen, possibly of the plastic and fluid combination, is one arrangement being considered. The elimination of halation effects between the glass surfaces of the cathode-ray tube screen increases the contrast and definition factors.

A recent addition to the projection television field is a wide angle refractive lens system with a variable focal length — a development of Wm. Mayer for Tele-sight (Katonah, N. Y.). This lens at its 5-in. f.l. setting has an opening equivalent to an f/0.8 speed. The focal length is variable from about 3½ in. to more than 10 in. to satisfy various projection screen requirements found in practice. Design expedients are incorporated that permit this lens to be made at reasonable costs.

**Large screen projection console below was developed in France for their 450-line system. A large projection cathode-ray tube, with a first-surface screen, swings in an adjustable cradle (right) with magnetic focusing coils (circular) and the deflection coils (rectangular) on offset neck of tube and field control coils at top**

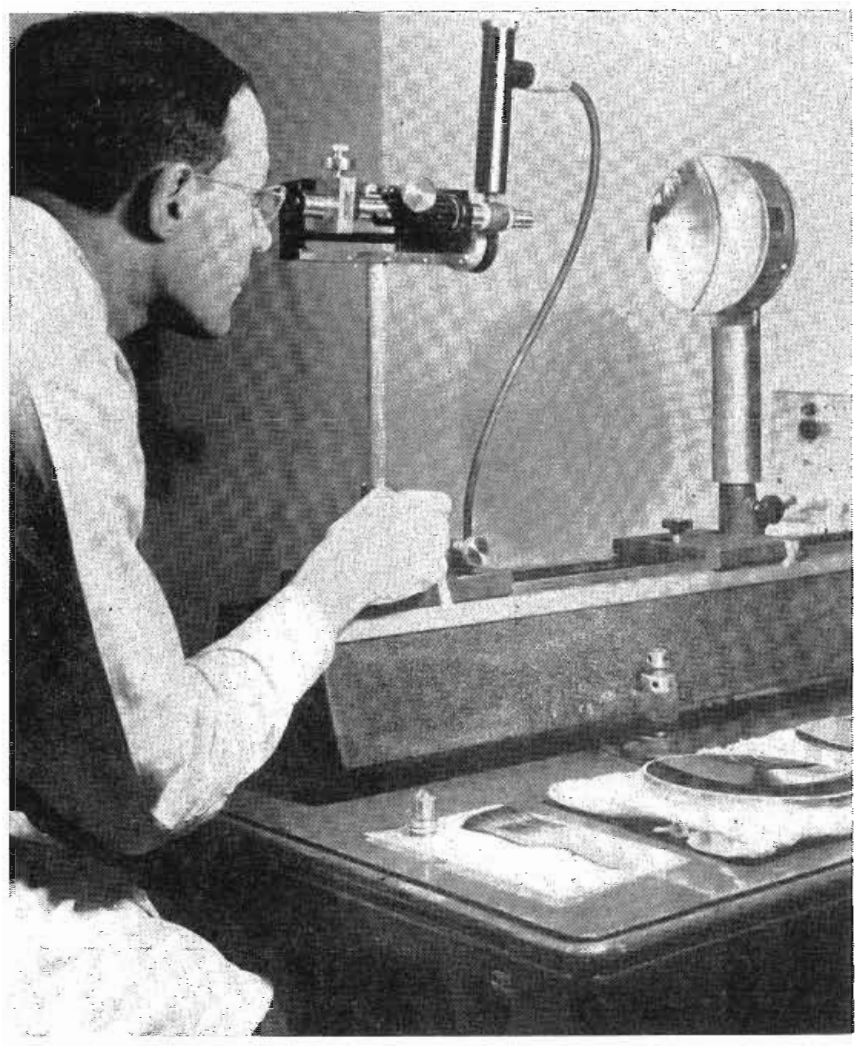
**Projection lens is shown below (upper center of CRT mount) opposite the screen of the tube. Cradle forms part of console shown at left. Gun of tube is at high negative potential necessitating substantial pillar insulators holding the video amplifier chassis and a large coupling capacitor to the rest of the TV circuit**





*AMONG the many picture display systems described on these pages there is no one method that seems superior to all others. The television art is expanding so rapidly that trends are evident in all directions. Public's preference will ultimately depend on price, quality and picture size.*

*Small tubes such as the one described on this page require simple electron gun assemblies and relatively modest layout requirements for their production. One problem was to get the spot to focus at a point small enough to produce a 525 line raster (area about 1.35 x 1.8 in.) but this appears to have been well handled. A similar problem was met in the scanning beam of the smaller image-orthicon mosaics, although the parallel is not exactly the same since in the latter the electron density gradient at the leading edge of the spot is all important.*



**Smaller elements in the Schmidt projection system used in the Philips Protelgram (Projection Television Program) arrangement require adherance to precise specifications. Spherical mirrors are being checked here on an optical bench for focal length and other factors**

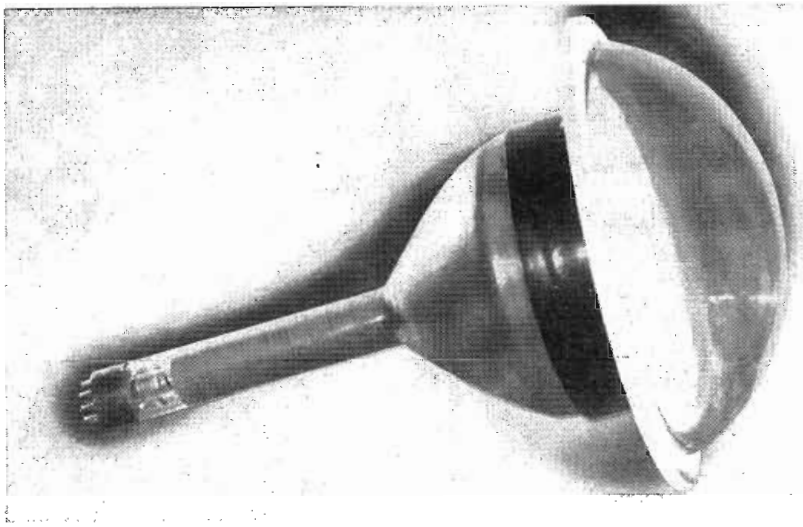
# NORELCO PROJECTION

NORTH American Philips Co., U. S. affiliate of the famous Dutch tube maker, discloses a new packaged Schmidt projection system complete with a small high-voltage unit that is readily adapted to either console or table models. This development, originally described by Philips engineers at the 1947 IRE convention, is called "Protelgram," and is built around an all-magnetic 2½-in. cathode-ray tube. Here a complete Schmidt projection system with small-sized parts has been carefully integrated into a fixed focus unit by the combined skills of the company's American and Holland engineers.

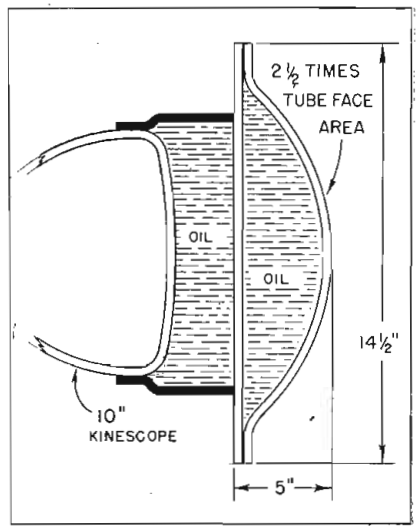
The tube forms an extremely intense, sharply focused image at the center of the folded Schmidt system all mounted in a metal box 8½ x 5½ x 9 in. A 7½-in. focusing extension is contained in the long, slender neck of the tube. The tube has a magnetic deflection and focusing yoke with similarly reduced dimensions. Because of the small deflection displacements necessary, modest demands on the scanning circuits are needed, even at the 25 kv potential applied to get the required brilliance. A clever alignment system insures permanence of the tube position with respect to the optical parts.

The Schmidt mirror and correction lens are at right angles to each other with a plane mirror interposed at 45°. A rather unusual method of making the Schmidt corrective plate from gelatine by a controlled shrinkage process assures accuracy and low cost. All active parts of the optical system are protected from misadjustment, dust and vibration. This arrangement keeps the deflection coils and the tube's neck and base out of the optical path and permits a fixed rigid mounting of the elements essential to good optical focusing.

An important part of the system is its self-contained, high-voltage source in a small sealed container. This unit contains 1000 c/s oscillator and a tripler rectifier. A form of AVC on the oscillator tube provides unusually close regulation of the dc output. The brilliance is adequate for any home projection receiver, such as a 12 x 16-in. screen. A number of receiver manufacturers are expecting to incorporate this system under a variety of mounting arrangements and screen types. Production in substantial numbers will be reached by midsummer. (A full description of this system will appear in the April issue of TELE-TECH.)



Photograph of the Liquid Lens Co. magnifier. The black collar connects the kinescope with the lens. Space between the fluorescent screen and magnifier screen is filled with oil




Cross section sketch of the coupling arrangement and oil chambers of the liquid lens

# LENS MAGNIFIERS

The popularity that is accorded lens magnifiers has been brought about by earlier set owners who selected a direct view television with a small screen. At present there are several relatively inexpensive lenses in use of a transparent plastic material (solid or like an oil-filled pillow). Indications are that such an accessory is by no means a temporary gadget, and the implication is that cabinets on all direct view sets should be designed to carry the lens "outrigger." The magnification obtained is, of course, equal to the ratio of the length of the lens and the length of the normal picture on the cathode-ray tube. It averages a little more than 1.5 to 1, thus increasing the useful area by at least double.

The earlier use of glass for lenses for magnification has changed, in most cases, to the light-weight plastics. The most recent designs have been formed of clear plastic sheets, preformed into a pillow shape and filled with a clear mineral oil having required optical density. One lens manufacturer increases the viewing angle by cupping the back face of the lens slightly and placing the cathode-ray tube as close to the lens as practicable. The slightly curved face on the back of the lens increases the critical angle at which complete reflection takes place. Viewing angles vary from 50° to 150° or more, depending on what the viewer considers a satisfactory picture. If magnification is increased, the viewing angle suffers.

The magnification effectiveness of a lens in front of a television tube can be determined by a rather simple relation. The definition of the magnification is the ratio of the apparent size of the picture to its actual size on the screen, or in most cases, the ratio of the diameter of the lens to the diameter of the cathode-ray tube screen. In most cases, however, the lens has been "squared off" to reduce cost and weight.

## LIQUID LENS

A recent development in plastic lens technic (by the Liquid Lens Co., New York) is aimed at improving the viewing angle as well as picture contrast. While the picture size is roughly doubled, there are no dead areas. Improved picture quality is also attained through the elimination of halation between the glass surfaces of the cathode-ray tube window which is responsible

TV PICTURE MAGNIFIERS BY MAKE AND LENS APPLICATION

| Company | Picture Tube Size (inches) | Approx. Equiv. Tube Size with Lens Magnifier (inches) | Lens Dimensions (inches) | Lens Thickness (inches) |
|---|---|---|---|---|
| Walco Sales Co. | 7 or 10 | 10 or 12 | 9 x 12* | 3¼ |
| | 10 or 12 | 12 or 15 | 14 x 19* | 5 |
| RCA | 7 or 10 | 10 or 12 | 14½ x 17½* | |
| Liquid Lens Co. | 7 | 10 | 9½† | 3¾ |
| | 7 | 10 | 10½† | 3¾ |
| | 10 | 12 | 14½† | 5 |
| | 12 | 15 | 18† | 6 |
| | 15 | 20 | 24† | 7 |
| Transvision | 7 | 10 | 10† | 3½ |
| | 7 or 10 | 10 or 12 | 12 x 9* | 3½ |
| | 10 or 12 | 12 or 15 | 15 x 12* | 5½ |
| | 15 | 20 | 18 x 15* | 6½ |

*Rectangular †Circular

for the halo effects around the focused spot.

The remarkable results obtained with this lens comes from the use of clear oil to fill the gap between the lens and the face of the tube. The oil is of the same type as that used in the lens and has approximately the same refractive index as the glass and plastic. The combination results in eliminating two reflective surfaces. Light rays emerging from the outer surface of the tube, which would normally diffuse somewhat, are kept collimated until they reach the lens.

Elimination of the air gap provides wide-angle viewability and is very close to 180°. It is quite possible to recognize a face, for example, when the lens is viewed very nearly sideways. Each lens is prefocused. Magnification holds up over essentially the whole viewing area. Tests indicate that a new set of values in picture quality with magnification would result with a different screen production technic — where a scattered surface gives better results. For horizontal mounting, a special "bubble-lock" can be designed into the lens to trap any air bubble which would otherwise appear at the center of the lens. To give an idea as to the magnitude of an installation, the weight of a 14½-in. lens for a 10-in. tube is about 40 lb. A 24-in., 130-lb. lens for a 450-sq. in. picture is also receiving some attention by set manufacturers.

Lens magnifiers are reported to be giving satisfaction to set users.

# THEATER PROJECTION

High quality television pictures measuring 18 by 24 ft. are now possible with an advanced optical system developed by RCA. This huge movie-screen picture is produced by the highly efficient Schmidt optical system.

Three major elements combine to make up a large screen projection television system. The first is the projection kinescope, or cathode-ray picture tube, which translates the video signal into a pattern of light and shadows on the tube face. The second is the optical system which collects the light rays from the face of the picture tube and directs them to the screen, properly focused, to form an image of the desired size. Third, is the screen on which the picture is seen.

## RCA SYSTEM

RCA's new projector utilizes a 15-inch cathode-ray picture tube operating at 80,000 volts, and an optical system employing a 42-in. spherical mirror and a 36-in. aspherical correcting lens. This is the largest Schmidt-type optical system in the world with the exception of the 72-in. Schmidt telescope at Mt. Wilson.

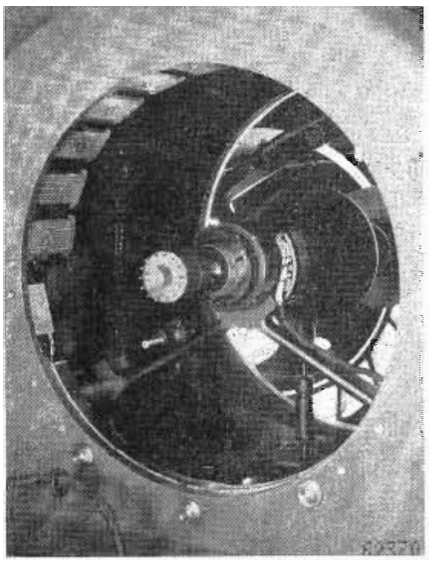
The projection distance or "throw" of the new equipment is 40 ft. Although this is not sufficient to permit mounting of the projector in the theatre's regular projection booth, a throw of this distance enables the relatively compact equipment to be installed in the balcony of some theatres. Ceiling mounts are also a possibility, according to some authorities in the field.

Construction of the large 42-in. mirror for the new optical system, accomplished at the Camden, N. J. plant of the RCA Victor Division, necessitated the development of special machines and new techniques. The 36-in. aspherical correcting lens used in the equipment to overcome optical effects introduced by the spherical mirror, is made of glass—an inherently costly process. However, it is expected that eventually these lenses may be molded from plastics as are the smaller correcting lenses for home projection-television receivers. In addition to costing only a few dollars each, these plastic lenses, which equal the optical properties of glass lenses, offer the added advantage of being practically unbreakable.

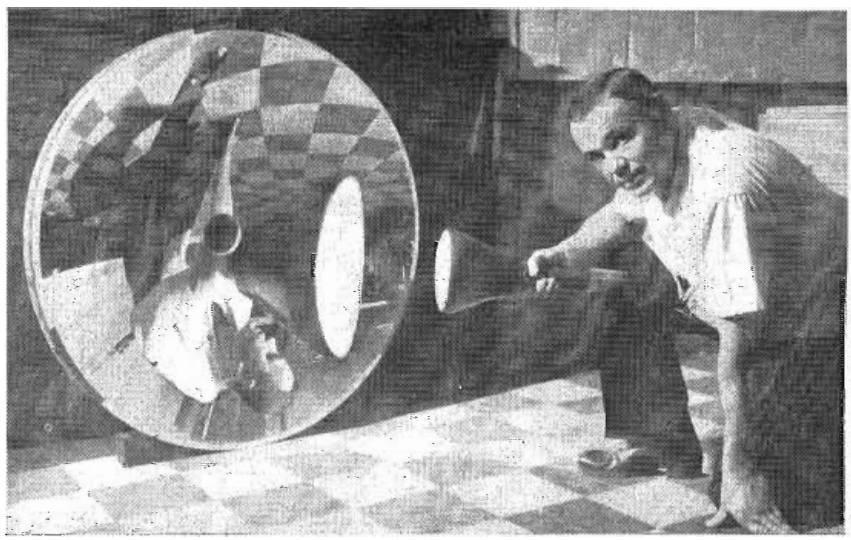
The special projection tube or kinescope employed in the Large Screen Projector was specially developed by RCA for use in reflective optical systems. Into this projection tube was designed a metal-backed screen such as is used in all RCA projection tubes. New types of phosphor compounds were developed which were coated with a fine

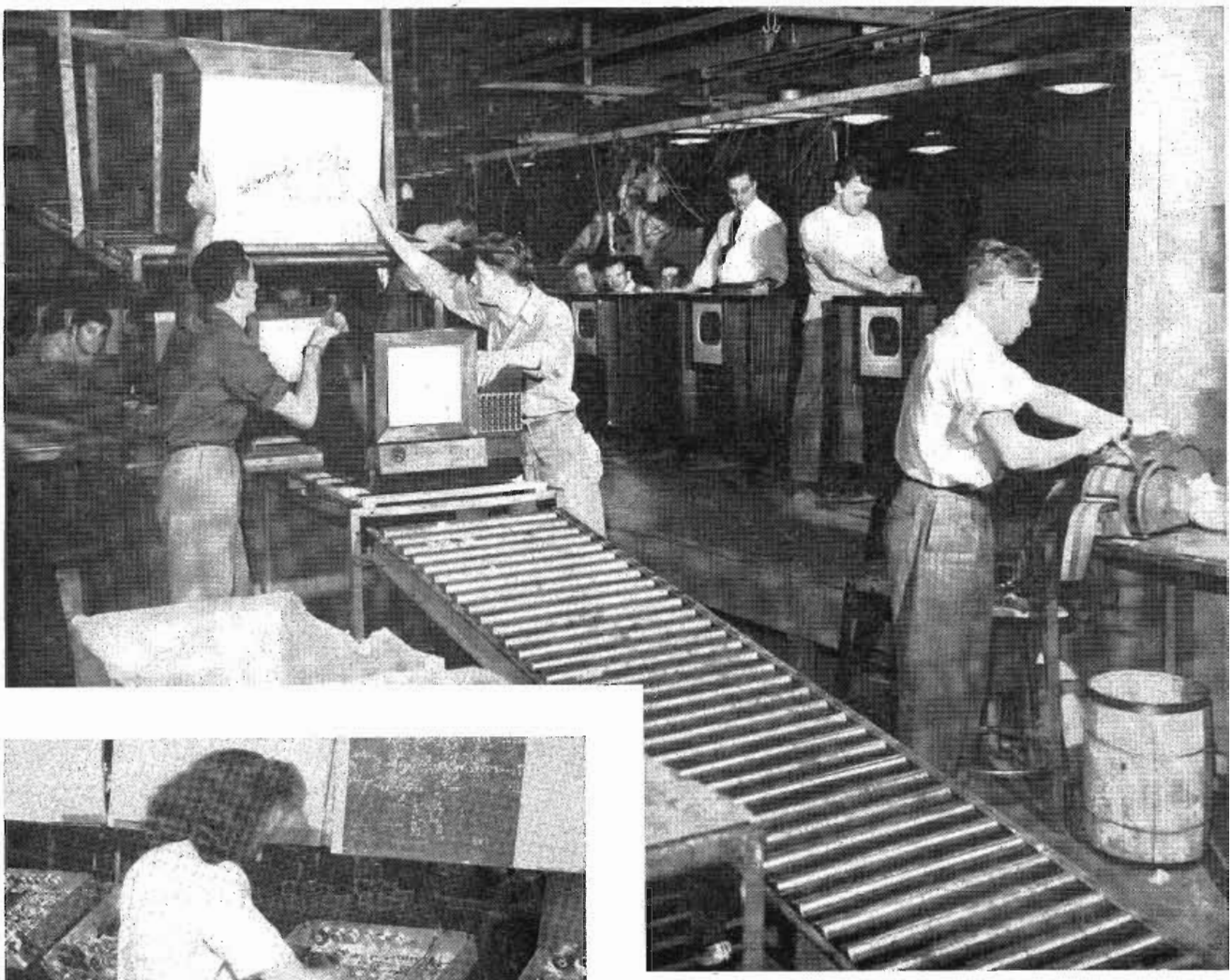
(*Continued on page 67*)

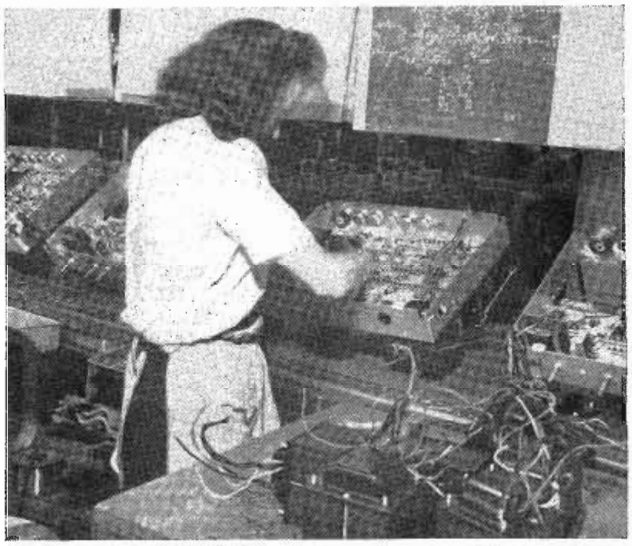
C-R tube and 30-in. spherical mirror in rear



Illustrating the magnifying power of the spherical mirror. I. G. Maloff, RCA engineer, holds the C-R tube which is part of the optical system of this theater-type television projector







TOP—Final operations on 2 conveyor lines for table and console-model Philco television receivers. On line at left overhead conveyor brings cartons ready for packing. Console models are crated.

LEFT—Start of chassis wiring line. Transformers, potentiometers, tube sockets, wiring lug strips are riveted to the chassis (below).

LEFT BELOW—Riveting parts to the metal sub-base before chassis starts on wiring line. Joe Lagore (left), production chief, looks on.

BELOW RIGHT—Girl operators do a certain number of wiring or soldering operations on chassis as belt moves 18 in. per minute.

# Conveyor and Test Systems Speed TV Set Assembly

**Philco procedure for aligning and testing TV sets on conveyor belts with special equipment is secret of firm's volume production methods**

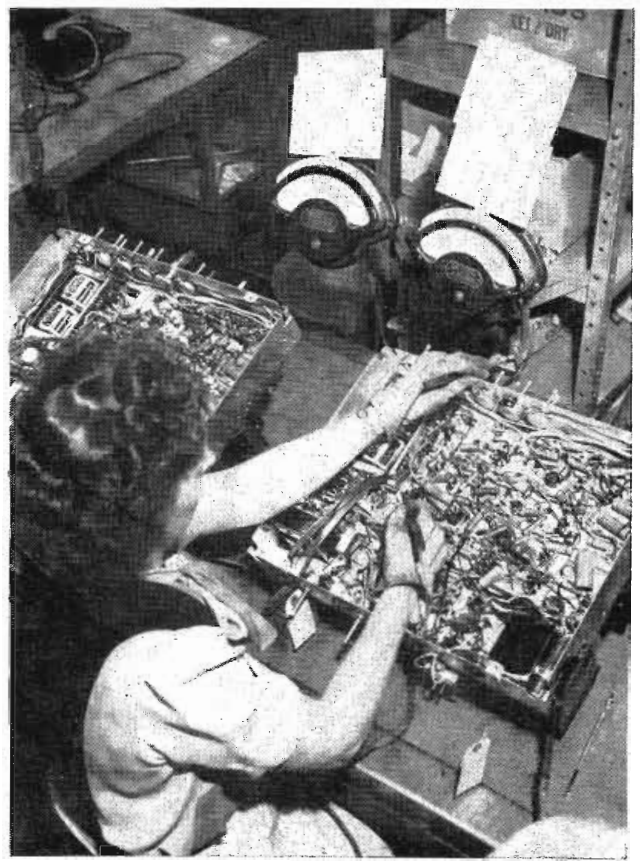
TO MEET the rapid expansion of the television market (Tele-Tech estimates 750,000 receivers may be produced in 1948) the Philco Corporation has equipped a $3,000,000 Philadelphia plant with the latest facilities for large-scale output of its table and console-model television receivers. By an ingenious arrangement of conveyor belts and installation of special testing equipment along the belt runways, Philco is realizing a considerable reduction in receiver assembly and testing time.

Manufacturing operations in the new plant go through the following sequence:

1. Incoming inspection of parts and materials.
2. Riveting parts such as tube sockets to metal sub-bases of chassis.
3. Wiring conveyor belts where the relatively bare sub-base is converted into a completely wired chassis.
4. Continuity testing.
5. Insertion of all tubes except picture tube.
6. Chassis alignment and testing on moving belt.
7. Chassis go from third floor to second floor on monorail conveyor.
8. Cathode-ray picture tubes, speakers and hardware are attached to cabinet on second floor at start of cabinet line, after cabinet is unpacked from carton or packing box.
9. Completed chassis, delivered by monorail from third floor, is inserted in table or console cabinet.
10. Complete television receiver is given mechanical and electrical tests, including a check of broadcast performance.
11. Touch-up of cabinet finish, when necessary.
12. Final inspection of complete receiver.
13. Television receiver is packed for shipment.

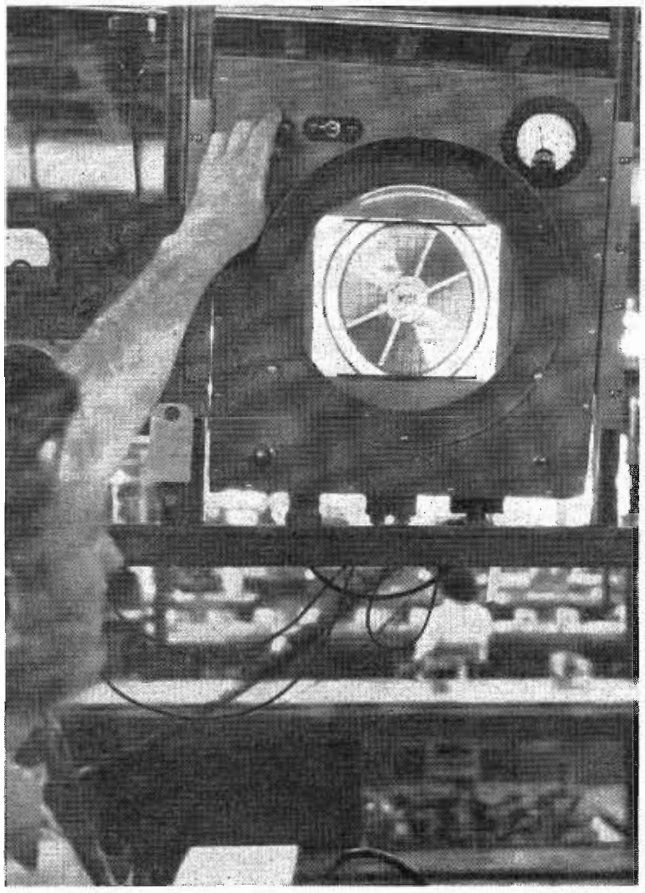
Exception to the above sequence in assembly is the model 2500 projection receiver whose optical system is assembled separately with the cathode-ray tube and inserted into the cabinet after alignment and before the chassis is put into the cabinet.

Speed of the chassis wiring conveyor belt is 18 in. per minute.



TOP—Alignment, test operations. Note how receivers are powered even though on a moving belt. Picture signals are checked by using fixed cathode-ray tubes temporarily attached to chassis on belt.

BOTTOM—Close-up of continuity test on completely wired chassis. This check occurs before inspection, tube insertion and alignment.



ABOVE—Test signal shows on viewing tube connected to chassis under test. When signal is clear chassis moves to next position. A monoscope generator broadcasts signals continuously at plant.

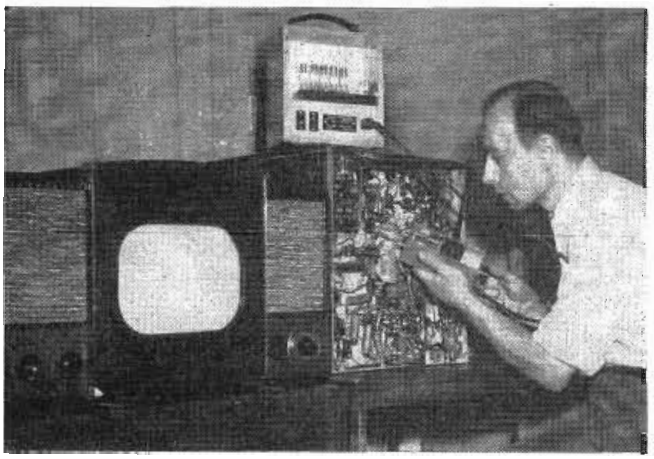
BELOW—Installing tube assemblies, speakers and other parts is first operation on cabinet assembly line. Next steps are to install chassis, connect set, align, check broadcast operation—then pack.

ABOVE—At end of test section where chassis are checked for continuity after wiring, they are aligned and performance tested. Note use of incandescent lights; fluorescents cause interference.

BELOW—First step in the insertion of chassis into receiver cabinet. Finished job is packed as shown in large photo on page 36.

# Resonance Indicator for Passive Circuits

**Grid-dip meter revived for use in design checking and routine service test; covers FM and TV bands — down to 2 megacycles**



The grid-dip meter gives direct readings of resonance characteristics of portions of circuits without disconnections

RECENTLY there has been a revival of interest in the grid-dip meter and several new versions have been marketed. Of particular interest is a versatile model illustrated here which permits checking many circuits and components in a television receiver without its disassembly.

In this instrument, the old circuits have been redesigned and brought up-to-date. The instrument is essentially an oscillating frequency meter particularly arranged for determining the resonant frequency of de-energized rf circuits. It contains a sharply tunable circuit in an extension probe, along with a 9002 triode oscillator tube and an indication instrument connected to read grid current. When placed near a resonant circuit a pronounced dip is indicated on the meter.

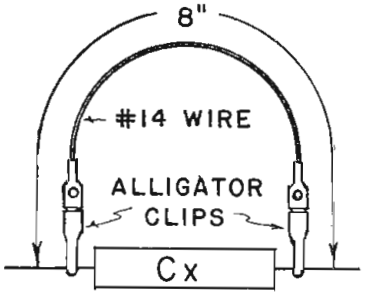
The instrument can be used either as an oscillator (plate voltage on) or an absorption meter (plate voltage off). Coupling to the circuit under test should be as small as possible, consistent with obtaining a satisfactory dip but the coil should be reasonably removed from adjacent metallic components. As the dial is rotated, some variation of grid meter reading may be noted; however, resonance is indicated by a pronounced dip. The sharper the dip, the higher the "Q" of the circuit being measured. When the resonant dip has been found, the frequency may be read directly from the calibrated scale on the drum dial.

Under oscillating conditions grid current is an indication of relative power so when the probe coil is coupled to the measured circuit, and tuned power is drained from the oscillator tank, it produces a drop in this current. Thus, the resonant frequency of any LC circuit may be checked without application of power to the circuit under measurement. Since the meter is a time saver for circuit measurements in transmitters, receivers, wave traps, absorption-type frequency meters, rf chokes and any other type of resonant circuits, it should find ever-increasing use in television circuit measurements.

As an oscillating detector, headphones are used instead of the grid meter. When the instrument is tuned for zero beat, the frequency may be read directly from the calibrated scale.

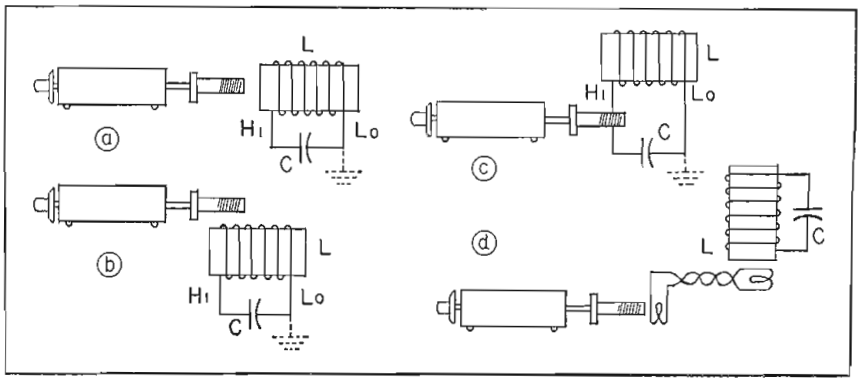
(*Continued on page* 82)

Capacitor tests in a synthetic circuit made with clipped-on loop. Capacitance values are approximately determined by referring resulting resonant frequency to table below




| $C_x$ | $f_r$ |
|---|---|
| 50 μμf | 62 MC |
| 100 " | 42 " |
| 200 " | 31 " |
| 500 " | 20 " |
| .001 μf | 13.5 " |
| .005 " | 6.3 " |
| .01 " | 4.3 " |
| .04 " | 2.1 " |

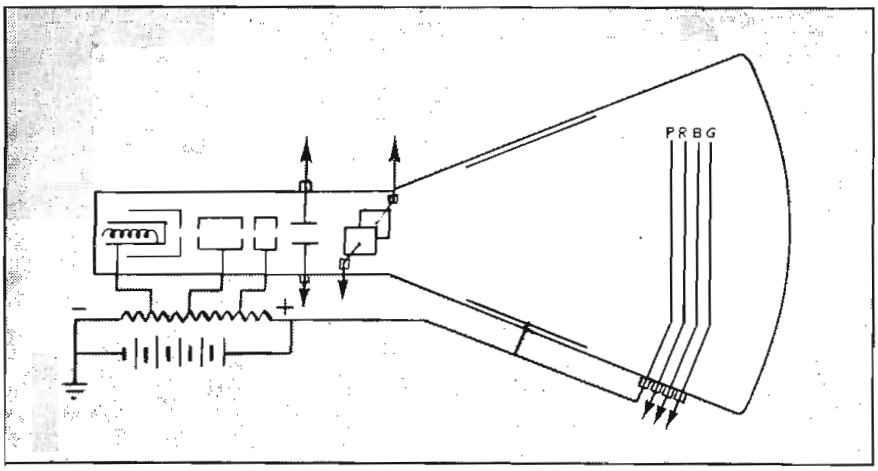
Below are illustrated four methods of coupling the pick-up probe to circuit elements



# New Viewing Tube for Color TV

By ARTHUR BRONWELL, Professor of Electrical Engineering, Northwestern Univ., Evanston, Ill.

**New cathode-ray tube identified as the "chromoscope" contains single electron gun and composite color screen; operates in sequential color system**




Drawing of the chromoscope, tube for color TV, showing constant-potential screen and the three color screens arranged so as to be physically separate but optically superimposed

ALTHOUGH many ingenious color television systems have been developed, the receivers, in general have proven costly, difficult to adjust, and not particularly amenable to mass production at a price within the range of the average pocketbook.

Ideally, a color television receiver should contain a single viewing tube, comparable in simplicity and cost to the viewing tubes used in the present black-and-white television receivers.

The chromoscope‡ is a relatively simple, all-electronic color television viewing tube. It contains a single electron gun, a single composite color screen and relatively simple and inexpensive associated circuits. The incremental cost of adding color, using the chromoscope, over the cost of black-and-white television would amount to only a few percent of the cost of the receiver. The chromoscope is designed for use in a sequential color television system. Since it is an all-electronic system, the color interval can correspond to the line frequency, the field frequency, the frame frequency, or any other desired interval.

The chromoscope consists of a cathode-ray tube which contains a single electron gun and a specially designed color image screen. The image screen is comprised of four parallel, semi-transparent screens, three of which are coated with phosphors corresponding to the three primary colors, red, blue, and yellow (or green). The fourth screen serves as a constant-potential screen; it will be described later.

### Screens Electrically Insulated

The individual screens are separated a short distance apart (in the order of one to three m.m.) and are electrically insulated from each other so as to permit independent control of the screen potentials. Any one color screen can be caused to fluoresce and the others to be extinguished by placing a high positive potential on the screen which is to fluoresce and a low potential on the other two color screens. In order to obtain a three-color television picture, it is therefore merely necessary to commutate the screen potentials so as to place a high positive potential sequentially on the three color screens.

The color pictures formed on the three separate color screens are optically superimposed and the color image has the appearance of originating from a single three-color screen. The resulting television picture can be viewed either directly or by means of a conventional television projection system, although, for reasons explained later, a projection system is preferred.

The basic principle of operation of the chromoscope is that a freely moving electron has a velocity which is proportional to the square foot of the potential, or specifically,

$$v = (2Ve/m)^{1/2}$$

where v is the electron velocity, V is the potential at the instantaneous position of the electron, and e/m is the charge-to-mass ratio of the electron. By virtue of this relationship, the velocity of an electron increases as it approaches a high-potential screen and decreases as it approaches a low-potential screen. The screen construction is such that approximately one third of the electrons strike each screen. However, only those electrons which strike a fluorescent screen having a high potential have sufficient velocity to cause fluorescence.

The fourth screen in the image-screen assembly, that nearest the electron gun, is a constant-potential screen. This screen is rela-

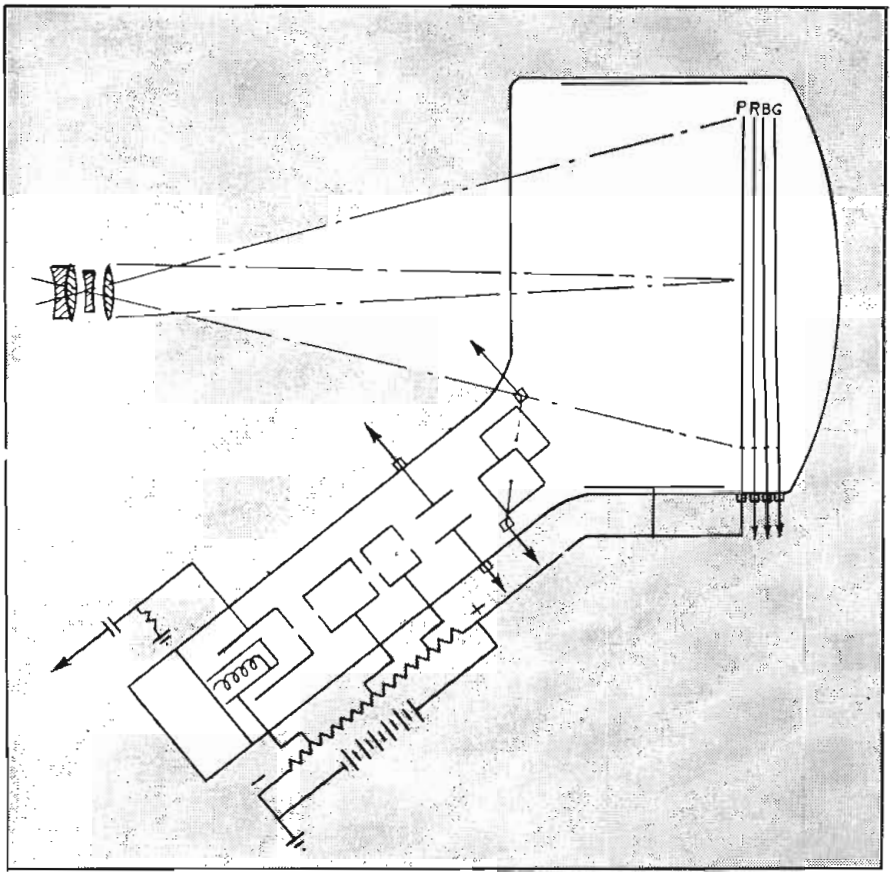
*Presented at the National Electronics Conference, Chicago, November, 1947.

‡U. S. patent applied for. Experimental tubes are being developed under contract with Dumont Laboratories.

tively transparent to light and electrons, and is given a high positive potential. It serves to shield the region between the electron gun and the image screen from potential fluctuations resulting from variations of the color screen potentials and therefore prevents defocusing errors. The only potential variation in the chromoscope therefore, (excluding the deflecting potentials) occurs in the immediate vicinity of the three color screens. Since the spacing between screen is of the order of a few millimeters, these potential variations do not adversely affect the focus of the electron beam.

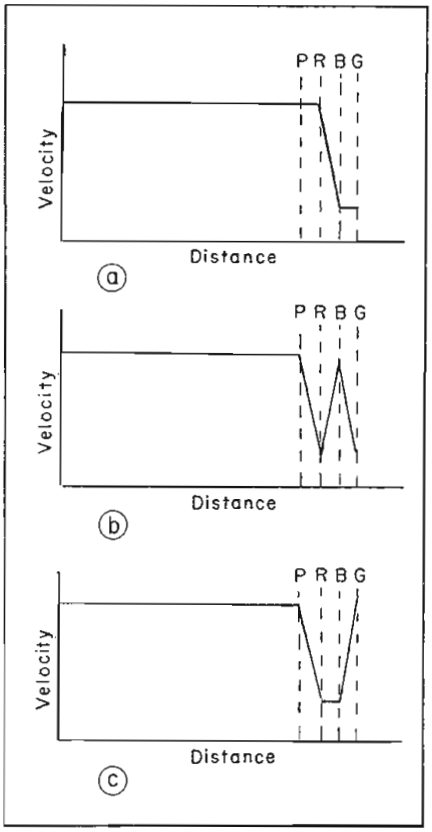
A plot of screen potentials for a red, blue, green color sequence is shown in one of the illustrations. Since the electron velocity is proportional to the square root of the potential, the illustrated plot may also be interpreted as a plot of electron velocity in the region of the color screens.

The screen potentials may be commutated electronically by means of sequentially operated multivibrators. The multivibrators can be synchronized by either the horizontal or vertical sync pulses and thus the color can be made to change either at the end of every line or at the end of every field. From a circuit point of view, the multivibrators constitute the only additional circuits which need be added to produce color in television. This is in contrast to the elaborate and costly triplication of circuits and viewing tubes required in a simultaneous color system.




Alternate arrangement of chromoscope for projection or direct view from electrogun side

Showing electron velocity or potential in the vicinity of the color screens. Drawing plots screen potentials for red, blue and green color sequence as described in text




## Image Screen Construction

The various color screens in the composite image screen may take any one of a variety of different forms. The principal requirements are:

1. The screens must be either conducting or semi-conducting.
2. They must be relatively transparent to light.
3. The screen construction must be such that each screen intercepts approximately one third of the primary electrons in the beam.
4. The screens must contain phosphors of the proper color hue and intensity to give correct color rendition and sufficient brillance.
5. The resolution must be comparable to that of present black-and-white pictures.
6. The color screens must be placed close together to avoid parallax errors.

One type of screen construction consists of a close-mesh, parallel-wire screen, containing small-diameter wires or metallic strips placed close together and welded or brazed to a metallic frame. The phosphor is then deposited upon the wire screen. For a 525-line picture definition, each color screen would contain at least 525 parallel wires. The spacing and size of the wires in any one screen is such that approximately one-third of the electrons in the beam impinge upon each of the color screens. The screens are thus relatively transparent to light and electrons, while presenting sufficient phosphor surface for the formation of the picture. In a 525-line screen, the wire

(*Continued on page* 60)

# How WABD Handles Remotes

**DuMont crews with modern apparatus make handling of program sources a science — Microwave and Coaxial technics**

By OTIS FREEMAN, Operating Engineer, WABD Television Station, New York
Photos by Steve Preston, WABD Engineering Staff

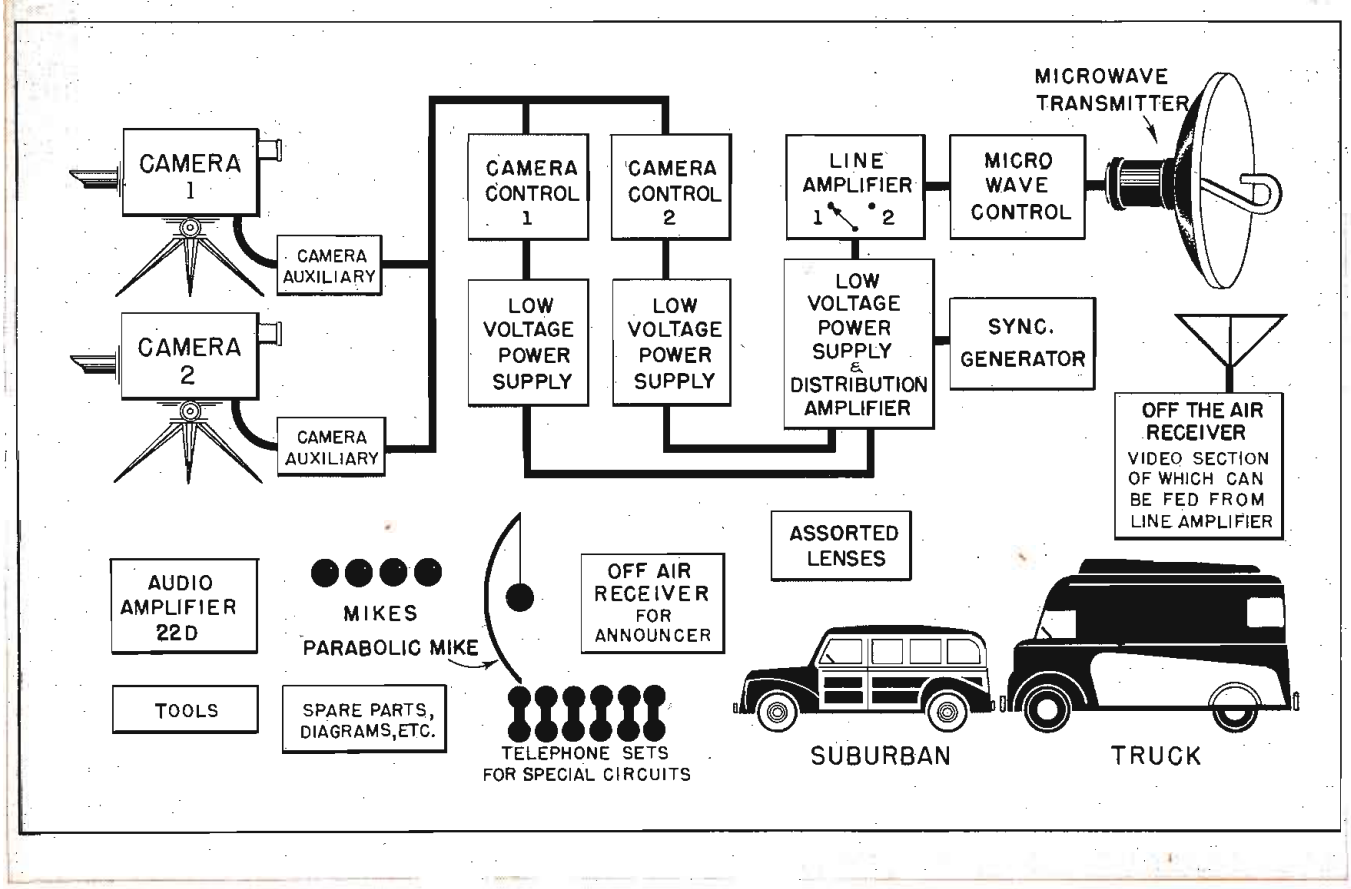
TELEVISION audience's interest in field pick-ups of sporting and special events is such that TV stations are programming at least 50% of their schedules for remotes. The entertainment value per dollar cost is proving the most advantageous of any type of programming. With the increase in remote practices, a description of the pick-up operations as practiced by DuMont's TV station WABD in New York is of timely interest.

Upon receiving an order to investigate a location for a possible remote, a program director and an engineer make an immediate survey, including an appraisal of available lighting, power, camera positions, places for lines to terminate, announcer positions, camera cable lengths and permits for such things as parking and possibly the use of a nearby roof for relaying, etc.

All information is noted on a standard form and filed in the engineering office. Sometimes, the office engineering staff makes a profile map of the terrain between the station and the proposed pick-up spot. This map will indicate the required height for the field transmitter or the number of intermediate relays. By this time management can be given an answer as to the practicability of making such a pick-up and an estimated cost of the operation.

If the cost and pick-up facilities are practicable, an engineering group makes a microwave test at the tentative pick-up spot. Most pick-ups are line-of-sight, although

Chart of the equipment complement of WABD's two-camera remote unit. Suburban vehicle is for personnel



sometimes too far away to be pinpointed even with powerful binoculars. On sunny days flashes from a meduim-sized mirror prove helpful for locating the exact spot on the horizon. Compass directions from a map are also very helpful.

After the microwave path is found, a scale drawing of the pick-up location is made showing seating, camera obstructions and factors peculiar to a television pick-up. Items such as equipment placement, (cameras, mikes, etc.) ac line terminations, location of nearest telephone, cable routes and other information pertinent to this particular site, are shown on the drawing. Thus it gives the engineers who go out to install equipment everything they need to know. The production department can also use this drawing to determine what lenses will be needed and to brief the announcer as to where certain action will take place or where prominent people will be seated.


Remote operating basket at baseball stadium. Vantage points sometimes offer limited facilities but crews hold equipment to a minimum for freedom of operation

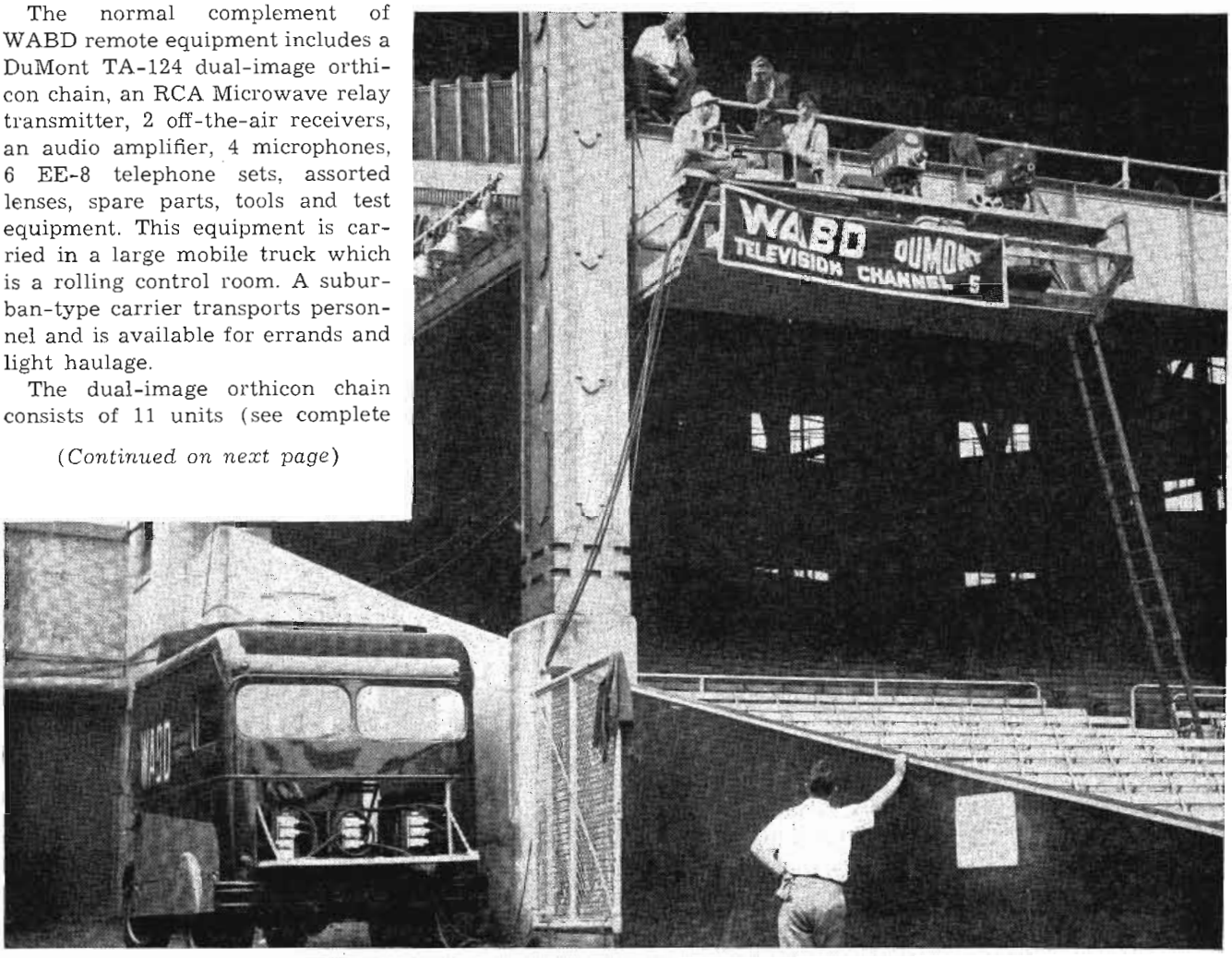
## Remote Equipment

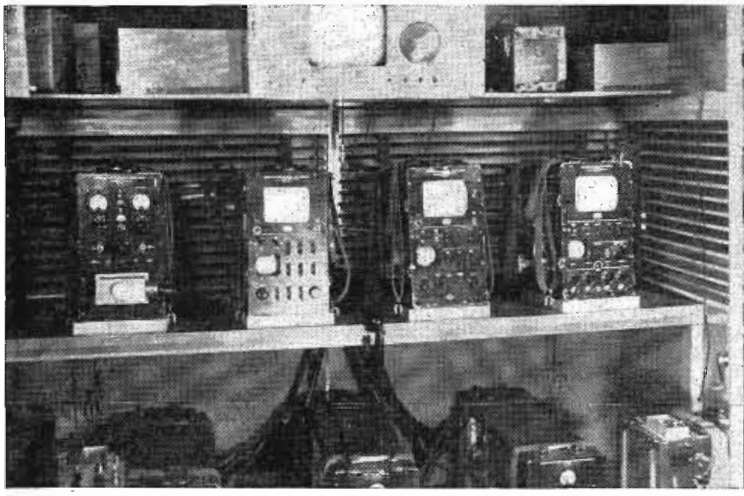
The normal complement of WABD remote equipment includes a DuMont TA-124 dual-image orthicon chain, an RCA Microwave relay transmitter, 2 off-the-air receivers, an audio amplifier, 4 microphones, 6 EE-8 telephone sets, assorted lenses, spare parts, tools and test equipment. This equipment is carried in a large mobile truck which is a rolling control room. A suburban-type carrier transports personnel and is available for errands and light haulage.

The dual-image orthicon chain consists of 11 units (see complete

(*Continued on next page*)

Specially designed truck with all remote equipment facilities setting up for remote operation. Lowered tailgate of truck reveals power supply source at rear of truck. More photos next page





Above left: Interior view looking towards rear of WABD truck showing off-the-air TV receiver and camera-chain equipment. Note power supply equipment at bottom of photo. Above right: Maintenance of mobile equipment at base headquarters for remote TV

description in TELE-TECH, March 1947, page 42), consisting of portable sync generator, distribution amplifier and low voltage power supply, mixer amplifier and monitor, 2 image orthicon control and monitor units, 2 low-voltage power supplies, 2 pick-up auxiliaries and 2 image orthicon pick-up heads with electronic viewfinders. All interconnections are made by the use of four different types of multiple conductor cables. Power is supplied to the chain by means of 3 ac power cords.

The DuMont portable synchronizing generator is self-contained with its own power supply. It delivers three composite output signals: (1) vertical and horizontal sync pulses; (2) vertical and horizontal driving pulses; (3) a vertical and horizontal blanking signal. These pulses have steepness and duration characteristics described by RMA.

The three composite signals from the sync generator are fed to a distribution amplifier which is built in the case containing the mixer amplifier and monitor power supply. Each of the three composite signals is fed to a group of cathode followers which allows these signals to be distributed at low impedance to the individual camera controls and cameras.

## Amplifier and Power Supply

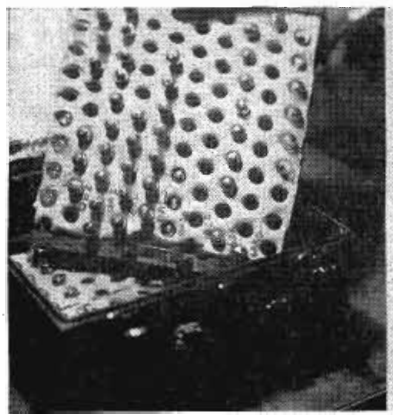
The mixer amplifier and monitor power supply is equivalent to the two low-voltage power supplies except for current capability. These power supplies give +300 and +120 volts through series tube regulators. Three cascaded 6AK5's are used as amplifiers in the feedback loop for these regulators which makes the power supplies have an inherent internal resistance of less than an ohm.

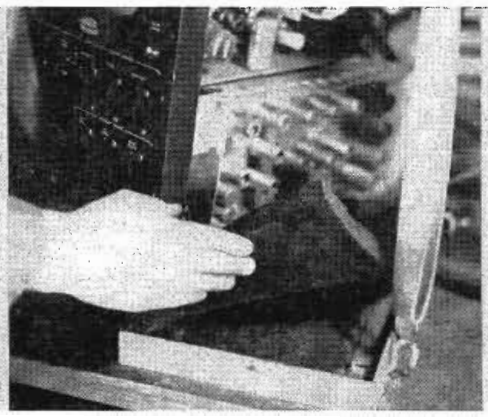
The mixer amplifier has 4 channels so that as many as 4 cameras may be used. Each channel in this amplifier is controlled by a push-button switch and a separate manual gain control. The transition between the different channels may be made by either fading one picture down and the next up, or lap dissolving between two pictures. These two technics may be used at four different speeds, "slow", "medium", "fast", and "instantaneous."

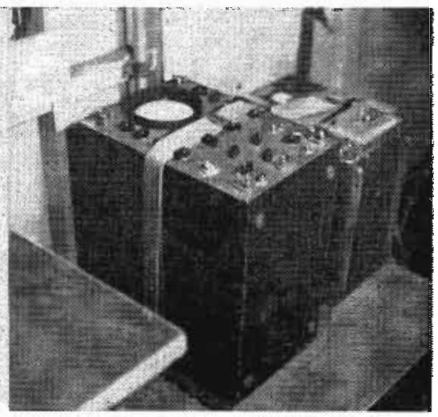
On the front panel there is a two-position switch, which allows a picture to disappear completely before another appears, or allows the two pictures to mix during the switching process. This switch is the fade or lap selector. A four-position selector switch (rather than ganged potentiometers) controls the rate at which the fade or lap is accomplished.

After these switches are set to

Left: Perforated, cellular rubber tray for holding miniature tubes. Center: Installing rubber shock mounting in mobile units. Right: Test equipment strapped down in WABD's specially designed truck for transit to remote operation. Read story for truck's details







give the type of transition demanded by the program format, the actual switch is made by pressing the appropriate button on a five-position push-button switch. Positions 1, 2, 3, and 4 will select their respective channels and position 5 energizes all channels allowing the mixing to be done by the manual gain controls. This allows sustained laps which are sometimes used for "effects." A system of "on-the-air lights," on mixer amplifier, camera control monitor, and camera viewfinder, connected to the pushbutton switching indicates to the operators which camera is in use.

The signals coming in to the mixer amplifier are made up of video and blanking. Sync is inserted in this unit. There is a sync gain control on the front panel which allows the sync amplitude to be varied if necessary. There is a 7-in. picture monitor for monitoring the picture which is "on the air." Also a 3-in. "A" scope is provided to accurately monitor the amplitude of the video and synchronizing pulses which constitute the output of the line amplifier. The engineer operating this line amplifier does the switching and also rides levels.

View inside the van when program is on the air. The standee is the director. Others include video operators and engineers. TV receiver usually mounted on panel above standee's head

### Picture Signal Controls

Each camera has a pick-up control and monitor unit which contain all the orthicon controls that might be varied during an actual pick-up. The picture signal controls which are used during operation are also located on this unit. Power is supplied by one of the low voltage supplies. There are 4 controls on this unit which affect the orthicon pick-up tube. These are beam current, beam focus, target voltage and photo cathode focus. Sometimes these may have to have random adjustments during air time. Of course, adjustments are made on camera 1 while camera 2 is on the air and vice versa.

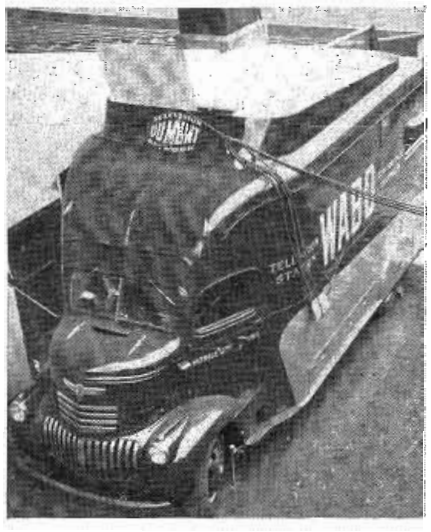
Video from the camera is amplified and mixed with the horizontal and vertical blanking signals. This blanking is then clipped to give the required pedestal height and the composite video and blanking is sent to the line amplifier where sync is inserted.

The horizontal driving pulse from the sync generator is delayed a half line compared to the horizontal sync pulse. In the pick-up auxiliary this half-line delayed pulse triggers a multivibrator, the period of which can be varied about an interval equal to a half line. The multivibrator output is finally differentiated to give positive and negative pulses. The negative pulses which were from the leading edge of the square wave are clipped to leave the positive pulse formed by differentiation from the trailing edge of the multi output. This pulse is used as driving pulses to the camera head. A half-line delay in the sync generator and a half-line delay in this multivibrator makes these horizontal pulses actually delayed by one line. They are used to form a horizontal saw at line frequency, the flybacks of which can be made to occur anytime during the horizontal blanking interval by changing the width of the delay multivibrator in the pick-up auxiliary. This allows any length cable up to about 1000 ft. to be used on one camera and a short cable on the other. By adjusting the compensator (duty cycle of multi) the flyback of the horizontal camera sweep can be made to occur at just the correct time.

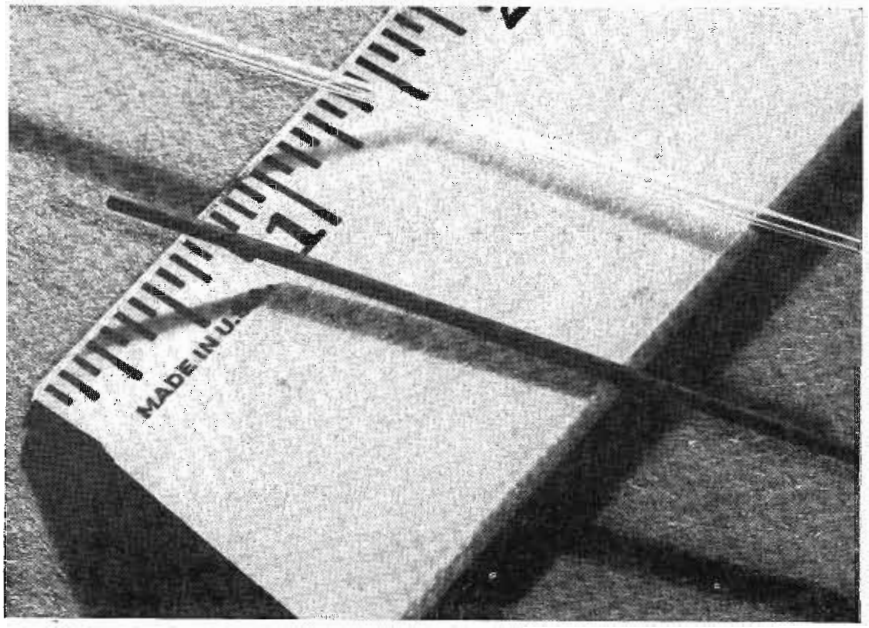
The pick-up head contains the image orthicon with its associated voltage control circuits, its sweep circuits and the video amplifier to amplify the signal out of the orthicon to a level great enough to be fed by coax to the camera control unit. There is also a 5-in. electronic monitor which can easily be detached to get at some of the orthicon circuits. The 1500 volts required for the orthicon is developed by rectifying the flyback voltage which appears across the horizontal output transformer. There is a four-position lens turret which can

(*Continued on page* 85)

Remote van in operating position. Note trap door in roof and protective rim for equipment



# Operating Characteristics of



Liquid resistive material is continuously applied to glass rod emerging from drawing stage

**Technics for producing thin resistance film and coatings with favorable characteristics for high-frequency TV circuits can be applied to printed circuit resistance elements as detailed below**

STABLE resistors needed in quantities in television receiver circuits have a long history. Practical experience relating to materials for film resistors and methods of construction now provides useful background in improved printed circuit technics and permits the selection of the type best suited to application in critical circuits such as television.

There are many different types of film resistors: (1) metallic films such as are produced by evaporation of metals, (2) films made from metallic compounds, such as phosphates, (3) carbon films produced by pyrolysis, (4) films in which the conductor is graphite or carbon mixed in a resinous binder. It is the last type of film resistor which is the subject of this paper.

Graphite or carbon resistance films have been and are being applied commercially on a large scale to various types of insulating bases such as glass, ceramic, paper and phenolic sheets. The supporting bases may be cylindrical or flat. Typical of the applications of such films is the use as resistance elements for low and medium power composition resistors and for volume controls. Although the commercial objective up to now has been to produce at any one time large numbers of separate individual resistors of a given value, the methods developed lend themselves to production of a number of resistors of different values on a single base.

## Varied Resistance Values

The film is made commercially in value varying between 100 ohms per inch to 100 megohms per inch. Films have been made as high as 1,000 megohms per inch. The thickness of the film depends upon resistance value and varies from 0.0004 in. for the low resistance value to 0.0002 in. for the very high values. The method of application of the film is such that a high degree of uniformity in the thickness, and therefore resistance, of the film is obtained. Any or all of the control factors which determine resistance value can be adjusted immediately during the process without stopping the machine. If the resistance value wanders out of tolerance, adjustments are made and the resistance is brought back in tolerance.

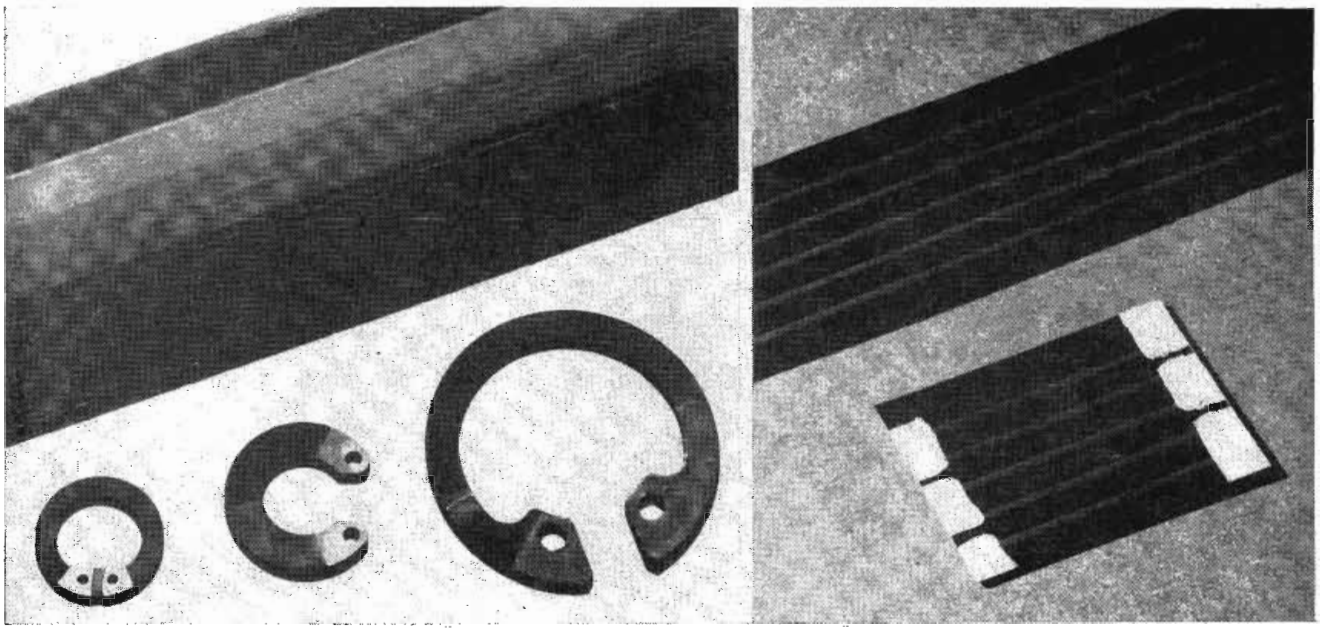
A similar film, but using different application technics can be applied to ceramics on a spiral track. Since such resistors are frequently used immersed in oil or water, severe requirements are necessary for adherence.

A resistance film can also be applied to a phenolic sheet. Since the application of resistance material is a mechanical one, a high degree of uniformity in resistance value is possible. A resistance element punched out of a strip 1½ in. wide in any position or direction will not vary more than ±25 percent from the mean. Closer tolerances may be obtained by additional processing. The rate at which the sheet is printed is one inch per second. The thickness of the film varies between approximately 0.0004 in. to 0.0012 in. depending upon resistance values, the lower resistance films being thicker. Using as a standard a unit 1-in. long and 1/18-in. wide, resistance values can be produced between approximately 500 ohms and 10 megohms.

From the complete paper at the Bur. of Stand. Symposium on Printed Circuits.

# Film Resistors

By JESSE MARSTEN & ALEXANDER L. PUGH, JR.
International Resistor Co., Philadelphia



Left: Volume controls with specified taper are punched from phenolic with four contiguous films of different resistivity printed thereon. Right: Strip with five resistive channels having any value between 500 ohms to 10 megohms per inch

There are some applications where resistance elements are required whose resistance is not a linear function of length. The most notable illustration of this is that of the tone control and volume control in radio receivers.

Cellophane tape about ½ in. wide and .001 in. thick is fed into a continuous printer from a reel containing several hundred feet of tape. The resistance material is applied, or printed, in a line which may vary in width from 1/32 in. to ⅛ in. (or wider) depending upon the requirements. The entire operation is a continuous unbroken chain, feeding tape into printer, (1-in. per sec.) printing resistance film, curing of film, measuring of final resistance value and re-reeling. Resistance values range from 500 ohms to 1.0 megohm per inch. The film is mechanically strong, adheres tenaciously to the tape, will not flake off since it has flexibility and can stand a 160° bend without any cracking or checking.

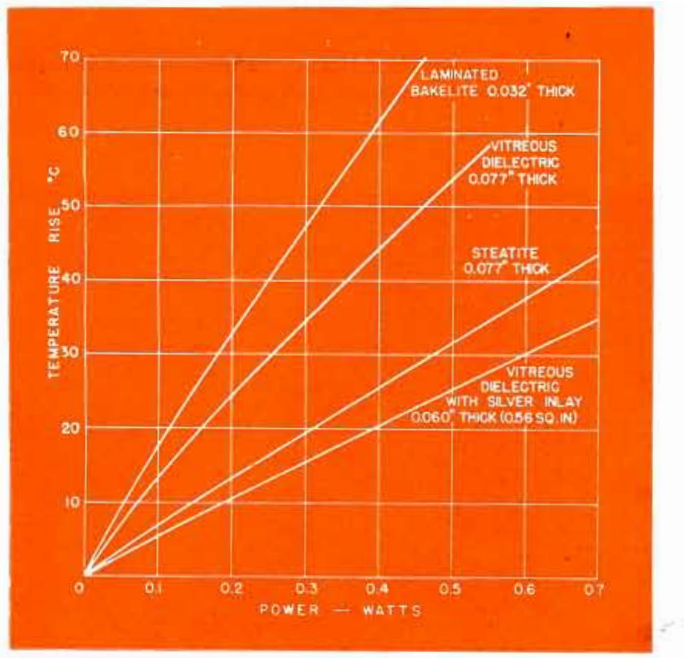
**CHARACTERISTICS OF FILM-TYPE RESISTORS WITH DIFFERENT BASES**

| Film Type Resistors | Temperature Coefficients % per °C. | Voltage Coefficient |
|---|---|---|
| Glass Rod or Tube | —0.02% (at 1000 w) to —0.05% (at 10 megohms) in positive temperature range 0 to 100° C. —0.02% (at 1000 w) to —0.3% (at 10 megohms) in negative temperature range 0 to —55° C. | —0.004% (at 1000ohms) to —0.035% (at 10 megohms) |
| Ceramic Base | —0.002% to —0.04% | —0.002% to —0.075% |
| Phenolic Base | —0.015% to —0.1% in positive temperature range 0 to 100° C. —0.06% to —0.3% in negative temperature range 0 to —55° C. | 0.004%/volt/inch to 0.02%/volt/inch |

### Application to Printed Circuits

It is a short step to apply these technics to printed circuits by printing multiple resistance films which will yield simultaneously a number of different valued resistors on one base. During the manufacture, phenolic sheets are conveyor-fed to a printer on which a number of independent resistance lines are printed having any value within the range of 500 ohms to 10 megohms per inch. The lines may be equal in width or vary as determined by electrical requirements. From these strips, by suitable design of punch and die, a bank of resistors can be punched out and all interconnections may be applied as shown. Size, shape, number of independent resistors and interconnections can be varied at will, within the limitations of the printing device and the dimensions of the sheet.

All these resistors, whether of the solid body or film type, are made in the same general way although there are wide variations in materials,




**Thermal conductivity of base material governs temperature rise of the resistor. Printed resistors on bakelite have lower wattage ratings than those printed on visreous dielectric**

formulations, details of procedure, etc. Resistors of this class are made by preparing a homogeneous mix of a conductor, generally graphitic or carbonaceous, or both, with a resinous binder and sometimes with filler. In the case of the solid resistor the binder is a resinous molding powder. In the case of the printed film resistor, the resin is in the form of a varnish. In both cases a curing operation is essential to harden the mass or film. Prior to the final polymerizing operation the mixtures have infinite or very high resistance. This operation, involving temperature or pressure, or both, shrinks and fuses the resistive composition into a tough hard body or film. The resulting structure then consists of conducting particles held together by a dielectric binder.

Resistance values are controlled by modifying the ratio of dielectric to conductor. The higher this ratio, the higher the resistance value. The conducting particles make contact with each other under the pressure that exists in the structure. Since most of the resistivity of the device is a summation of the contact resistances between particles, whatever alters the contact pressure will affect the resistivity. Many of the unorthodox performance characteristics of this type of resistor are a direct result of the structure of this device.

## Resistance Film Requirements

Mechanical requirements of the resistance film are listed as follows:

1. Adhesion of film requires a good base.
2. Film should be hard and resistant to abrasion.
3. Film should not be brittle.
4. Film should be flexible.
5. Thermal characteristics of film must not deviate too greatly from that of the base.

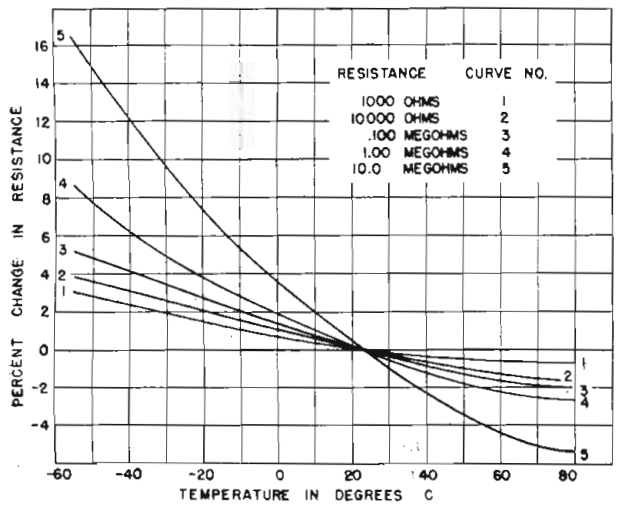
All of these requirements are dictated by the obvious consideration that unless they are met, normal use conditions such as handling, and environmental factors such as humidity and temperature, will result in injury of the film with resultant deterioration of the resistor. Most of these requirements are so obvious as to be axiomatic.

Electrical requirements are as follows:

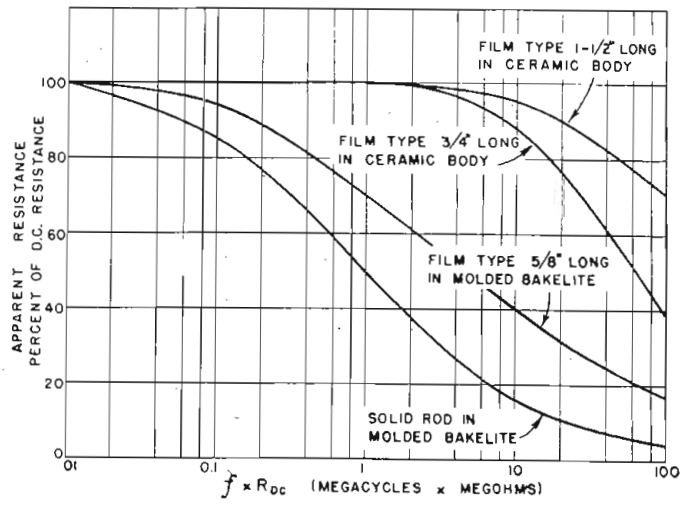
1. Aging should be reduced to a minimum; that is, its resistance should not change appreciably on shelf.
2. Humidity should not affect the film.
3. The film should not show polarization effects.
4. Temperature coefficient should be low.
5. Voltage coefficient should be low; that is, resistance should be insensitive to voltage changes.

(*Continued on page* 54)

**Graph below left indicates how temperature coefficient of film resistors depend on both resistance and temperature**

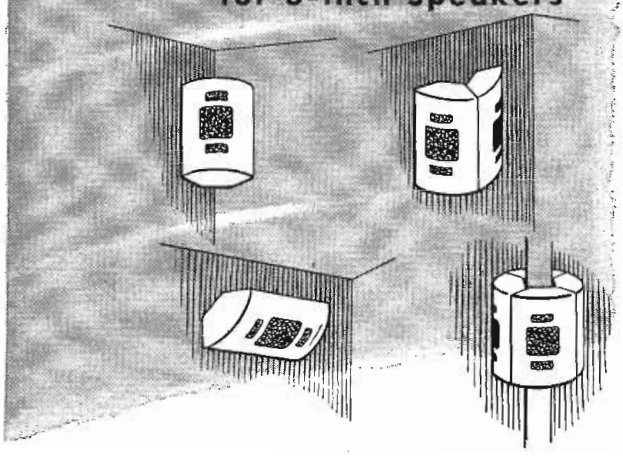


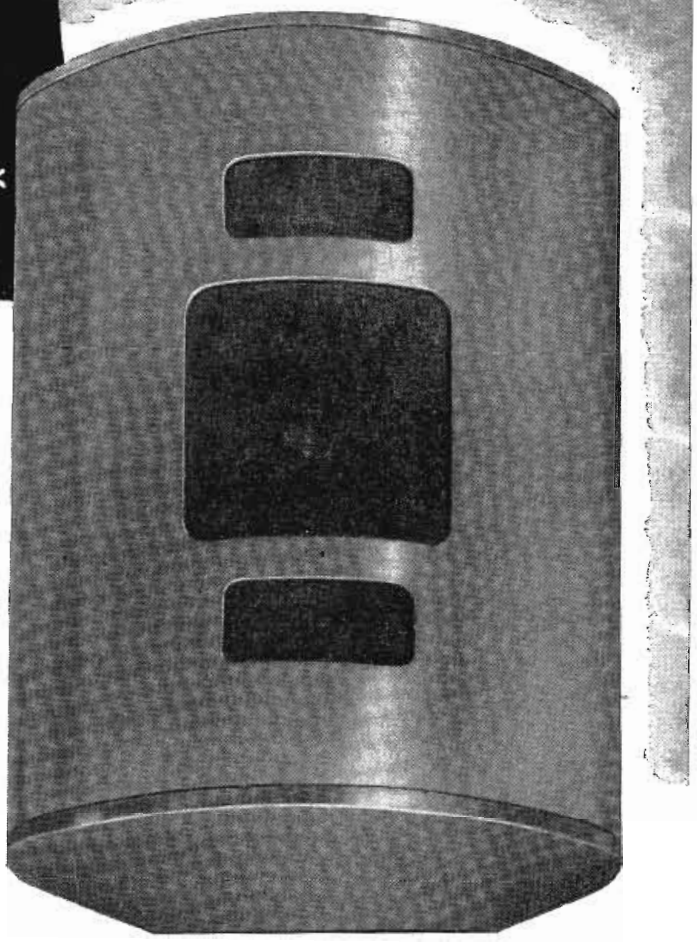

**Showing Boella Effect of film resistors. Direct current resistance values decrease with increasing efficiency**



# Jensen "SECTOR" CABINET WITH *Bass Reflex**

for 8-inch Speakers





*Model H-81 Sector Cabinet (ST-141) List Price $22.50*

They fit anywhere — in 90-degree corners — flat on walls — or in clusters to give wide-angle distribution. Perfectly adapted for nearly all interior sound installations, because of their economy, small size and, above all, the high quality performance of JENSEN speakers in Bass Reflex enclosures. Use with any JENSEN 8-inch speaker. Model P8-SH is recommended for high fidelity as required by many wired music installations.

Type H Sector Cabinets are built around a frame of solid wood with wood composition replacing the conventional plywood panels.

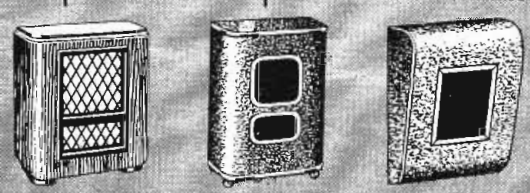
Finish is brown opaque lacquer although covering colors may be applied on the job if desirable to match environment. Size: Height 22½", width 17¾", depth 8½" Furnished with mounting brackets and screws.

**JENSEN MANUFACTURING COMPANY**
**6605 South Laramie Avenue, Chicago 38**
In Canada: Copper Wire Products, Ltd., 11 King St., W., Toronto

*Trade Mark Registered

OTHER Jensen CABINETS

BASS REFLEX — PERI-DYNAMIC



IMPERIAL TYPE D
D-151 (15-inch)
D-121 (12-inch)

UTILITY TYPE B
B-151 (15-inch)
B-121 (12-inch)
B-81 (8-inch)

WALL TYPE J
J-61 (6-inch)

Jensen
FINE ACOUSTIC EQUIPMENT

# Jensen SPEAKERS WITH ALNICO 5

*Designers and Manufacturers of Fine Acoustic Equipment*

# IRE Convention and

## MAIN EVENTS TIMETABLE

**Registration:** Hotel Commodore and Grand Central Palace, Monday March 22—9 AM to 5:30 PM

**General Annual Meeting:** Grand Ballroom, Hotel Commodore—Monday March 22, 10:30 AM

**Radio Engineering Show Opening:** Grand Central Palace—Monday March 22, 11:50 AM

**IRE Cocktail Party:** Hotel Commodore—Monday March 22, 6 PM

**President's Luncheon:** Grand Ballroom, Hotel Commodore—Tuesday March 23, 12:30 PM

**Annual IRE Banquet:** Hotel Commodore, Wednesday March 24, 7:00 PM

**For time, date and place of technical sessions, see table on opposite page.**

PLANS are under way to accommodate 15,000 people at the 1948 National IRE Convention to be held March 22, 23, 24 and 25 in New York at the Hotel Commodore. This figure is a third over that of last year when attendance totalled 12,500. A diversified technical program consisting of 130 papers and 26 sessions and two special symposia have been arranged.

Approximately 175 companies will exhibit their products on 3 floors in the Grand Central Palace building. Registration will take place all day Monday March 22 between 9:00 A.M. and 5:30 P.M.

The convention will open with a general meeting of the Institute's membership on Monday morning when H. B. Richmond of the General Radio Co. will speak on the subject of "An Engineer in the Electronics Industry—Prospect—Preparation—Pay."

Wayne Coy, FCC Chairman, will speak at the president's luncheon.

A special session on "Advances Significant to Electronics" promises to be one of the outstanding programs of the convention. Cybernetics, the capacity of the individual to assimilate and apply information, will be one of the topics. The philosophy of computors as a substitute for the brain in repetitive and original thinking processes will also be discussed. Another special session scheduled for Wednesday afternoon is on the subject of Synthetic Crystals. Methods of growing quartz crystals will be discussed by Bell Lab. engineers.

The technical program is laid out to give something for everybody with five separate sessions going on and five papers being delivered simultaneously at times. All the technical papers may be divided into three main categories. These are:

*Communication Systems, Circuits and Equipment*:

Monday PM—Frequency Modulation; System Studies (Group 1)

Tuesday AM—Amplifiers or System Studies; System Studies (Group 11)

Tuesday PM—Superregeneration

Wednesday AM — Broadcasting and Recording; Television

Thursday PM—Receivers

*Theoretical Aspects of Circuits, Components and Measurements*:

Monday PM—Network Theory; Antennas (Group 11)

Tuesday AM—Antennas (Group II)

Tuesday PM—Transmission Computations

Wednesday PM — Measurements (VHF, etc.)

Thursday AM—Measuring Equipment; Propagation Studies

Thursday PM—Microwaves

*Electronic Tubes, Circuits and Applications in other than communication fields*:

Monday PM—Navigation Aids (mainly aircraft)

Tuesday AM—Tube Design and Engineering

Tuesday PM—Industrial Applications and Electronic Circuits; Components

Wednesday AM—Advances Significant to Electronics (symposium)

Wednesday PM—Tube Manufacturing

Thursday AM—New Forms of Tubes; Computer Systems

Thursday PM—Computer Equipment Components; Active Circuits

# Radio Engineering Show

B. E. Shackelford, 1948 President, Institute of Radio Engineers and Director, License Dept., RCA Int'l Div.

### Radio-Electronic World Leadership

**"Just as other nations of the world now look to the United States for economic aid, the engineering groups of those nations look to us for the lead in radio and television. Among other electronics advances, television will find eager acceptance by the rest of the world for three main reasons: (1) television is *prima facie* evidence of an excellent medium for turning on the light for educational development; (2) television is a universal language that transcends all racial and language barriers, and is understood by all who have eyes to see; (3) television, more than any other medium provides a foundation for many of the newer technics in the electronic arts.**

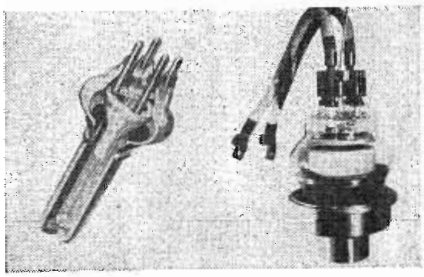
**"To hasten this worldwide achievement, it devolves on the engineers of this country to accept this responsibility and foster pioneering on the radio-electronic frontiers."**

***—Benjamin E. Shackelford***

## IRE TECHNICAL PROGRAM BY DATE, TIME AND PLACE

| | Hotal Commodore | | | Grand Central Palace | |
|---|---|---|---|---|---|
| | Grand Ballroom | East Ballroom | West Ballroom | Maroon Room | Blue Room |
| Monday 3/22 | | | | | |
| Morning | — | — | — | — | — |
| Afternoon 2:30–5 P.M. | Frequency Modulation | Passive Networks | Systems I | Navigational Aids | Antennas I |
| Tuesday 3/23 | | | | | |
| Morning 10 A.M.–12:30 P.M. | — | Amplifiers | Systems II | Electronics I—Tube Design and Engineering | Antennas II |
| Afternoon 2:30–5 P.M. | Superregeneration | Transmission | Nuclear Studies | Electronics II—Industrial Application of Tubes and Electronic Circuits | Components and Miscellaneous |
| Evening 8–10:30 P.M. | Nuclear Symposium | — | — | — | — |
| Wednesday 3/24 | | | | | |
| Morning 10–12:30 P.M. | Symposium: Advances Significant to Electronics | — | — | — | — |
| Afternoon 2:30–5 P.M. | Television | — | Broadcasting and Recording | Electronics III—Tube Manufacture | Measurements I—V.H.F., U.H.F., and S.H.F. Measurements |
| Thursday 3/25 | | | | | |
| Morning 10–12:30 P.M. | Computers I—Systems | — | Propagation | Electronics IV—New Forms of Tubes | Measurements II |
| Afternoon 2:30–5 P.M. | Computers II—Components | — | Microwaves | Receivers | Active Circuits |

# New Types of Electron Tubes



## RF HEATING TUBES

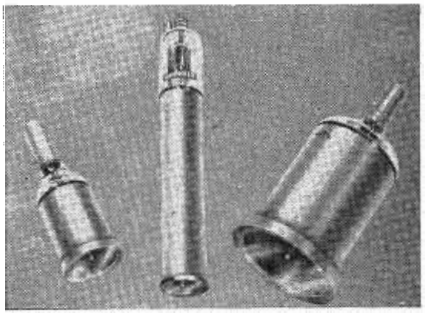
Five rf heating tubes for use in equipment with 5 to 50 kw rating have their electrical and beat-dissipating characteristics adjusted so they can handle severe load mismatching without shortening their life or impairing their performance. Four of the tubes in the new line are available in both air- and water-cooled types; the fifth is water-cooled only. The ML-5658 Heating Triode is shown right above and the ML-5604 appears in a sectional view on the left. No tools are needed for the installation or removal of water jackets because a perfect seal is automatically provided by a twist of the wrist without danger to the tube and without leakage.—**Machlett Laboratories, Springdale, Conn.**

## 5-GUN CATHODE-RAY TUBE

Type 7Z5P7-A is a 5-gun electrostatic focus and deflection cathode ray tube permitting registration on a single screen of five independent phenomena of transient nature or of periodic nature at high frequencies, where electronic switching would be impractical. The five guns are of the "A" anode type, and are completely shielded from each other over their entire length. Separate electrode connections are made in the 27-pin base. Deflection plates are arranged to give parallel registration of five separate time base traces within a degree. Nominal screen diameter is 7 in., and can be supplied with any of the standard phosphors. Overall length is 18⅝ in. Cathode heaters draw 0.6 amps at 6.3 volts.—**Electronic Tube Corp., 1200 E. Mermaid Ave., Philadelphia 18, Pa.**

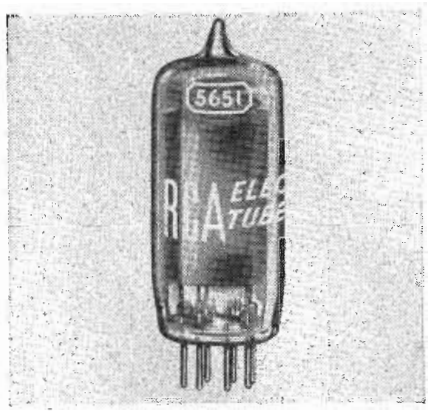
## DUAL GUN CATHODE RAY

Electrically and mechanically identical with type 5Z2P cathode ray tube, the 5Z2P-S1 dual gun, electrostatic focus and deflection cathode ray tube has two additional pairs of horizontal deflecting plates (one for each gun), located between the accelerating anode A2 and the deflecting plates D3D4. All twelve deflecting plates have separate connections of short lead length to a ring of twelve equally spaced terminals around the neck of the tube. The additional pair of deflecting plates is useful, when it is necessary to deflect the beam along the X-axis by the application of two isolated inputs instead of one composite input. This requirement exists, for example, in the design of a dual-channel recording oscillograph, where transient signals of very high frequeney content are to be impressed on a low frequency sweep extending through several revolutions of the camera drum.—**Electronic Tube Corp., 1200 E. Mermaid Ave., Philadelphia 18, Pa.**



## COUNTER TUBES

A complete line of Geiger-Mueller counter tubes, formerly built as laboratory projects, has been redesigned for standardized production to provide uniformly accurate, stable, interchangeable tubes at a reasonable price. Gasketed or waxed seals have been eliminated by direct bonds between mica and metal, and mica and glass. The first series released includes counter tubes for beta, gamma, and X-rays. (See table below)—**Amperex Electronic Corp., 25 Washington St., B'klyn., N. Y.**




## VOLTAGE REFERENCE TUBE

Extreme voltage stability is a characteristic of model 5651 miniature voltage-reference tube, a cold cathode, glow-discharge type. Voltage fluctuation at any current value within the operating current range of 1.5 to 3.5 milliamperes is less than 0.1 volt. Operating current range is from 1.5 to 3.5 milliamperes and dc operating voltage is 87 volts. A thin metallic coating on the inside of the glass metal envelope minimizes slow voltage drift.—**Tube Dept., RCA Victor Div., Radio Corporation of America, Harrison, N. J.**

## NEW IMAGE ORTHICON

Recommended for studio use and other applications employing artificial illumination, image orthicon 5655 lends itself to use in comparatively light weight, portable television cameras, and facilitates the use of telephoto lenses with such cameras. Becauss its photocathode does not respond to infra red, halftones are portrayed with more satisfactory graduation than in previous types.—**Tube Dept., RCA Victor Div., Radio Corporation of America, Harrison, N. J.**

**MORE PRODUCTS PAGE 55**

## *RADIATION COUNTER TUBES*

| Type of Tube | Temperature Range (°C) | Plateau Voltage | Slope of Plateau Per 100 V | Capacitance at Terminals $\mu\mu$F | Background Counts/Min. | Cosmic Ray Efficiency | Life expectancy Counts | Operating Volts | Counter Applicatian |
|---|---|---|---|---|---|---|---|---|---|
| 1E | −20° to +100° | > 300V | 2 to 5% | 1.5 | 10 | > 99% | > $10^8$ | 1400 | Gamma |
| 1M | 0 to +100 | > 500V | 10% | 1.5 | 2 | > 20% | > $10^{10}$ | 1400 | Gamma |
| 4E | −20 to +100 | > 300V | 2, to 5% | 2.4 | 90 | > 99% | > $10^8$ | 1400 | Gamma |
| 4M | 0 to +100 | > 500V | 10% | 2.4 | 20 | > 20% | > $10^{10}$ | 1400 | Gamma |
| 10E | −20 to +100 | > 300V | 2 to 5% | 3.6 | 200 | > 99% | > $10^8$ | 1400 | Gamma |
| 10M | 0 to +100 | > 500V | 10% | 3.6 | 40 | > 20% | > $10^{10}$ | 1400 | Gamma |
| 200C | −20 to +100 | > 300V | 2 to 5% | 1.0 | 50 (unshielded) | | > $10^8$ | 1200 | Alpha(1) |
| 100C | −20 to +100 | > 300V | 2 to 5% | 1.0 | 50 " | | > $10^8$ | 1200 | Beta(2) |
| 100N | −70 to +100 | > 100V | 5% | 1.0 | 50 " | | Unlimited | 450 | Beta(2) |
| 120C | −20 to +100 | > 300V | 2 to 5% | 1.0 | 250 " | | > $10^8$ | 1200 | Beta(3) |
| 150C | −70 to +100 | > 300V | 5% | 2.4 | 62 " | > 99% | Unlimited | 1200 | Beta, Xray, Gamma(2) |
| 150N | −70 to +100 | > 100V | 5% | 2.4 | 62 " | > 80% | Unlimited | 450 | Beta, Gamma(2) |
| 150M | 0 to +100 | > 500V | 10% | 2.4 | 15 " | > 20% | > $10^{10}$ | 1400 | Beta, Xray, Gamma(2) |

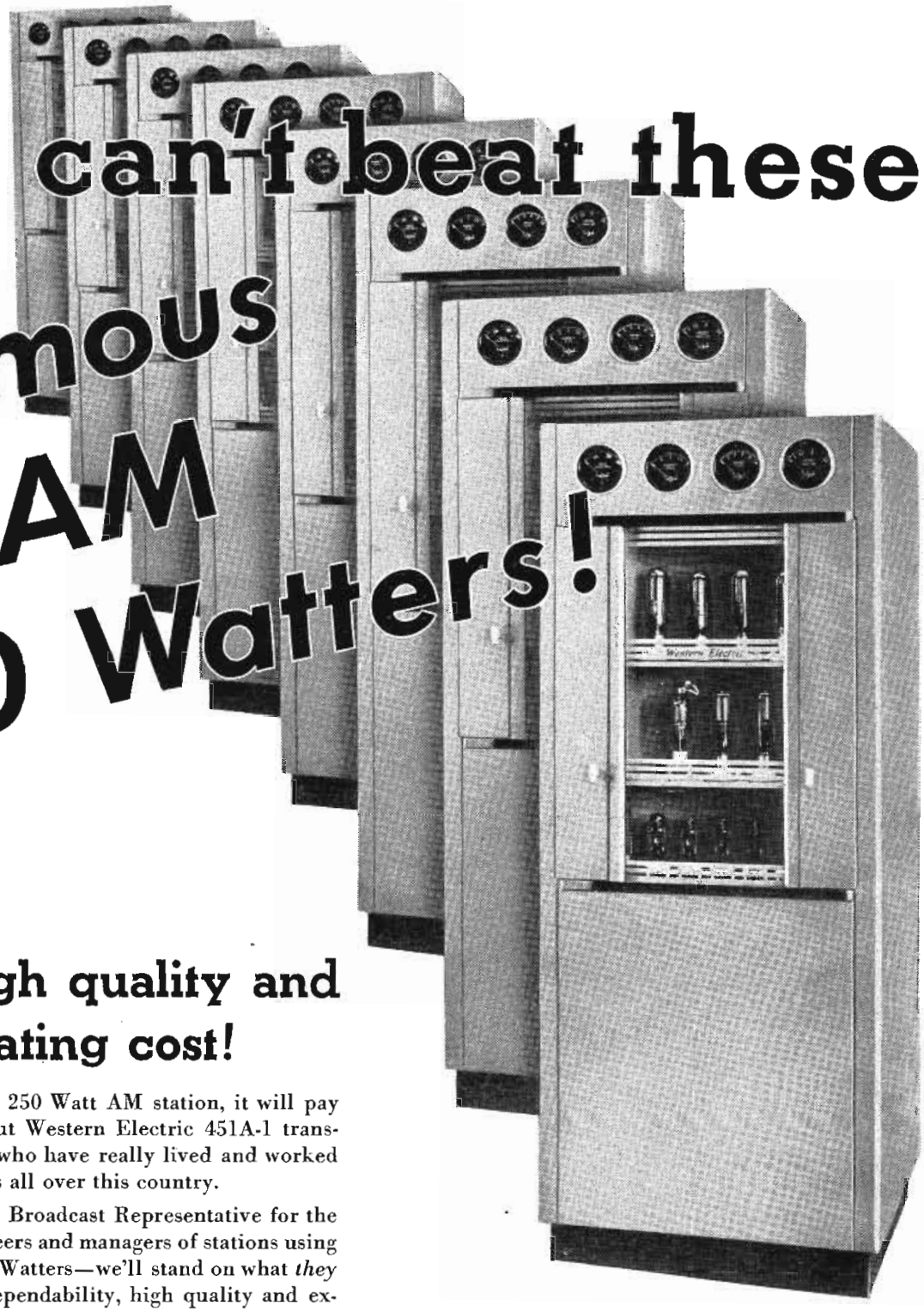
NOTES—All of these counters have a dead time of 200 microseconds. They are argon filled with a quenching vapor added

(1) Mica window thickness of 1.4mg/cm$^2$. Has the equivalent stopping power of one centimeter of air. Will pass all beta radiation in excess of 25KeV close to the window.

(2) Mica windows 3.5mg/cm$^2$ thick. Will pass all beta radiation of energy in excess of 43KeV close to the window.

(3) Mica windows 5.6mg/cm$^2$ thick. Will pass all beta radiation of energy in excess of 57KeV close to the window.

# You can't beat these famous AM 250 Watters!



## . . . for high quality and low operating cost!

If you're planning a 250 Watt AM station, it will pay you to find out about Western Electric 451A-1 transmitters from people who have really lived and worked with them in stations all over this country.

Ask your Graybar Broadcast Representative for the names of some engineers and managers of stations using Western Electric 250 Watters—we'll stand on what *they* tell you about the dependability, high quality and exceptional economy of the 451A-1—*now available for immediate delivery from stock.*

Call your Graybar man today—or write Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

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Graybar Electric Company
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Northern Electric Company, Ltd.

# Western Electric
## —QUALITY COUNTS—

# FILM RESISTOR CHARACTERISTICS

(*Continued from page 48*)

6. The film must be capable of withstanding wide variations in temperature.

7. It should have good high frequency characteristics.

8. It should operate at its rated load indefinitely without important changes in resistance values.

9. It should withstand vibration.

10. It should have low noise level.

11. It should withstand effects of salt water spray.

In the last analysis the rating of devices like the printed resistor is determined by long time tests. That safe rating is usually applied which insures satisfactory performance under the rated load. Obviously the temperature limitations of the resistor components are determining factors in this rating.

### Supporting Base Important

The supporting base plays a very important part, as was disclosed during experiments in printing resistors on vitreous dielectric bodies. Comparative tests were made between phenolic sheet, steatite and vitreous dielectric, with and without printed silver inlay. The resistor dimensions were .040 in. by ½ in. printed on supporting bases having a projected area of one square inch, except in the case of the vitreous dielectric with silver inlay, which was 0.56 square inches.

The differences disclosed by the tests are due primarily to the differences in the thermal conductivity of the base materials. As is to be expected, the lower thermal heat conductivity of phenolic results in higher temperature rises than with ceramic.

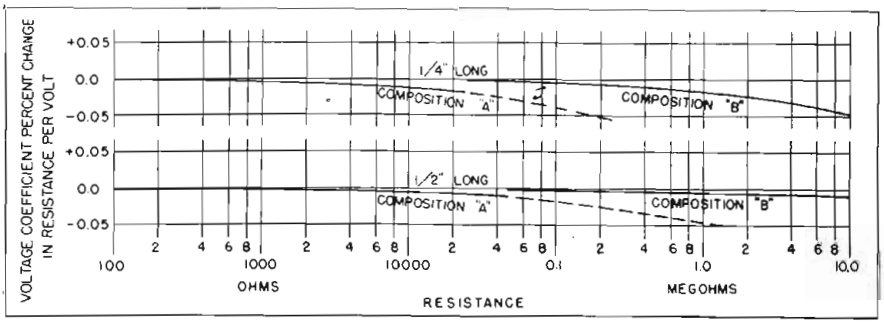
It should be pointed out that despite the higher temperature rise for phenolic sheets, they have proved to be a very satisfactory base for numerous reasons. The ratings and temperature requirements which would normally be assigned to a resistor of these dimensions, namely, .1 to ¼ watt, are well within the temperature and life limitations of these materials. Also many applications require resistors carrying negligible power. In addition, the adhesion of printed film to phenolic is remarkably good. Another factor of importance is that the thermal properties of a phenolic are very close to those of the film. Finally, the use of phenolic lends itself readily to mass production methods.

The temperature coefficient of this class of resistors is not a constant factor. It varies with resistance value, and for a given resistance value it varies with temperature. The coefficient may even change sign at some point on the temperature scale. This anomalous behavior is due to the peculiar structure of the resistor. We are not dealing with a pure conductor which has a positive coefficient or a semi-conductor which has a negative coefficient. We are dealing with a conduction (graphite or carbon, or both) which may have negative or positive coefficients, mixed in varying proportions with insulation. In addition, the supporting base is affected by temperature. Temperature changes affect all these components differently. Stresses are set up by even small differences in coefficient of expansion between these various components. Also, contraction and expansion may affect the contact pressure between conducting particles non-linearly for the same temperature increment at different temperatures.

It is well known that the apparent ac resistance of composition resistors shows a drastic fall-off from the dc value as frequency increases. This is more particularly true of high resistance values. This effect, known as the "Boella effect," named after its discoverer in Italy, was further investigated in England where G. W. O. Howe proposed a theory explaining this behavior. The fall-off in resistance value with increasing frequency is primarily due to the shunting effect of the distributed capacitance in the resistor. Large numbers of conducting particles interspersed with large amounts of dielectric produce capacitances and its concomitant dielectric losses which act as shunts at high frequencies. Minimum dielectric is therefore the condition for better frequency characteristics.

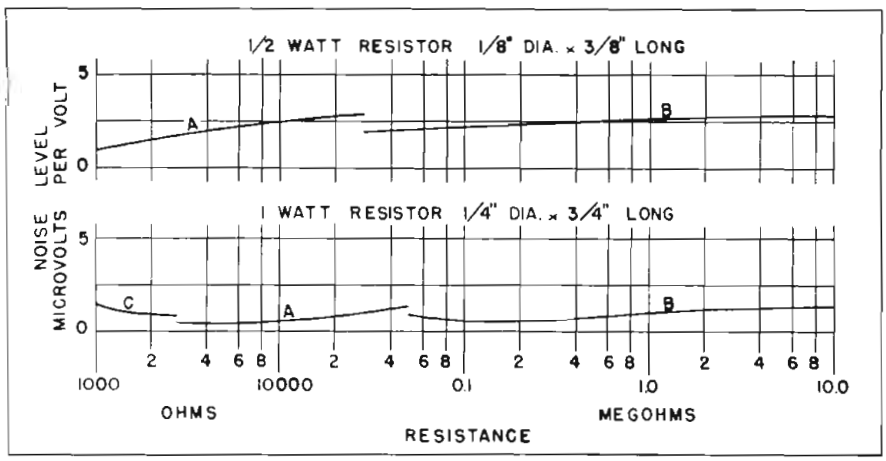
As a direct result of this condition, the geometry of the resistor

(*Continued on page 84*)

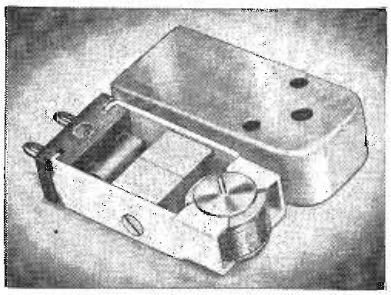



**Film resistor voltage coefficient is a function of composition, resistance and length of film**

**Noise characteristics in film resistors are dependent on composition, resistance and wattage**

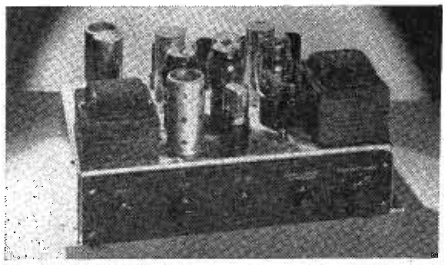


## SOUND EQUIPMENT



### *Magnetic Pickup*

The Clarkstan RV pickup with removable sapphire stylus is a magnetic reproducer with a frequency response flat to 15,000 cycles. The only moving part is the needle, weighing 31 mg, which is also the armature. Needleforce is 20 grams, output 60 millivolts at 1000 eps with a lateral displacement of .001 in. The standard cartridge has high impedance, but impedances of 5, 50, 250, and 500 ohms are available. The unit is designed to operate in conjunction with a transcription-type tone arm.—**Clarkstan Corp., 11927 West Pico Blvd., Los Angeles 34, Cal.**



### *Laboratory Amplifier*

Supplied with a matched variable reluctance pick-up cartridge, type 210-A laboratory amplifier provides a complete phonographic system with the exception of turntable and loudspeaker. Amplifier output is 20 watts with less than 2% distortion; below 8 watts the distortion is under ½%. The output transformer matches speaker impedances between 2 and 500 ohms. With the Dynamic noise suppressor the response is flat to 10,000 cycles and extends to 16,000 cycles. Maximum frequency range exceeds 20,000 cycles.—**Hermon Hosmer Scott, Inc., 285 Putnam Ave., Cambridge, Mass.**

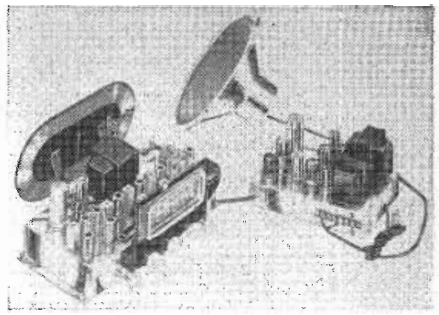
### *Program Equalizer*

The 4031-B program equalizer is designed to fulfill a wide range of equalization requirements for broadcast and recording studios. 12 db equalization is affected at 100 cycles and 3, 5 and 10 kc in calibrated and detented two db steps. High and low frequency atteuuation up to 16 db in two db steps is accomplished by turning the same controls counter clockwise past the center point. Over 1465 curve combinations may be obtained. The unit has only 14 db insertion loss in a 500/600 ohm circuit.—**Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif.**

### *Recording Disc*

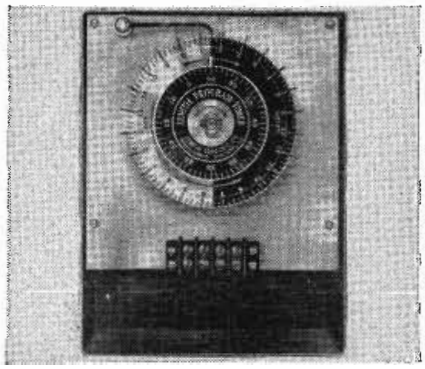
Sonic blanks a new lacquer formulation and controlled coating technic, involving new ingredients are designed to provide unusual cutting cleanliness, correct chip throw, freedom from static, low signal-to-noise ratio, and absenee of clicks, crackles, wows and other surface noises. The blinks are made iu three grades, both single-and double-face. — **Sonic Recording Products, Inc., 50 Mill Road, Freeport, L. I., N. Y.**

## COMMUNICATIONS & TV



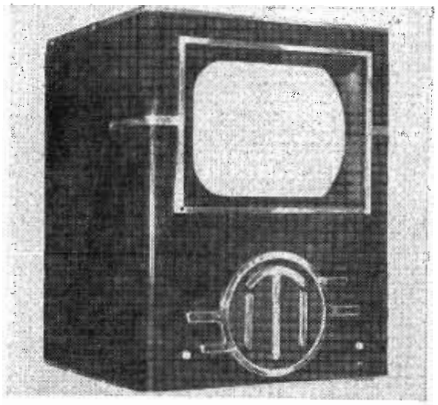
### *AM-FM Tuner*

An automatic frequency control in the FM circuit of Model 1-2-3, AM-FM Tuner with Hi-Fidelity Amplifier and 12-in. speaker, compensates for drift and eliminates the need for a tuning indicator because it has only one, non-critical, tuning response point. Model 1-2-3 has self contained interually-switched inputs for phonograph, recorder, television sound, and microphone and multiple outputs to adopt to many sizes and numbers of speakers, transmission line, or facsimile recorder.—**Radio Craftsmen, Inc., 1341 So. Michigan Ave., Chicago 5.**



### *Program Timer*

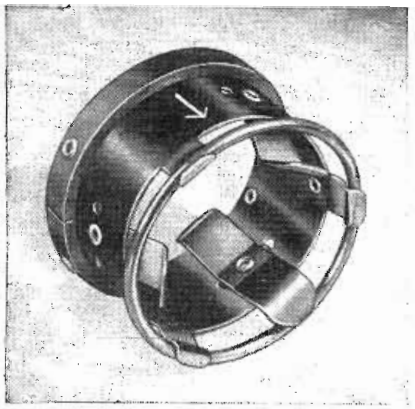
The Zenith P-15-24 is a low-priced program timer which can be set to sound a bell or other signal at predetermined 15-minute intervals for 24 hours a day. Circuit closure will give a signal, which can be set from 2 to 60 seconds duration. Another available model, PR-15-24, is for controlling radio programs, record players etc.—**Zenith Electric Co., 152 Walton St., Chicago 10, Ill.**



### *Program Monitor*

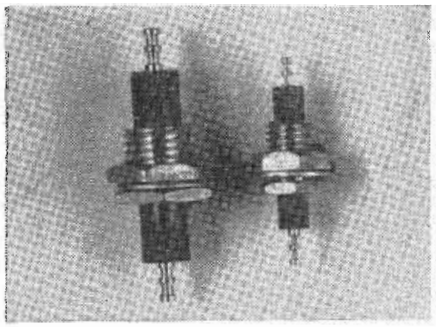
Designed for use in television stations for high quality picture and sound reproduction, the IT-4R Series Deluxe Program Monitors are available in 2 picture sizes: 12¾ x 17¼ and 9½ x 12¾ in. Stations using RMA video and sound standards can connect any number of these monitors to available signal sources without change. Power consumption is 350 watts from 115-volt, 60 cycle ac line. All primary circuits are fused properly.—**Industrial Television Inc., 359 Lexiugton Ave., Clifton, N. J.**

## NEW PRODUCTS



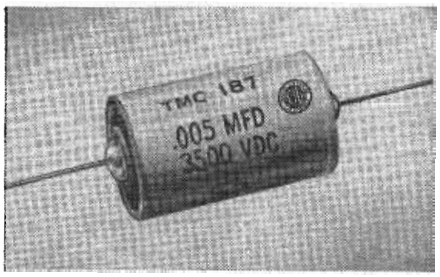
### *TV Tube Beam Bender*

Consisting of 2 ring magnets held in a non-magnetic mounting collar, the Clarostat Beam-Bender is entirely self contained and can be applied without tools. Three spring fingers provide a frictional yet adjustable fit on the neck of the usual 7 in. or 10 in. tube. The beam-bender is simply slipped over the base of the tube and on to the right position on the neck so that the permanent ring magnets can provdie magnetic flux proportional to the required beam-bending function in the tube.—**Clarostat Mfg. Co., Inc., 130 Clinton St., Brooklyn, N. Y.**



### *Feed-Through Terminals*

Designed to feed high voltages through chassis, panels, cavity walls etc., these insulated feed-through terminals have heavily plated metal parts and are constructed to withstand shock and vibrations. Two lengths are available, each for either ¼ in. or ⅜ in. hole mounting. The larger model will withstand a breakdown voltage of 8000 V, 60 cycle, ac.—**Dept. 6, Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.**




### *TV Capacitor*

An extremely compact tubular capacitor specifically designed for television applications, type TMC—1B7, is made in a rating of .005 mfd., 3500 volts dc working, and is available in single and dual capacities and other voltage ratings with small physical dimensions. It is housed in a hermetically sealed cylindrical metal container and a wax impregnated cardboard sleeve with rolled over ends insulates the case.—**Cornell-Dubilier Electric Corp., South Plainfield, N. J.**

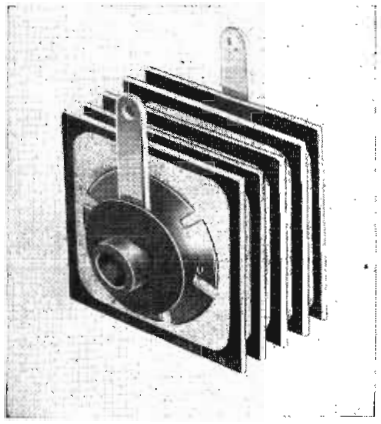
# DIRECTORY OF TELEVISION RECEIVER MANUFACTURERS

**One hundred eleven companies listed below by name, address and name of the chief engineer include all firms known to be making television receivers or who are expected to go into production shortly. This list has been specially compiled by Tele-Tech. Omissions, if any, will be included in future listings.**

| COMPANY | ADDRESS | CHIEF ENGR. |
|---|---|---|
| Admiral Corp. | 3800 Cortland St., Chicago 47 | R. M. Jones |
| Aeromotive Equip. Corp. | 1632 Central St., Kansas City 8, Mo. | E. D. Smith |
| Air King Products Co. | 170 53rd St., Brooklyn 19, N. Y. | L. M. Kay |
| Andreo Radio Corp. | 27-01 Bridge Plaza N., Long Island City 1, N. Y. | H. J. Heindel |
| Ansley Radio Corp. | 41 St. Joes Ave., Trenton, N. J. | A. C. Ansley |
| Arcturus Radio & Television Corp. | 99 Sussex Ave., Newark 4, N. J. | Rudolph Selbmann |
| Atlas Development Labs. | 26 Journal Square, Jersey City 6, N. J. | Stanley Selnick |
| Audar, Inc. | Walnut & Maple Sts., Argas, Ind. | E. W. Applebaum |
| Automatic Radio Mfg. Co. | 122 Brookline Ave., Boston 15 | C. S. Wexler |
| Bace Television Corp. | Green & Leuning Sts., S. Hackensack, N. J. | C. N. Bace |
| Belmont Radio Corp. | 5921 W. Dickens Ave., Chicago 39 | P. A. D'Orio |
| Bendix Aviation Corp. | E. Joppa Rd., Baltimore 4 | P. C. Hieroth |
| Berger Electronics | 109-01 72nd Rd., Forest Hills, N. Y. | G. E. Berger |
| Bowers Radio & Television Co. | 44 S. Sixth St., Reading, Pa. | James Cochran |
| Browning Labs., Inc. | 750 Main St., Winchester, Mass. | F. A. Spindell |
| Brunswick Div., Radio & Television Inc. | 244 Madison Ave., New York 16 | Myer Lerner |
| Cage Projects, Inc. | 393 Grove St., Upper Montcloir, N. J. | J. M. Cage |
| Certified Radio Labs. | 5507 13th Ave., Brooklyn 19, N. Y. | Max Seligsohn |
| Cleervue Television Corp. | 18 Willoughby St., Brooklyn 1, N. Y. | H. L. Sachs |
| Colonial Radio Corp. | 254 Rano St., Buffalo 7, N. Y. | H. C. Tittle |
| Colonial Television Corp. | 780 E. 137 St., Bronx, N. Y. | P. N. Tsokris |
| Concert Master Radio & Television Co. | 1800 Winnemac Ave., Chicago 40 | M. Gaber |
| Consolidated Television Corp. | 601 W. 26th St., New York 1 | J. T. Koleda |
| Coronet Radio & Television Corp. | 500 W. 52nd St., New York 19 | Raphael Spiegelman |
| Crosley Div., AVCO Mfg. Corp. | 1329 Arlington St., Cincinnati 25 | L. M. Clement |
| Delco Radio Diiv., General Motors | Kokomo, Ind. | B. A. Schwarz |
| DeWald Radio Mfg. Corp. | 35-15 37th Ave., Long Island City 1, N. Y. | Marcus Glaser |
| DuMont Labs. Inc. | 2 Main St., Passaic, N. J. | T. T. Goldsmith |
| Duval Radio & Television Corp. | 423 Grove St., Jersey City, N. J. | G. Kirk |
| Dynamic Television Associates, Inc. | 155 Prince St., Brooklyn 1, N. Y. | M. Berinsky |
| Electromotic Mfg. Corp. | 88 University Place | |
| Electronic Labs., Inc. | 24 W. 24 St., Indianapolis 8, Ind. | W. C. Otte |
| Electro-Technical Ind. | 121 N. Broad St., Phil. 2 | Sam Sounders |
| Emerson Radio & Phonograph Corp. | 111 Eighth Ave., New York 11 | Dorman Irsael |
| Espey Mfg. Co. | 528 E. 72nd St., New York 21 | John Benedikt |
| Fado Radio & Electric Co. | Belleville, N. J. | Don Brand, Sr. |
| Fornsworth Television & Radio Corp. | 3702 E. Pontiac St., Fort Wayne 1, Ind. | Madison Cawein |
| Federal Telephone & Radio Corp. | Harrison, N. J. | W. H. Cooper |
| Fisher Radio Corp. | 41 E. 47th St., N. Y. C. | G. P. Maerkle |
| Freed Radio Corp. | 200 Hudson St., N. Y. C. | Murray Weinstein |
| Garod Radio Corp. | 70 Washington St., Brooklyn 1, N. Y. | B. S. Trott |
| General Electric Co. | Electronics Div., Syracuse 1, N. Y. | Charles Fick |
| General Television & Radio Corp. | 2701 N. Lehmann Court Chicago 14 | Wm. Kroening |
| Gilfillan Bros. Inc. | 1815 Venice Blvd., Los Angeles, Calif. | C. F. Wolcott |
| Globe Electronics, Inc. | 225 W. 17th St., New York 11 | Henry Fogel |
| Hallicrafters Co. | 4401 W. Fifth Ave., Chicago 24 | Nelson Case |
| Hommarlund Mfg. Co. | 460 W. 34th St., New York | D. K. Oram |
| Hoffman Radio Corp. | 3761 S. Hill St., Los Angeles 7 | S. C. Cutler |
| Howard Radio Co. | 1735 Belmont Ave., Chicago 13 | Wilfred James |
| Industrial Television, Inc. | 359 Lexington Ave., Clifton, N. J. | Horace Atwood Jr. |
| International Detrola Corp. | 1501 Beard Ave., Detroit, Mich. | R. M. Dougherty |
| Jamaica Television Mfg. Co. | 148-18 Jamaica Ave., Jamaica 2, N. Y. | W. B. Still |
| Jewel Radio Corp. | 583 Avenue of the Americas, N. Y. C. | Robert Lieberman |
| Kingston Radio Co. | 1415 N. Webster, Kokomo, Ind. | H. F. Rieth |
| Kinsey Radio Mfg. Co. | 5807 Oak St., Omaha 6, Nebr. | M. Kinsey |
| Leor, Inc. | 110 Ionia Ave. N.W., Grand Rapids 2, Mich. | R. G. Leitner |
| Magnavox Co. | 2131 Bueter Rd., Fort Wayne 4, Ind. | R. H. Dreisbach |
| Majestic Radio & Television Corp. | Elgin, Ill. | E. B. Possow |
| Meck Industries Inc. | John, Plymouth, Ind. | |
| Midwest Radio Corp. | 909 Broadway, Cincinnati 2, Ohio | P. Smith |
| Minerva Corp. of America | 238 William St., New York 7 | Ignatius Volpe |
| Motorola, Inc. | 4545 Augusta Blvd., Chicago 51 | Don Mitchell |
| National Company Inc. | 61 Sherman St., Malden 48, Mass. | W. J. Larkin |
| Nielson Television Corp. | Newtown Ave. & Crawford Rd., Norwalk, Conn. | M. J. Jelen |
| Noblitt-Sparks Industries Inc. | Columbus, Ind. | B. H. Irwin |

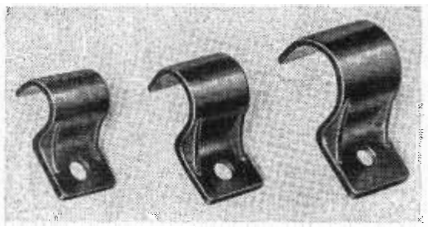
*(Continued on page 60)*

## NEW PRODUCTS



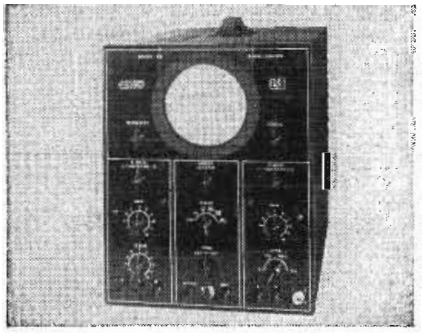
### *Selenium Rectifiers*

Models 6RS5GH1 and 6RS5GH2 selenium rectifiers are one-inch square and have a high inverse peak voltage rating wih a low inverse current, even with peak voltages up to 350 volts. Each rectifier will withstand safely the inverse peak voltages obtained when rectifying (half wave) 110-125 volts, rms, and feeding a capacitor. Ratings are based on ambient temperatures of 50 C. to 60 C. The forward voltage drop through the rectifier is approximately 5 volts at rated current output.—**Tube Div., General Electric Co., Schenectady 5, N. Y.**



### *Plastic Cable Clamps*

Plastic cable clamps are furnished in ⅜ in., ½ in., and ⅝ in. sizes with single screw mounting. Good dielectric characteristics afford short circuit protection due to worn cable insulation. The clamps are light, weather and fume resistant.—**American Molded Products Co., 1644 N. Honore St., Chicago 22, Ill.**



### *Oscilloscope*

Model 75 oscilloscope has a vertical amplifier response within 2 db from 10 cycles to 5 megacycles, permitting direct observation of the composite video signal. Its vertical input impedance with probe is .1 megohm in parallel with 14 mmf., and the sweep is variable between 10 cycles and 60 kc. A self-contained voltage calibrator is accurate within 5%.—**Electronic Development Lab., 2655 W. 19th St., Chicago 8, Ill.**

## DIRECTORY OF TELEVISION RECEIVER MANUFACTURERS (continued from page 60)

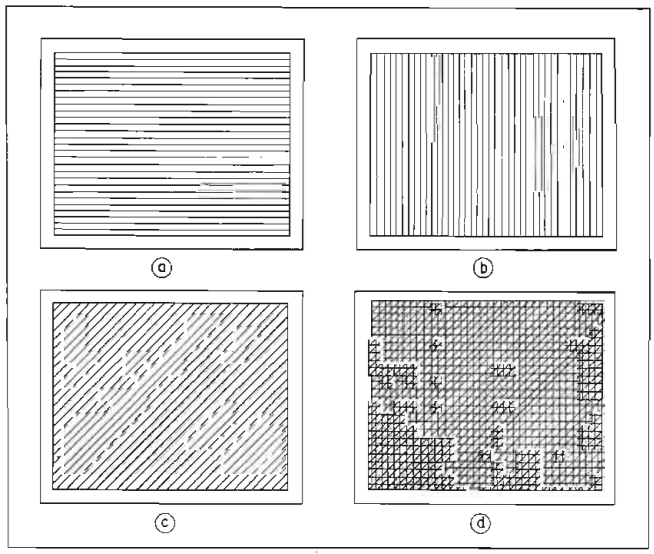
| COMPANY | ADDRESS | CHIEF ENGR. |
|---|---|---|
| Olympic Radio & Television, Inc. | 3401-19 38th Ave., Long Island City, N. Y. | Benjamin Bordiga |
| Paramount Television Corp. | 14 New Hyde Park Rd., Franklin Square, N. Y. | Louis Asheraff |
| Philco Corp. | "C" and Tioga Sts., Philadelphia 34, Pa. | P. M. Craig |
| Philharmonic Radio Corp. | 528 E. 72nd St., New York, N. Y. | David Kretchman |
| Philips Laboratories, Inc. | P. O. Box 39, Irvington-on-Hudson, N. Y. | J. Fleming |
| Phoenix Electronics, Inc. | Lawrence, Mass. | Anthany Lambo |
| Pilot Radio Corp. | 37-06 36th St., Long Island City 1, N. Y. | W. A. Auerbacher |
| Prestan Television Co. | 38-26 Bell Blvd., Bayside, N. Y. | Burt Preston |
| Radio Corporation of America | Camden, N. J. | D. F. Schmit |
| Radio Development & Research Corp. | 26 Cornelison Ave., Jersey City, N. J. | Robert Dorr |
| Ray Energy Corp. | 32 W. 22nd St., New York, N. Y. | Bernard Meyers |
| Regal Electronics Corp. | 603 W. 130 St., New York 27 | Leo Galanek |
| Remington Radio Corp. | 80 Main St., White Plains, N. Y. | M. Dolbey |
| Republic Television, Inc. | 7 E. Madison Ave., Dumont, N. J. | D. P. Nelson |
| Rod Radio Mfg. Co. | 4226 S. Lawndale Ave., Lyons, Ill. | M. Stillman |
| Scott Radio Laboratories, Inc. | 4541 Ravenswood Ave., Chicago 40 | W. F. Cotter |
| Sentinel Radio Corp. | 2100 Dempster St., Evanston, Ill. | W. J. Schnell |
| Setchell Carlson, Inc. | 2233 University Ave., St. Paul 4, Minn. | |
| Shevers, Inc., Harold | 33 W. 46th St., New York 19 | Louis Arma |
| Sightmaster Corp. | 220 Fifth Ave., New York 1 | Harold Edelstein |
| Signal Electronics, Inc. | 114 E. 16th St., N. Y. C. | George Miller |
| Sonora Radio & Television Corp. | 325 N. Hoyne Ave., Chicago 12 | Donald Fetterman |
| Sparks-Withington Co. | 2400 E. Ganson St., Jackson, Mich. | H. H. Knubbe |
| Sportsview Television Co. | 540 Bushwick Ave., Brooklyn, N. Y. | Gerard Francoeur |
| Stewart-Warner Corp. | 1826 W. Diversey Parkway, Chicago 14 | S. Kolanowski |
| Stromberg-Carlson Co. | 100 Carlson Road, Rochester 3, N. Y. | F. C. Young |
| Tech-Master Products Co. | 123 Prince St., New York 12 | Jack Reuben |
| Telesonic Corp. of America | 5 W. 45th St., New York 19 | Ben Jaeger |
| Tele-Tone Radia Corp. | 609 W. 51st St., N. Y. C. | Ben Singer |
| Televue Corp. of America | 339 Laurel Ave., Lakewood, N. J. | W. A. Huber |
| Television Development Labs. | 252 W 64th St., New York 23 | Samuel Lieben |
| Televox, Inc. | 451 S. Fifth Ave., Mt. Vernon, N. Y. | Robert Augustine |
| Telicor Corp. | 851 Madison Ave., New York 21 | Richard Shottenfeld |
| Templetone Radio Mfg. Corp. | Templetone Bldg., New London, Cann. | Edward Jahns |
| Tradio, Inc. | 1001 First Ave., Asbury Park, N. J. | Nat Hellman |
| Transvision, Inc. | 385 North Ave., New Rochelle, N. Y. | Sam Carlisle |
| Trav-Ler Radio Corp. | 571 W. Jackson Blvd., Chicago 6 | R. J. O'Brien |
| U. S. Television Mfg. Corp. | 3 W. 61st St., New York 23 | Antony Wright |
| Universal Television Corp. | 147 Montague St., Brooklyn 1, N. Y. | R. M. O'Dea |
| Warwick Mfg. Corp. | 4640 W. Harrison St., Chicago | H. Gates |
| Watterson Radio Mfg. Corp. | 2700 Swiss Ave., Dallas 1, Texas | P. D. Davis |
| Wells-Gardner & Co. | 2701 N. Kildare Ave., Chicago 39 | G. T. Bennett |
| Westinghouse Electric Corp. | Home Radio Division, Sunbury, Pa. | G. C. Larson |
| Westminster Television, Inc. | 210 E. Ninth St., New York 3 | Irving Shulman |
| Wilcox-Gay Corp. | Charlotte, Mich. | L. V. Wells |
| Zenith Radio Corp. | 6001 Dickens Ave., Chicago 39 | G. E. Gustafson |

## NEW VIEWING TUBE FOR COLOR TV

(*Continued from page* 41)

structure would be no more visible than the line structure in the ordinary black-and-white television wire; hence the screen construction should present no serious problem. The depth of penetration of high velocity electrons into a phosphor is of the order of two to three microns. For this reason, a very thin layer of phosphor on the surface of the screen wire is just as effective in producing fluorescence as a thick layer.

If the wires in the three color




Composite color screen made up of three separate screens with horizontal, vertical and diagonal wires. Each screen contains a different color phosphor. A fine mesh screen is used so that the lattice structure is invisible.

screens are all parallel, an objectionable "picket fence" optical effect may occur. This can be overcome by the arrangement shown in Fig. 3, wherein the wires are horizontal in screen (a), vertical in a screen (b), and at an angle of 45° in the screen (c). A screen can be designed so that all three screens are equally visible to the observer. The three color screens, together with the constant - potential screen, are clamped together, screen (d), and inserted into the cathode-ray tube as a unit, with leads brought out for the potential connections.

An alternative type of screen construction utilizes a thin transparent film, such as lucite, sodium silicate, magnesium fluoride or a suitable plastic material. The film should be permeable to electrons, which calls for either a thin film or one which is moderately porous. The film can be made porous by perforation. Conductivity is obtained by depositing a small amount of finely divided metal upon the film, either by a photographic process or by settling. The phosphor is then applied to the film. An alternative procedure is to mix the metal particles and the phosphor before deposition on the film. Mechanical stability as well as improved surface conductivity can be obtained by imbedding in the film a grid consisting of fine wires spaced relatively far apart.

In the foregoing method, the three screens may be either separated a short distance apart for additional insulation, or if the insulation provided by the film is sufficient to withstand the potential differences required to produce selective fluorescence, the screens can be laid one on top of another to form a "three decker sandwich" type screen. In such a screen, there is a tendency toward scattering of the electrons as well as a decrease in velocity of the electrons as they pass through the film. Both of these effects can be minimized by using a film material which is either naturally porous or one which is made porous by perforation.

### Source of Screen Potentials

The screens normally have an ambient dc potential of from several hundred to several thousand volts.

(*Continued on page 63*)

# WASHINGTON

★ ★ ★ **Latest Electronic News Developments Summarized by Tele-Tech's Washington Bureau** ★ ★ ★

**ALLOCATIONS BLUEPRINTING IS MAJOR AND MOST DIFFICULT TASK FOR FCC**—Even though the activities which attract the greatest publicity are their authorizations and policy determinations on broadcasting operations and stations, the Federal Communications Commission fully realizes that their uppermost and major problem and task during the coming spring is a satisfactory blueprint of frequency allocations to serve the imperative needs of postwar radio such as television, FM, facsimile and the various forms of mobile and industrial services. The spectrum today, even though it is more extended than ever before dreamed-of, is likewise tighter than foreseen with the justified demands of these new radio services. Although the FCC is tightening up its policy of requiring the use of wire communications instead of radio, especially in the case of many of the projected mobile services, the bands, where legitimate "stakes" have been laid out by radio services, still are insufficient and the future job of the next few months of formulating an adequate allocations plan is proving extremely difficult. The FCC leadership realizes that time is awasting, but on the other hand the plotting of the allocations has to be accomplished with great care and certainty as many of the postwar services are ready to transfer from the experimental to a regular public service basis.

**ENGINEERS AND SCIENTISTS OF INDUSTRY MAY AID FCC**—With its own techanical staff, limited both in size and experience, the FCC is slated to make a direct appeal to the various segments of the radio industry (research and manufacturing) for cooperative assistance in supplementing the studies and talents of its own technical staff. The improvements in the radio art by the industry during the past year have proved a big boon in aiding the allocation blueprinting and high FCC officials commented to Tele-Tech's Washington Bureau that examples of these developments are the steady narrowing of channel separations, greater stability of emissions and in broad-band multi-channel transmission. Important in indicating possible reservoirs of spectrum space for public radio services, is the growing willingness of the armed services to encourage sharing of their band assignments with commercial radio operations so as to obtain greater experimentation results. The formation of national, regional and local groups in the various mobile radio transportation and industrial services for cooperative coordination of frequency allocation and usage is another helpful step. In order to speed up its allocations pattern formulation, the FCC, in addition, is toying with the idea of seeking the loan from industry of engineers and allocation experts of high calibre on a basis similar to the wartime dollar-a-year service by industrial executives with government agencies.

**TELEVISION COMPANIES' OWN MICROWAVE SYSTEMS FOR RELAYING**—Even though the coaxial cable network of the telephone company is growing rapidly, the FCC feels television organizations with ample engineering and manufacturing resources can speed the day of nationwide television service by establishing their own microwave systems for the relaying of video programs. Policy has been formulated by Commission which permits extension and operation of microwave systems by large television companies towards ends of enlarging scope and facilities of television program relaying for the next five years or so. After the coaxial cable facilities become fully adequate, the microwave systems can be utilized by aviation mobile and industrial radio services. Nationwide television is moving ahead more rapidly than even is disclosed in press—example was given in FCC grist of TV actions and applications during the first week of February with 10 construction permit grants and 19 applications from all sections of the country.

**FM BROADCASTING GIVEN BIG IMPETUS BY SPACE FOR RELAYING**—The recognition by the FCC of the imperative necessity of bands for relaying FM broadcasting in the 44-50 megacycle-band came after presentation of the requirements of FM by Dr. Edwin H. Armstrong before a House of Representatives Committee. The FM inventor won wholehearted support from the members of Congress. The bright future of FM broadcasting was painted at that hearing by Stromberg-Carlson and Zenith executives who predicted the sale of 2 million receivers for the FM listening audience this year. Facsimile through the FM broadcasters and the leading "fax" manufacturers, like Alden Products, Finch, Hogan and Faximile Inc., will be given a major boost in its plans for public service through the preparations for promulgation of rules and standards by the FCC at hearings starting March 15.

*ROLAND C. DAVIES*
*Washington Editor*

## Viewing Tube for Color

(*Continued from page 61*)

The additional potential required to produce full brilliance is keyed by either multivibrators or keying circuits. Three such multivibrators or keying circuits are interlocked so as to operate sequentially at any given instant, only one such circuit operates to apply a high potential to its corresponding screen. Those circuits can be synchronized by either the horizontal or the vertical synchronizing pulse.

The two principal obstacles encountered in the design of the chromoscope are those associated with voltage breakdown between the color screens and parallax errors. With phosphors presently available, accelerating potentials of the order of 3 to 15 kilovolts are required to produce the desired luminous intensities. In the chromoscope, the maximum potential difference between adjacent color screens is of the order of from a half to two thirds of the accelerating potential. Since relatively high potential differences between screens are required and the separation distance between screens is small to avoid parallax errors, voltage breakdown becomes an important consideration.

There are two types of parallax errors. The first is the electron beam parallax which causes the screen farthest from the electron gun to have a somewhat larger image than that closest to the gun. This type of parallax error is ordinarily not serious, since the angle of the electron beam with respect to the axis of the tube is small in conventional viewing tubes. It can be corrected by applying a somewhat higher positive potential (during the fluorescing phase) to the screens farthest from the electron gun.

The second type of parallax error is due to the angle at which the observer views the television picture. In a projection type of television system there is no observer parallax error, regardless of the position of the observer with respect to the projected picture. The reason for this is that the optical system is centered on the axis of the cathode-ray tube. The picture which it projects, therefore, is that which an observer would see if he were view-

(*Continued on next page*)

## Viewing Tube for Color

(*Continued from page* 63)

ing the image from a position on the axis of the tube.

If the television picture is viewed directly, there will be an observer parallax error which increases as the angle between the observer and the axis of the tube increases. The parallax error also increases with the separation distance between color screens. The observer parallax error for large angles will be of the order of magnitude of the separation distance between the color screens. For this reason, the chromoscope is best suited to projection-type receivers, although if the color screens can be placed close together without producing voltage breakdown, the parallax error may not be serious even in the direct-viewing tubes.

### Features of the Chromoscope

In color television systems, it has been found that two objectionable characteristics known as color flicker and color breakup occur if the color is changed at the end of each field. Color flicker occurs when the observer moves relative to the screen. The entire picture then appears momentarily as independent red, blue, and green pictures. Color breakup occurs when fast moving objects are televised. The moving object then appears as a succession of red, blue, and green objects owing to the motion of the object during each color scan.

Color flicker and color breakup can be completely eliminated by synchronizing the color interval with the horizontal sweep frequency instead of with the vertical sweep frequency. Successive lines of the picture would then be scanned in the red, blue, green color sequence and the color repetition rate would be sufficiently high to prevent color flicker or color breakup. Since the chromoscope is an all-electronic color system, it is just as easy to synchronize the color with the horizontal sweep frequency as with the vertical sweep frequency.

It is the opinion of the author that a sequential system in which the color is changed at the end of every line offers the only satisfactory solu-

tion to the perennial problem of how to receive high-definition television pictures on either a black-and-white or a color receiver, with a minimum bandwidth and approximately the present black-and-white television standards. The only deviation from the present black-and-white standards would be to change the number of lines in the picture from 525 to either 523 or 527 or some number not divisible by 3 which can be derived by multivibrators from a 60 cycle source. This is necessary since 525 is exactly divisible by 3; hence in a three-color 525-line picture, with the color changing at the end of every line, a given line would always be scanned in the same color in successive fields. The use of a line frequency which is not divisible by 3 assures color rotation for any one line in successive fields.

If the color is changed at the end of every line, each field (1/60 of a second) contains a three-color picture. With a double-interlaced system, each frame (1/30 of a second) contains a color picture in which every line has been scanned. Three consecutive frames are required for each line of the picture to be scanned in all three colors. It is believed that such a picture would have a definition at least comparable to that of a 525-line black-and-white picture. Because of the interlaced nature of the color scanning, there is no observable color flicker or color breakup. The total bandwidth would then be the same as that of black-and-white television.

At the transmitter, the camera would contain three pickup tubes with appropriate color filters. The signals from the three tubes can then be switched electronically to obtain the desired sequential color signal.

The chromoscope is particularly well adapted to the foregoing scanning method. Electronic switching can be used to change the color at the end of every line. Phosphors which have a fairly long persistence can be used, since it is not necessary to erase the picture at the end of every frame. In this respect, the chromoscope is superior to the revolving color disk system in which each picture must be erased before the next color filter comes into position.

## What's Ahead in TV?

(*Continued from page* 27)

of adjustment in receivers but it can and must be done.

REDUCE RADIATION. Receiver radiation, due to the heterodyne oscillator, must be kept at a minimum so that neighboring TV sets can "live together".

PICTURE SIZE AND BRILLIANCE. To most observers picture size means a good deal. Of course it is tied directly to picture brightness and sacrificing the latter to gain the former does not profit the designer. Home movies yield a larger, brighter picture at lower cost than television and it will take considerable technical development before TV will surpass home movies, but the writer has no doubt that ultimately the picture quality of TV will be the better.

What is the optimum picture size for the home, assuming that sufficient light is available and that cost is no object? It is believed that the ordinary family (possibly increased by some guests) seated in the average living room 21 feet long, would find a picture 4 feet high to be the largest they would want. Introducing the factor of cost and drawing the family circle together it is quite possible that a picture 1½ feet high, which is now available, will be entirely satisfactory. As far as brightness is concerned, most observers agree, once they have viewed pictures of such brilliance that normal room illumination can be used, they do not desire to go back to a darkened room for television entertainment.

TV SERVICEMEN. An important place on this list should be accorded the subject of selection and training of the television technician. He must be able to service radio receivers and must have special instruction in TV installation, know how to instruct the new owner in the operation of his set and, finally, be able to quickly diagnose troubles.

To diagnose deep-seated troubles the TV serviceman must be familiar with the latest "tools" which in themselves often present technical problems. He must know how to utilize a CR oscilloscope and inter-

pret what he sees. He must do considerable technical reading to keep abreast of this rapidly changing art, to get a working knowledge of UHF wave propagation and to learn antenna placement so as to reduce ghosts, etc.

A look into the future reveals, without any doubt, that one of the major factors that is going to keep TV rolling is more receivers in the hands of the public. This means lower priced sets—sets giving larger pictures of higher quality. In the past, television engineers have solved some difficult problems; it is reasonable to anticipate early progress towards the solution of these problems discussed above.

## Big Picture Practices

(*Continued from page 35*)

metallic film, thin enough to allow the passage of electrons. This greatly increased the tube brilliance. In addition to this, a new type of electron gun and other elements were developed to withstand the very high current used by the projector.

The development tube, the reflective optical system, and the necessary power supplies and control equipment are all self-contained in one unit. While the projector is designed for fixed focus operation, the various operating controls which are mounted on the unit, permit the operator to adjust the brightness, focus, framing of the picture.

A new type of power supply has been incorporated into the large screen projector which eliminates the danger usually present when high voltages are used. The high-frequency oscillator power supply used, instead of the conventional 60-cycle type, prevents the storage of high voltage in the filter circuits, and thus eliminates the potential hazard to operating personnel.

Television signals can be fed to the large screen projector from any regular television source such as network coaxial lines, microwave television rely sources, from studio or camera pickup sources, or any other standard video source.

Possible applications of large-screen television, in addition to that in the theatre include the accommodation of overflow crowds at conventions and meetings, and accommodation of studio visitors.

# Heard in Tele Circles

**9-Tube TV Sets . . . TRF Circuits . . . That 16-in. Tube . . . Share TV Towers . . . New Camera Tube . . . TV Projection Kits . . . Lens Magnifiers as Standard Equipment**

First 7, then 10, now 16 in. Add to the Big Picture Practices article, page 30, these facts about RCA's metallic tube. Its 16-in. size is being hailed by the many advocates of large-picture, direct-vision receivers as vindication of their ideas as to what the public will want. Samples of this new tube, which will permit a 15-in. viewing picture, will be made available this year but quantity production is not expected until 1949. The tube weighs about half as much as present 15-in. tubes — or about the same weight as a 10-in. tube, due to the chrome-iron funnel sealed to the glass neck and to the fine optical glass face plate carrying the screen. Cost of the tube is expected to be under $50.

* *

A television receiver revolution may result if a reportedly oscillatorless, 9-tube TV receiver is put into production. A number of new and radically different circuit changes are incorporated into the design to enable the set to operate satisfactorily on a comparatively small number of tubes. A specially designed, synchronizing circuit is said to be stable even with weak signals. It is rumored that a number of manufacturers are now dickering with the inventor, a government employee, for the rights to put the set into production.

* *

Study TRF. Design engineers of tele receivers are urged to keep in mind the possibility of tuned radio frequency circuits for lowering the price of TV sets — and not only as a cost-cutting expedient, either. It is likely that such receivers with less than half the usual number of tubes in the lineup will be commonplace before long. Oscillator drift and oscillator reradiation would be avoided, at least.

* *

RCA is reported making a new camera tube which will combine the high definition of the iconoscope and the high sensitivity of the image orthicon. We should hear more

about this next August.

* *

Will telecasters share strategically located towers in metropolitan areas? The American Broadcasting Co. is trying to work out an arrangement for sharing the Chrysler Building tower in New York where the Columbia Broadcasting System now has its TV antenna. So few good high spots are available to equal the UHS (ultra high spots) such as the Empire State and Chrysler towers, that share and share alike is becoming the cry of those who do not now have access to New York's highest buildings for television broadcast tower facilities.

* *

Transvision, Inc., who has been doing such a good distribution job with its direct-view tele kits, is expected to bring out a TV projection set kit in 4 to 6 months.

* *

Add to our Liquid Lens Corp. story on page 34: Bruno-New York has undertaken distribution of this lens magnifier element in the metropolitan area. Immediate effect is a reduction in its price from $55.95 to $29.95 list. So much interest has been manifested in this lens that Sylvania engineers investigated and there was loose talk about equipping thousands of their viewing tubes with the lens. (Mr. Sarnoff now has a Liquid Lens Corp. "liquid lens" attached to his personal home receiver to observe its magnification effect.) Sarnoff's is the first to have a slight dye tint added to the liquid to give better contrast.

* *

Significance of RCA's reported action in selling knock-down "kits" of its tele model 630TS to NBC and AT&T engineers for about $130, less 10-in. tube and cabinet, is not clear — but it's a break for the boys, nevertheless. One recipient opined that the knocked-down set will go on sale to the public soon.

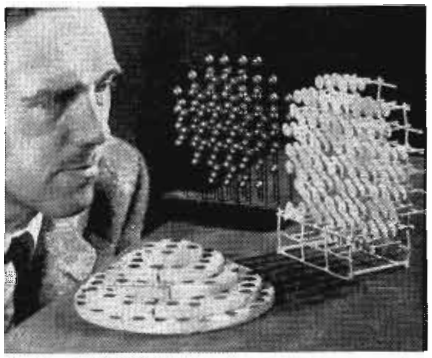
* *

Will a man buy a tele set when he has no television station within the range of his receiver? We have a number of reports that people are doing this. The build-your-own kits are particularly appealing to those who like to tinker or want to learn something about this new medium and want to have a tele set in the home ready for visual programs.

* *

We have it directly from Frank Stanton that CBS "definitely is not" going into the field of broadcast equipment manufacturing as rumored in back rooms.

# NEWS OF THE INDUSTRY



New type of metal lens developed by Bell Telephone Labs for focusing radio waves in relay systems. Theoretically capable of handling 50 to 100 television channels, the lens is based on the theory of light transmission through atomic and molecular structures and use of metallic spheres, discs or strips in a scaled-up pattern similar to the arrangement of atoms in a crystalline molecule. Dr. W. E. Kock of Bell Labs, who developed the lens is shown with three models. The one in the rear uses metallic spheres; model on right uses metallic discs; lens in foreground employs thin metallic discs mounted in polystyrene foam

## TV Statistics to Feb. 1

Statistics on the television industry, corrected to February 1, 1948, shed some interesting light on the direction and rapidity of the industry's growth. The 178,571 TV receivers produced in 1947 at an estimated retail sales value of approximately $123,000,000 is expected to reach an output volume of 3,000,000 receivers in 1950 with an estimated value of $600,000,000.

Present statistics show that there are 18 TV stations on the air realizing an annual time sales volume of $500,000. Seven of these stations are fully licensed. There are approximately 70 construction permits and 106 applicants. There are 400-odd channel assignments in 140 major TV areas. The total number of channel assignments will vary slightly in the light of FCC modifications of spectrum assignments.

## *CONVENTIONS AND MEETINGS AHEAD*

**March 22-25—IRE Convention and Radio Engineering Show,** Grand Central Palace and Hotel Commodore, New York.
**April 7-9—Midwest Power Conference,** Sheraton Hotel, Chicago.
**April 14—IRE Conference, Chicago,** Illinois Institute of Technology.
**April 24—Regional Television Conference,** IRE Cincinnati Section, Cincinnati, Ohio.
**April 26-28—IRE Spring Meeting on Transmitters,** Syracuse Hotel, Syracuse, N. Y.
**May 3-5—American Section, International Scientific Radio Union, IRE,** Washington, D. C.
**May 10-15—Radio Parts and Electronic Equipment Shows Inc.,** Show, Hotel Stevens, Chicago.
**May 17—National Association of Broadcasters,** 26th Annual Convention and Engineering Conference, Los Angeles.
**May 22—New England Radio Engineering Meeting, IRE,** North Atlantic Section, Cambridge, Mass.
**Sept. 30- Oct. 2—4th Annual Pacific Electronics Exhibit,** West Coast Electronic Mfgs. Assoc., Biltmore Hotel, Los Angeles.

# RCA Studio Image Orthicon


• Long awaited by many television stations is RCA's new Image Orthicon, model 5655, designed for sensitive pick-up under artificial illumination. The new tube will reduce studio lighting requirements considerably and consequently reduce the much-too-high studio operating temperatures which play havoc with television performers.

The sensitivity of the RCA 5655 is at least 100 times that of the iconoscope and has an inverse spectral response curve in the direction of the red and infra-red region. This latter characteristic is the principal difference from the Outdoor Image Orthicon (RCA 2P23).

Resolution of 500 lines or better at the center of the picture can be attained with the 5655. For such a horizontal resolution, the amplifier bandwidth should be about 5 mc or 1 mc per 100 lines of resolution. To prevent crosstalk seven separate layers of silicon-steel straps are applied to the outside of the focusing coil.

## TVA to Use 2-Way FM Radiophone

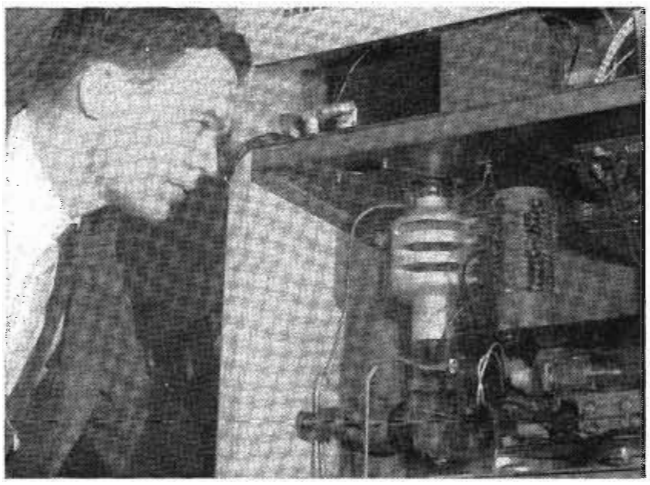
An FM radiotelephone network is being installed by the Tennessee Valley Authority to keep the repair crews of its 6400 miles of transmission lines in touch with each other and with operating headquarters. Twenty-four of the Motorola installations will be fixed stations located at division and district headquarters. Maintenance vehicles will be equipped with 50-watt Motorola mobile units which in test runs have provided communication over an average 30-mile radius from station-to-truck, and 15 miles from truck-to-truck.

## FCC Hearings on Facsimile

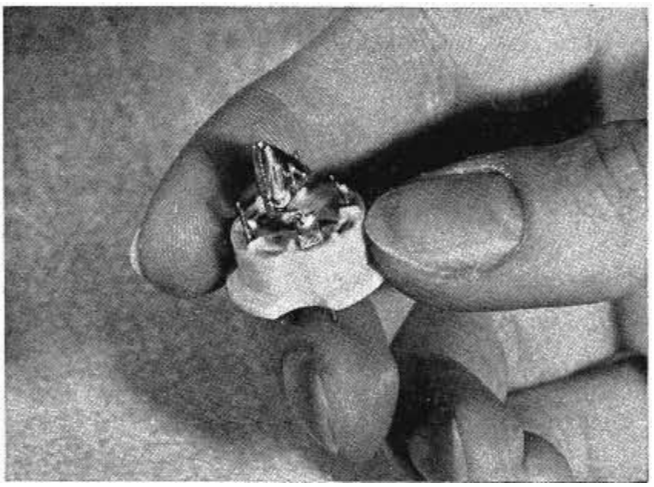
Repeated requests for hearings on facsimile transmission standards proposed by the Radio Technical Planning Board have spurred the FCC to announce that it will hold a meeting on March 15 in Washington. The standards proposed would provide for use of both 8.2 and 4.1-in. width recorders operating at the same linear rate of 105 lines per inch.

## FM License Application Rules

The FCC ruled last month that license applications for FM broadcast stations may not be filed until: (1) construction has been completed in exact accordance with the terms of the construction permit, and (2) equipment tests have been completed . . . or interim operation has been conducted with the equipment authorized in the construction permit.



Dr. K. G. McKay, Bell physicist, inspects apparatus showing electron gun which shoots a beam of electrons up into a diamond chip



Diamond chip is ¼-in. square, 20 1/1000-in. thick. Gold is evaporated onto the flat surfaces 100/1000-in. thick for conduction

# Insulator Amplifies Current 500 Times

A RADICALLY new method of controlling the flow and amplification of electric current — one that may have far-reaching influence on the future of electronics and the design of electron tubes — has been developed by Bell Telephone Laboratories. The method is based on the discovery that when beams of electrons are shot at an insulator — in this case a diamond chip — electric currents are produced in the insulator which may be as much as 500 times as large as the current in the original electron beam.

The process itself is somewhat similar to the technic of translating the energy of a beam of light into electricity. The experiments stemmed directly from previous pio-

(*Continued on page* 74)


# SOLDERING IRON

## PIN-POINT PRECISION • LOW-COST OPERATION

Only 8 inches long . . . weighs less than 2 ounces . . . with 1/8- and 1/4-inch tips! The new G-E Midget soldering iron really "goes places" in those complex, close-quarter assemblies. Its cool, easy-to-grip handle and its featherweight make it as simple to use as a pencil—permitting pin-point precision . . . giving faster, stronger, neater joints.

This new G-E iron combines big-iron performance with midget-iron economy. The famous Calrod* heater is built right into its Ironclad-copper tip—giving a rapid heat flow, delivering a full 25 watts to the work. The Midget soldering iron will do jobs formerly requiring much heavier, higher wattage irons. *Only $5.40, list* (without transformer). *See your local G-E Apparatus Distributor today!* *Reg. U.S. Pat. Off. 675-167

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CAPACITANCE RELAY.
FM-AM TUNERS.
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**TELE-TECH**

## CLOSING DATES

**1st** of preceding month—for all ads requiring proofs, composition, foundry work, key changes, etc.

**5th** of preceding month — For complete plates only. No setting.

**1st** of month—Publication Date.

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480 Lexington Ave. New York 17 PLaza 3-1340

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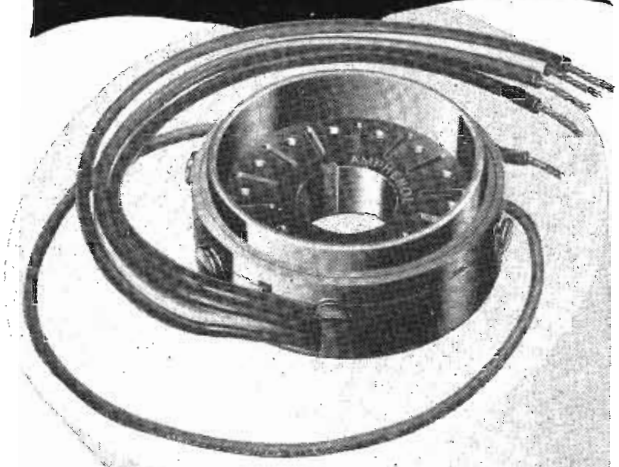
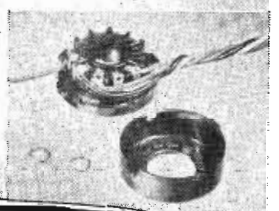
**QUALITY SHORT CUT TO MASS PRODUCTION OF TV RECEIVERS . . .**



**Compact, Custom-Wired**



**AMPHENOL**

## CATHODE RAY TUBE SOCKET ASSEMBLIES

DUODECAL AND DIHEPTAL

• Amphenol custom-wired cathode ray tube socket assemblies are unusually compact. Leads are grouped within the housing in unit cable form and brought through the side of the socket in any of six positions. This effects a further saving of space. High voltage lead may be segregated from main trunk wires. Safety socket cap enclosing all wiring connections is easy to remove. Recessed socket front shields operator or serviceman from high voltages; serves also as a guide for tube insertion. Creepage barriers between contacts provide long leakage paths and positive lead wire separation. *For manufacturer's applications, sockets are furnished in wired assemblies.*

**Duodecal Tube Sockets:** For most popular television viewing tubes with a maximum of twelve pins on a pin circle diameter of 1.063 inches.

**Diheptal Tube Sockets:** Made in two sizes, for small (2.050 inch) diameter tube bases, also for medium (2.250 inch) diameter bases. Both provide for a maximum of fourteen pins on a 1.750 inch diameter circle.

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

## Insulator Amplifies Current

(*Continued from page 72*)

neer research in which current was flowed through the diamond one way for a fraction of a second and then in the other direction, reversing itself 120 times a second. Alternatively negative and positive charges are drawn through the crystal and some of each kind are trapped. The trapped positive charges cancel out the effect of the trapped electrons, or negative induced in diamonds by bombarding them with alpha particles.

Inducting electric currents in diamonds by bombarding them with relatively light-weight electrons proved to be difficult. Bell physicists found that as the current started to flow in the diamond chip, the electrons became trapped in the tiny imperfections which are present in all crystals. Thus, after the first fraction of a second, the induced current tended to waste away under the opposition of the trapped electrons.

To overcome this, the investigators applied an alternating voltage to the diamond chip so that current charges, and the induced current is allowed to flow freely.

In bombarding the diamond chips with electrons, the physicists used successive pulses of electrons lasting probably a millionth of a second rather than a steady stream of electrons. Energies of approximately 15,000 electron volts were employed.

## Engineering Standards for TV Transmitters, Export Sets

Recommended engineering standards for radio receivers designed for export and covering the electrical performance of television broadcast transmitters were issued recently by the RMA Engineering Dept. along with other new and revised standards for the industry.

Among the standards recommended for export are that manufacturers shall state the number of receiving and amplification tubes, not including rectifier, ballast or tuning indicators; specify the frequency coverage and the power supply voltage and power supply frequency; shall have certain safety and shock prevention safeguards.

The recommended engineering standard of electrical performance for television broadcast transmitters covers both visual and aural TV transmitters, antennas, and transmission lines.

## TV Installation Study

A study of the problems involved in the installation and servicing of television receivers in metropolitan New York will be launched by a sub-committee of the National Electrical Wholesaler's Association. The N.E.W.A. Service and Repair Parts committee will investigate television transmitter coverage, difficulties of receiver installation, and whether metropolitan receivers are being serviced by dealers or an outside agency.

## FM ST Link Package

Final development of 940 to 960 mc FM studio-to-transmitter link equipment by Radio Engineering Labs., New York, has been announced by that company. The equipment consists of transmitter, monitor, receiver, transmitting and receiving antennas with their supporting structures and a supply of transmission line. Deliveries in quantities will be possible within the next few months.

## Movie Camera Films TV Pictures

A special 16mm movie camera for recording scenes directly from the face of the monitoring picture tube in the station has been developed by Eastman Kodak Co., Rochester, N. Y. It contains a 1,200-ft. film magazine for continuous recording of a half-hour program. Shutter and film mechanisms are operated by separate synchronous motor drives and the film chamber is designed so that film changes can be made in a lighted room. Equipped with a coated f/1.6 lens, the camera is particularly adaptable for recording programs for promotional or rebroadcast purposes.

## New Companies Formed

Chicago Electronic Engineering Co. is the name of the new organization replacing the Electronic Engineering Co., whose quarters at 3223 W. Armitage Ave., Chicago, were destroyed by fire in November 1947. The new company, temporarily located at 3845 W. Madison St., Chicago, will continue in the transformer and electronic wave filter field.

Audio Equipment Co., Inc., 80-20 45th Ave., Elmhurst, N. Y., has been formed by Anthony Marra and Arthur J. Sanial who have purchased the Portable Electric Megaphone, its patents and all rights to its manufacture, from the Guided Radio Corp., N. Y.

The newly formed Teletran Corp. will manufacture components for the television industry. Executive and sales offices are at 443 Greenwich St., N. Y. C., and the factory is in Ramsey, N. J.

Ohmega Laboratories, Inc., has been formed to specialize in research, design and development of all types of electronic and associated equipment. The new corporation, which will be located at Pine Brook, N. J., is an outgrowth of Kay Electric Co., also of Pine Brook.

Selenium Corp. of America, Detroit, Mich., has been voluntarily dissolved and is succeeded by Vickers Electric Div., Vickers, Inc., 2160 East Imperial Highway, El Segundo, California.

## Highway Maintenance Favors Owning Mobile Radio Systems

"State and county highway maintenance departments should own and control the mobile radio systems that they operate and they should not be leased from common carriers." This was the unanimous opinion of the technical committee on radiocommunications for highway operations of the American Road Builders Association at its recent convention in Washington. In the interest of economy and dependability of service, the committee believes that portable and walkie-talkie radio used by road building contractors while working on state or county projects should be under the control of the state highway services and licensed to them.

## New England IRE Meeting

The second New England Radio Engineering meeting sponsored by the North Atlantic Region of the Institute of Radio Engineers will be held on May 22, 1948 in the Hotel Continental, Cambridge, Mass.

## TV Set Output Up

Production of television receivers by RMA member manufacturers reached a new high of 30,001 for the month of January to slightly exceed December output by 656 units. January TV receiver production also showed an increase in console models of more than 100 percent. A total of 13,261 consoles and 16,740 table models make up the score.

All production for January was 1,339,256 receivers of all kinds. Of these, FM-AM sets totalled 136,015 for an increase of 140 percent over the 1947 monthly average. Of this figure, 65,166 were FM-AM table models.

## Nuclear Exhibit at Chicago Show

Atomic energy, its peace and wartime potentialities, will be the theme of an exhibit at the Chicago Production Show in the Stevens Hotel on March 22-24. Designed by the editorial boards of the American Chemical Society's two journals, the exhibit features an animated unit showing what happens in nuclear chain reactions. A pattern of lights is used to depict the shattering of an atom's nucleus by bombardment with a neutron, and the resultant scattering of fragments.

## Candidates for FCC Chief Engr.

Leading possibilities for the post of Chief Engineer of the FCC are acting Chief Engineer John A. Willoughby; Col. Edwin L. White, Chief of the Aviation Engineering Division; E. L. McIntosh, Chief of the Frequency Service and Allocation Division. No final selection is expected until Commissioner E. M. Webster returns from the London "Safety-at-Sea" conference.

## TV Receiver Magnifying Lens

Three new models have been added to the Walco line of plastic magnifying lens for television receivers, bringing the total number of models presently distributed to four. The Standard, Economy, and Moderne models are priced lower than the original Walco Deluxe and are sold nationally by Walco Sales Co., 76 Franklin St., East Orange, N. J.

## WU Uses Radio During Storm

When heavy coatings of ice put the main pole line between New York and Philadelphia out of commission during the recent blizzard, Western Union resorted to microwave radio beam telegraph to handle communications between New York and points south. During the interruption of normal service caused by the ice storm, a total of 100 carrier telegraph channels were employed. This load represented many more telegraph printer channels because multiplex circuits were used enabling several operators to send and receive telegrams simultaneously over a single channel.

## CBS Plans Huge TV Studios

The two immense television studios which are the largest in the world planned to date and which the Columbia Broadcasting System will build in leased space in the Grand Central Terminal Building, New York, will be mostly RCA equipped, according to Frank Stanton, CBS president. Several hundred thousand dollars will be spent in building and equipping the TV studios which will occupy a total of 700,000 cu. ft. of space. The first studio is expected to be in operation in April.

## New Transmitter for WNBT

A new RCA television transmitter was delivered to the National Broadcasting Co. last month to replace WNBT's pre-war TT-1 transmitter atop the Empire State Building. The TT-1 will be used as an emergency standby unit after the new transmitter is installed.

## DuMont and Crosley Form Tele Manufacturing Pact

Dr. Allen B. DuMont, president of Allen B. DuMont Laboratories, Inc., and R. C. Cosgrove, vice-president of AVCO Manufacturing Corp., Crosley subsidiary, have announced that the 2 companies have effected an agreement with respect to the manufacturing of television receivers under DuMont patents and the exchange of engineering and manufacturing information.

## "Special Red" Tubes

Featuring an unusual "girder" construction to hold internal elements rigidly in adjustment, the new RCA "Special Red" tubes are for highly critical industrial and commercial applications where long-life, stability, uniformity, and resistance to vibration are essential. The minimum life specification of this new line is 10,000 hours, the equivalent of 14 months round-the-clock service.

## NEW BULLETINS

### *Capacitors*

Catalog No. 200 published by Cornell-Dubilier Electric Corp., South Plainfield, N. J., is a 24-page reference book illustrated with detail drawings and photos of more than 20 different classes of capacitors manufactured by the company. (Mention T-T)

### *Radio Parts Supplement*

A 48-page supplement (No. 114) to the 164-page master catalog (No. 112) has been issued by the Allied Radio Corp., 833 West Jackson Blvd., Chicago 7, Ill. The supplement features new wire and disc recorders, test instruments, high fidelity sound equipment, a television kit and other new builders' kits, communications receivers and radio receiving sets. (Mention T-T)

### *Tube Manual*

Another edition of the RCA Receiving Tube Manual RC-15 has just been published featuring new developments in FM, up-to-the-minute technical data on miniature receiving tubes, and installation and application of kinescopes for television broadcast receivers. Copies of the RC-15 may be obtained from RCA Receiving tube distributors or by sending 35 cents to Commercial Engineering, RCA Tube Dept., Harrison, N. J. (Mention T-T)

### *Waveguide Assemblies*

Bulletin F-1 of the Technicraft Laboratories Inc., 237 East Aurora St., Waterbury, Conn., features three types of flexible wave guides: interlocked construction, seamless construction, and vertebra construction. The bulletin lists 11 applications for flexible waveguide assemblies. (Mention T-T)

### *Resistors*

Type B high voltage resistors is the subject of bulletin 2 by the Resistance Products Co., 714 Race St., Harrisburg, Pa. Construction, power rating stability, resistance tolerance, temperature and voltage coefficients and tapped units are covered. (Mention T-T)

### *Rheostats and Relays*

Rheostats, radio amateur relays and resistors are part of a new line of stock units manufactured by the Ward Leonard Electric Co., Mount Vernon, N. Y., and are illustrated and described in catalog D-30. (Mention T-T)

### *Transformers*

Air-cooled step-down transformers for power circuit installations manufactured by the Electran Mfg. Co., 103 East South Central Ave., Tuscola, Ill., are described in bulletin 27-A. Complete wiring diagrams, permanently etched on the nameplate of each transformer to prevent installation errors are described. (Mention T-T)

### *Test Films*

A catalog of test films for 16 and 35-mm motion picture projectors and sound reproducing equipment is available on request from the Society of Motion Picture Engineers, 342 Madison Avenue, New York 17. (Mention T-T)

### *Relays*

A new line of sensitive multiple arm relays is announced in bulletin 50-61 by Signal Engineering and Mfg. Co., 154 West 14th St., N. Y. C. The small general-purpose relays are available in three assembly styles. (Mention T-T)

### *Transformer Engineering*

"Engineering a Transformer," published by Standard Transformer Corp., 3560 Elston Ave., Chicago, Ill., is a practical introduction to the fundamentals and processes of transformer design and manufacture. Some of the subjects treated are: core design, coil conductors and insulation, coil testing and inspection, laminating magnetic cores, impregnation, and potting and sealing magnetic compounds. (Mention T-T)

### *Network Transformers*

A cut-a-way diagram showing how an alternating current network operates in city power systems is featured in bulletin 61B-6152A. The 24-page booklet, issued by Allis Chalmers Mfg. Co., Milwaukee 1, Wis., also describes planning and construction of Allis Chalmers' cores, coils, bushings, tanks, and other mechanisms. (Mention T-T)

### *Vibrometers*

Designed to give instant and accurate measurement of vibration in industrial machinery, model 11-B Vibrometer is described in bulletin 33 of the Televiso Products Co., 7466 West Irving Park Road, Chicago 34, Ill. Bulletin 33-A outlines the Vibrometer's application to electric motors, ball and roller bearings, electrical equipment, fans, pumps, compressors, buildings and structures. (Mention T-T)

### *Timing Motors*

Descriptions of synchronous timing motors, timing devices, and clock movements are included in a 16-page catalog published by the Haydon Mfg. Co., Inc., Torrington, Conn. The Haydon catalog is divided into separate sections for each of nine different motor series manufactured; also for various types of timing devices. (Mention T-T)

### *Ultrasonics*

Practical ultrasonic equipment as well as methods and results available to engineers in all industrial fields is published in bulletin 37 by the Televiso Products Co., 7466 West Irving Park Road, Chicago 34, Ill. Two improved Ultrasons are described. (Mentiou T-T)

### *Tube Price List*

A revised price list effective January 15, 1948 and covering tetrode, triode vacuum pump, and rectifier type tubes has been released by Eitel McCullough, Inc., San Bruno, California. (Mention T-T)

### *Radio Parts*

Over 1100 Bud products are illustrated and described in a new catalog issued by Bud Radio, Inc., 2124 East 55th St., Dept. A. Cleveland 3, Ohio. The catalog is free upon request. (Mention T-T)

### *Loud Speakers*

A complete compilation of engineering data, illustrations and dimensioual information covering Magnavox speaker models from the 4x6-in. elliptical to the 15-in. size are available from Magnavox Co., Components Div., Fort Wayne 4, Indiana. (Mention T-T)

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**Rodney D. Chipp** has been appointed assistant engineer for the DuMont television network. Formerly chief engineer of WKAV, Laconia, N. H., Mr. Chipp leaves his present position of facilities engineer of the American Broadcasting Co. to join DuMont.

**E. F. Herzog** has been named division engineer in the newly established engineering sections in the Government Division of General Electric's Electronic Department. **M. R. Johnson** was appointed design engineer; **R. C. Longfellow, H. F. Mayer, R. E. Moe** and **F. M. Reynolds** are section engineers.

**Wally B. Swank,** former radio engineer, has been appointed New York State sales representative of the Snyder Manufacturing Co., Philadelphia.

**Charles Francis Adams, Jr.** has been upped to the presidency of Raytheon Mfg. Co. He succeeds **Laurence K. Marshall** who has been elevated to chairman of the board.

**E. D. E. Geoghegan,** formerly chief engineer for the Tobe Deutschmann Corp., has been appointed factory manager of the Chicago plant of Solar Manufacturing Corp. at 4501 South Western Blvd.

## Resonance Indicator

(*Continued from page* 39)

With plate voltage removed, the instrument becomes a tuned rf diode voltmeter. The grid meter, now in the diode load circuit, will read upward when resonated to a source of rf energy, forming an absorption type frequency meter. It becomes a relative field strength meter when an antenna is connected to one of the coil posts. With the increase in circuit complexity, as in television equipment, timesavers like the grid-dip oscillator will assume increasing importance. For example as a signal generator, it can be used for receiver alignment. A small antenna on the receiver picking up a signal from the meter of the desired frequency may be all that is necessary for the servicer to align the set. The signal strength may be controlled

by the oscillator-to-antenna spacing. Precaution must be exercised so as not to confuse harmonics or receiver images.

Other interesting laboratory and service uses for the grid-dip are its application in checking capacitors in circuits without removal of wiring, using the set-up shown in the drawing. Clip a small loop of heavy wire 8 in. long across the terminals of the capacitor to be tested. Tune the grid-dip oscillator and note the frequency where the dip occurs. Refer to the table which indicates the capacitance. If resonance cannot be found within this range, the capacitor is bad. This test can be applied to most capacitors of smaller sizes in television and radio sets.

Other important applications for

this versatile instrument are as an oscillating detector or an absorption meter for in tracking down troublesome parasitic oscillations and stray radiations; its use for determination of resonant frequency of antennas and rf chokes, rf resistance, reactance and impedance.

In the instrument shown here, the coils are protected by a polystyrene sleeve and are mounted to permit convenient use in small and hard-to-reach places. The grid meter is mounted right in the instrument case where it may be easily observed as the resonant dip is found. The calibrated drum dial and the phone jack are likewise mounted in the case for greatest convenience. The only external element is the power supply which may be either batteries or an ac-operated supply. The scales are hand calibrated on a full-view drum dial, each scale being of equal length and having a modified SLF characteristic. The range of the instrument is covered by seven coils, each having at least two to one ratio with an overlap between ranges as follows: 1.9 to 4 mc; 3.9 to 8 mc; 7.9 to 15 mc; 15 to 30 mc; 30 to 60 mc; 60 to 110 mc; 110 to 200 mc, although other ranges can be supplied. The circuit is designed around a 9002 miniature triode.

## Electronic Calculator

A calculating machine that combines "the speed of electronic circuits" with a "memory capacity" was dedicated last month for the use of science. Developed by International Business Machines Corp. and known as the IBM Selective Sequence Electronic Calculator, this new machine automatically adds, subtracts, multiplies, divides, and calculates square and cube roots.

The electronic calculator contains 12,500 electronic tubes, 21,400 relays and 4,000 plug connections. Only a few days may be needed for the mechanical "brain" to unravel complex problems that ordinarily would require scientists a lifetime to solve.

## Rutgers Names Engr. Dean

Dr. Elmer Charles Easton of the Harvard Graduate School of Engineering has been named dean of the College of Engineering of Rutgers University. The appointment will become effective on July 1.

## WMAS Installs 8-Bay Antenna

FM station WMAS, Boston, Mass., recently began operations with its 8-bay Western Electric Cloverleaf antenna mounted atop historic Mount Tom. The large transmitter building which houses WMAS's 1 kw FM transmitter is shared with two other stations serving the Boston area, WHYN-FM and WACE-FM.

## Film Resistors

(*Continued from page 54*)

influences the high frequency characteristics. Consider two resistors of equal length, one having twice the cross-section of the other. For a given resistance value, the smaller unit would require resistance material with the lower specific resistivity. This means less dielectric resulting in better frequency characteristics. The condition for minimum dielectric is therefore minimum cross section of resistor. Similarly, if the area of both resistors is constant, the condition for minimum dielectric is maximum length. For best high frequency characteristics, the ratio of area to length of the resistor should be a minimum.

The resistance value of printed resistors is not independent of applied voltage; that is, it does not strictly obey Ohm's law, and decreases with increasing voltage. This characteristic, called the "voltage coefficient," is a function of:

1. Composition—materials used in film.

2. Resistance value—for a given type of composition and size resistor, the coefficient decreases with decreasing resistance value.

3. Length of resistor—for a given type of composition and resistance value, the coefficient decreases with increasing length.

The explanation for this is largely in the observed relationship between contact resistance between carbon particles and voltage across contacts. The contact resistance between two carbon particles is an inverse function of voltage. Since most of the resistance resides in the contacts, anything which reduces the voltage across the contact of conducting particles will reduce the voltage coefficient. Increasing the number of conducting particles is the equivalent to reduction of the amount of dielectric in the resistor, which is the condition for minimum voltage coefficient.

There are available methods for large scale production of printed resistors which can meet the difficult requirements imposed on them. The application of these methods to printed circuit work is one of adapting these methods to particular requirements.

## WABD Remotes

(*Continued from page* 45)

be rotated from the rear of the camera. Optical focus is accomplished by moving the orthicon with its focus and deflection yokes.

One of the off-the-air receivers is mounted in the truck but handles have been attached to the other to make it "portable."

The large mobile truck was designed by WABD personnel and has proved itself sufficiently practical and efficient to warrant description. The basic unit is a Chevrolet 1½ tone cab-over-engine chassis. It is designed so that inside, at the rear of the truck is mounted a DuMont Model 103 television receiver. During remote operations this receiver is used to monitor the main transmitter and shows the on-the-air switching between the studio and field. This receiver is so modified that the video section can be fed directly from the line amplifier of the image orthicon chain by the flick of a toggle switch which causes a DPDT relay to act. This relay takes voltage off one of the video IF's and feeds the video amplifier of the receiver from the line amplifier direct. The sound section of the receiver is left operative. On both sides of this receiver are storage compartments for auxiliary lenses. These compartments are divided into sections and each section lined with rubber to protect the lenses.

Under the receiver is the video equipment proper arranged in the following sequences from left to right: the sync generator, control unit No. 1, control unit No. 2, and the line amplifier. Beneath the table on which these units are mounted there are the three power supplies. All of these units as well as the camera heads, microwave units and critical test equipment are set in channel iron, cushioned with cellular rubber and held in place by canvas straps anchored in the channel-iron frame. This method of riding equipment is simple and yet affords a great amount of safety at low cost. The designs of the vehicle and arrangement of equipment serves to facilitate DuMont's remote operations as described in this article.

## PERSONNEL

**Carlton Wasmansdorff** has assumed a newly created post in charge of development engineering for the Hoffman Radio Corp., Los Angeles. He was formerly chief engineer for Maguire Industries, New York and Globe Wireless, San Francisco.

**Kenneth Kenyon,** recently in charge of Philco Corporation's field engineering for the army and navy, has been appointed general service manager of the corporation.

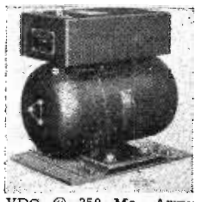
**Irvin R. Weir** has been appointed design engineer of the Transmitter Division of General Electric at Electronics Park, Syracuse, N. Y. **Donald W. Pugsley,** formerly section leader for television receivers, has been named designing engineer with responsibility for the technical design of television receivers. **N. F. Shofstall,** formerly designing engineer, has been appointed assistant division engineer. **C. R. Miner,** formerly section leader for standard line and Musaphonic receivers, is now designing engineer with responsibility for the technical design of Musaphonic, standard line, portable, contract and export receivers.

**William E. Wilson** has been elected vice-president in charge of sales by the directors of Acme Electric Corp., Cuba. Formerly with Jefferson Electric Co., he will direct sales and promotion of radio and television transformers, air cooled power transformers, and luminous tube transformers for the company.

**Philips B. Patton** has been appointed west coast engineering and sales representative of the Farnsworth Television and Radio Corp., Fort Wayne, Ind. He was formerly acting chief engineer of the Common Carrier Engineering Section of the FCC, and for the past two years technical coordinator of Farnsworth's Mobile Communications division.

**Alan H. Bodge** has been appointed manager of the new West Coast office of Audio Devices, Inc., at 844 Seward St., Hollywood, California. He was in the radar division of the army signal corps for 4 years before joining Audio Devices in 1946.

# "Communications"



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Mfrs: write for quantity prices and discounts on above item.
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PE 101C. Input: 13/26 VDC @ 12.6/6.3 A. Output: 400 VDC @ 135 Ma., 800 VDC @ 20 Ma. (9VAC @ 1.12 A.) .....$3.40
PE 55. Input: 12 vdc @ 25 amp. Output: 500 vdc @ 400 ma. (slightly used, but in excellent condition) .....$4.95

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Magnet for 725A...$ 8.00
W.E. 700-A (L band) .....$45.00
W.E. 720-BY (S band) 1000 KW .....$25.00
Klystron, 2K25-723 AB .....$3.50

INVERTERS

PE 206-A. Input: 28 vdc @ 38 amp. Output: 80 volts @ 500 volt-amps, 800 cycles. Leland. New, complete with enclosed relay, filter, instruction book .....$12.50
PE 218. Input: 25-28 vdc @ 92 amps. Output: 115 volts @ 1500 volt-amps, 380-500 cycles. New. .....$15.00

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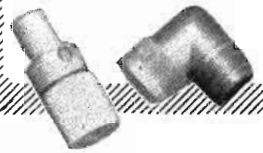

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We carry all popular standard and British type coaxial cable connectors in stock. These connectors are brand new and were produced for the Government by the leading manufacturers in this field. Our inventory contains sufficient quantities for the largest users at prices well below the market. Write or wire for special Coaxial Cable and Connector Listing 100A or send us your requirements.

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## *Advertisers March 1948*



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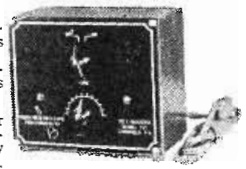

Model: TVL 50-100Mc. Channels 1-6
Model: TVH 170-220Mc. Channels 7-13

Pre-amplifier for television receivers, completely self contained, with power supply. Works on any television receiver. Makes the difference between "flat" and "bright" pictures.

Size—6" x 5" x 3½"
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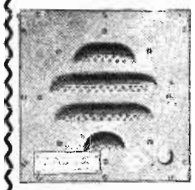
2¢ per foot 1000 feet—$17.50



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OUR LOW PRICE— **$5.95**

**A T R INVERTER**
**Model 12RSB**

12V DC input—110 VAC output
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List price—$44.00
OUR LOW PRICE **$17.60**
BRAND NEW ORIGINAL CARTONS

**MODULATION TRANSFORMER**
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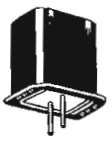

Fully shielded. Primary 4500 ohms, secondary 8500 ohms for single 6L6, HY69 in class A, or single 6B5, 6F6, 6N6 class A (with sec. used as pri.). 10 Audio Watts. DC primary 60 ma, secondary 50 ma. 2-11/16" x 2¾" x 2-3/16".

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List Price—$4.50
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**92-32 Merrick Rd., Jamaica 3, N. Y.**
*Branch: 71 Murray St., New York 7, N. Y.*

**Edward G. F. Arnott** has been named assistant director of research for the Westinghouse Lamp Division. **Gilbert C. Larson** has been appointed chief engineer of the company's home Radio division.

**H. G. Bennecoff** has been appointed manager of transformer sales at Federal Telephone and Radio Corp., Clifton, N. J. He was formerly sales manager of the wire transmission division.

**Leopold M. Kay,** formerly chief engineer, has been appointed vice-president in charge of engineering of Air King Products Co., Brooklyn, New York. He is credited with an important role in the development of popular-priced wire recorder combinations with radio and phonograph.

**James F. Cosgrove** has joined the Federal Telephone and Radio Corp., Clifton, N. J. to act as district representative for broadcast equipment in the New York-New England area. **R. P. Lamons,** formerly of Western Electric, will act as Federal's district representative for broadcast equipment in Illinois, Indiana, Michigan, Ohio, Kentucky, Minnesota, Wisconsin, Missouri and Kansas. **William E. Hanna** has been appointed sales engineer of mobile communications equipment in Illinois, Wisconsin, and Minnesota. His headquarters will be in Federal's Chicago office at 343 No. Michigan Blvd.

**Ralph T. Brengle** has been re-elected president of the National Association of Relay Manufacturers at their first annual meeting. He is presently with Potter and Brumfield Sales Co., Chicago.

**Harley Wall,** formerly sales manager for International Detrola Corp., has been appointed manager of the contract division of Air King Products Co.

**Joel Peterson,** former associate editor of Tele-Tech, has been named editor of Televiser. Before joining Caldwell-Clements in 1945, Mr. Peterson served with the Signal Corps and previously handled studio and transmitter operational duties for radio station WSAN.

**Crawford H. Greenewalt** has become the tenth president of E. I. du Pont de Nemours & Co. **Willis S. Carpenter, Jr.** has been elected chairman of the Board of directors.


# RCA SPECIAL RED TUBES

## Minimum life — 10,000 hours!

● These new RCA Special Red Tubes are specifically designed for those industrial and commercial applications using small-type tubes but having rigid requirements for reliability and long tube life.

As contrasted with their receiving-tube counterparts, RCA Special Red Tubes feature vastly improved life, stability, uniformity, and resistance to vibration and impact. Their unique structural design makes them capable of withstanding shocks of 100 g for extended periods. Rigid processing and inspection controls provide these tubes with a minimum life of 10,000 hours when they are operated within their specified ratings. Extreme care in manufacturing combined with precision designs account for their unusually close electrical tolerances.

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**TABLE OF RECEIVING-TYPE COUNTERPARTS**

| | |
|---|---|
| 5691 | 6SL7GT |
| (0.6 A. heater) | (0.3 A. heater) |
| 5692 | 6SN7GT |
| 5693 | 6SJ7 |

RCA Special Red Tubes can be used as replacements for their counterparts in equipment where long life, rigid construction, extreme uniformity, and exceptional stability are needed.

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