TELE-TECH

formerly ELECTRONIC INDUSTRIES

TELEVISION • TELECOMMUNICATIONS • RADIO

October • 1950

CALDWELL-CLEMENTS, INC.

MAJOR EAST-MIDWEST TV MARKETS FOR 1951

New Microwave-Relay and Coaxial Cable Links Add 14 Cities to Existing Networks

War Mobilization Progress

Simultaneous Video & Audio Master Switcher

Multi-Output Equal-Impedance Audio Networks

SHARE THIS COPY!

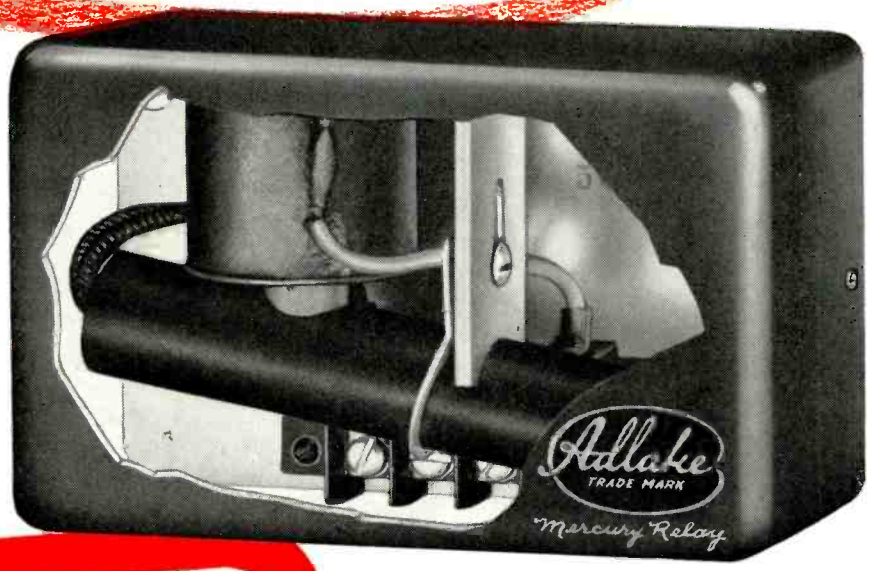
Please Route to

SPECIALLY DESIGNED FOR USE WITH

SENSITIVE

THERMO-REGULATORS

New ADLAKE No. 5000 Mercury Relay



Because of its amazingly high load-input ratio, the No. 5000 relay operates at 115 volts 60 cycles on *only 0.007* ampere—a fraction of the current consumed by any other type of mercury relay!

It is ideally suited for use in electronic tube circuits where the output of the tube is limited. With its low amperage operating the coil, the contacts will handle 5 amperes at the same voltage — and tests indicate the No. 5000's life to be over 30 million operations!

It can be used as a pilot relay operating from a very sensitive thermo-regulator—serves equally well for high and low temperature control—and functions perfectly with either mercury-and-glass or bi-metal regulators.

FOR FULL INFORMATION on this sensational relay, write The Adams & Westlake Company, 1117 N. Michigan, Elkhart, Indiana. No obligation, of course.

Every ADLAKE Mercury Relay offers these advantages:

- Hermetically sealed—(dust, dirt, moisture, oxidation and temperature changes can't interfere with operation)
- Silent and chatterless
- Requires no maintenance
- Absolutely safe

Manufacturers of
Hermetically Sealed Mercury Relays for Timing, Load and Control Circuits

THE Adams & Westlake COMPANY

Established 1857 ELKHART, INDIANA New York • Chicago

TELE-TECH

Formerly ELECTRONIC INDUSTRIES

TELEVISION • TELECOMMUNICATIONS • RADIO

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

Manufacturing

TELEVISION • FM
LONG & SHORT WAVE RADIO
AUDIO AMPLIFYING EQUIPMENT
SOUND RECORDERS & REPRODUCERS
AUDIO ACCESSORIES
MOBILE • MARINE • COMMERCIAL
GOVERNMENT
AMATEUR COMMUNICATION
CARRIER • RADAR • PULSE
MICROWAVE • CONTROL SYSTEMS

Research, design and production of special types
TUBES, AMPLIFIERS, OSCILLATORS, RECTIFIERS, TIMERS, COUNTERS, ETC. FOR
LABORATORY • INDUSTRIAL USE
ATOMIC CONTROL

Operation

Installation, operation and maintenance of telecommunications equipment in the fields of

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

OCTOBER, 1950

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

Publishers also of RADIO & TELEVISION RETAILING

TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

Formerly ELECTRONIC INDUSTRIES

O. H. CALDWELL, *Editorial Director*
M. CLEMENTS, *Publisher*

BERNARD F. OSBAHR, *Associate Editor*
JOHN H. BATTISON, *Associate Editor*

H. D. WULFORST, *Assistant Editor*
CHARLES DREYER, *Art Director*

R. C. DAVIES, *News Editor*, *National Press Bldg.*, *Washington, D. C.*
DR. A. F. MURRAY, *Consulting Editor*, *4707 Windom Pl.*, *Washington, D. C.*

CIRCULATION
B. V. SPINETTA, *Circulation Director*
M. GROENING
Subscriptions, List Compilation

BUSINESS DEPARTMENT
M. H. NEWTON, *Business Manager*
HOWARD A. REED, *Sales Manager*
JOSEPH DRUCKER, *District Manager*
480 Lexington Ave., New York 17, N. Y.

S. M. GASKINS, *Western Manager*
ANDREW M. GENT, *District Manager*
201 N. Wells St., Chicago 6, Ill.
Telephone RAndolph 6-9225

CHRIS DUNKLE & ASSOCIATES
Southern California Representative
2506 W. 8th Street, Los Angeles 5, Calif.
Telephone DUnkirk 7-6149

W. W. SWIGERT,
Credit Manager

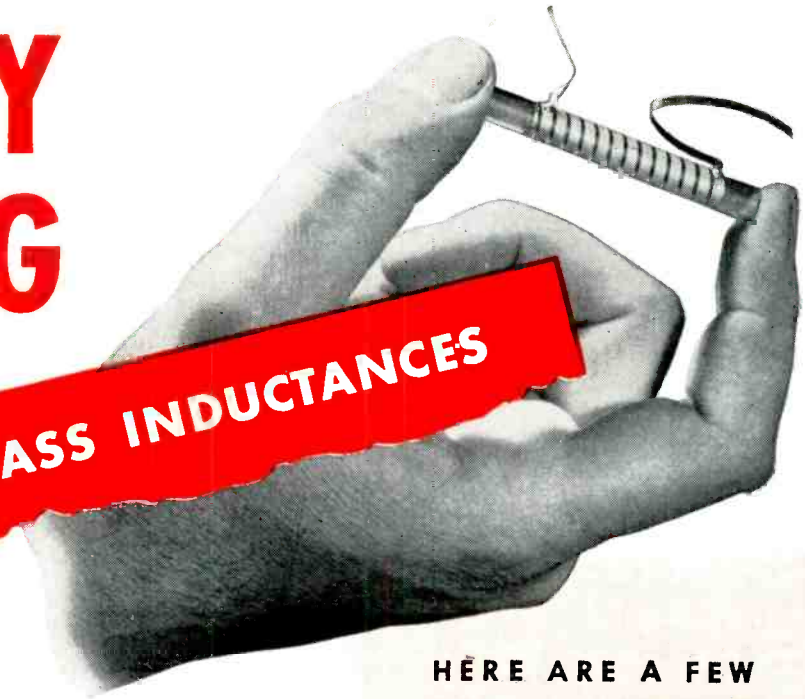
N. McALLISTER, *Director Reader Service*
M. E. SCHNEIDER, *Production Supervisor*
M. TEMMEL, *Editorial Secretary*

TELE-TECH*, October 1950, Vol. 9, No. 10. 40 cents a copy. Published Monthly by Caldwell-Clements, Inc. Publication office, Orange, Conn. Editorial, Advertising and Executive Offices, 480 Lexington Ave., New York 17, N. Y. M. Clements, President; Orestes H. Caldwell, Treasurer. Subscription rates: United States and Possessions, $3.00 for one year, $5.00 for two years. Canada, $4.00 for one year, $6.00 for two years. All other countries, $5.00 for one year, $7.00 for two years. Please give title, position and company connection when subscribing. Entered as second class matter June 9, 1947 at the post office at Orange, Conn., under the act of March 3, 1879.

Printed in U. S. A. *Reg. U. S. Pat. Off.

SPECIFY CORNING

METALLIZED GLASS INDUCTANCES



For Economical, Trouble-Free Design and Assembly

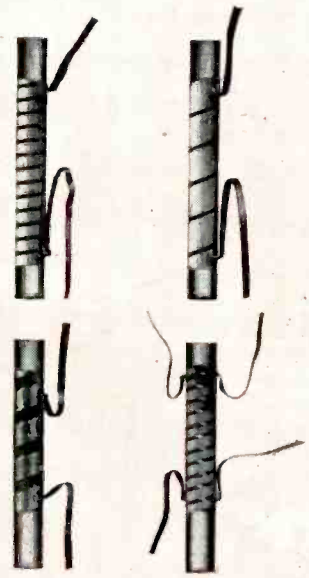
Here is a positive solution to your high frequency inductance problems—Corning Metallized Glass Inductances. For F.M. and television applications, they offer a new standard of quality, versatility and economy.

Corning Metallized Glass Inductances combine specially selected glass forms with fired-on conductors to give remarkably high temperature stability and low loss. This means you are assured of negligible drift characteristics, even under unusual temperature changes. In many instances, the use of stable Corning Metallized Inductances eliminates the need of including additional stabilizing components in the circuit. Being precision made, every Corning inductance of a given type can be duplicated within very close tolerances in any quantity.

Easy and convenient to use, Corning inductances can stand repeated handling during production assembly. They are readily installed by conventional soldering methods or grommet mounting techniques. The tin electroplated surface facilitates soldering and minimizes oxidation. Low initial cost, accuracy, ease of installation and durability contribute to production economy.

Corning inductances can be designed to fit your most exacting high frequency inductance requirements. They can be obtained as fixed tuned, permeability tuned or permeability tuned inductance-trimmer combinations. Uniform variable or double pitch windings are easily supplied. Let Corning engineers help solve your inductance problems. They will be glad to discuss them with you.

HERE ARE A FEW OF THE UNLIMITED DESIGN POSSIBILITIES



Corning Metallized Inductances are superior in every way for high frequency applications. Their electrical characteristics include low temperature coefficients, high Q and high stability. The smooth glass wall insures noiseless tuning and fine adjusting screws permit rapid and accurate alignment.

CORNING GLASS WORKS
ELECTRONIC SALES DEPARTMENT
Electrical Products Division

PYREX

CORNING, N. Y.

Corning means research in Glass

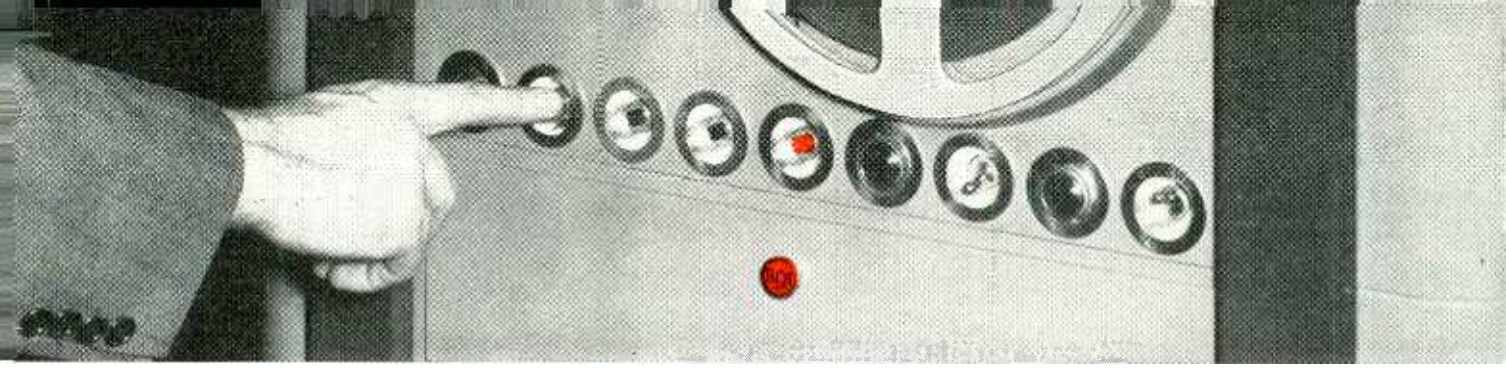
METALLIZED GLASSWARE: INDUCTANCES · CAPACITORS · BUSHINGS · ALSO A COMPLETE LINE OF TELEVISION TUBE BLANKS

RCA TAPE RECORDER Type RT-11A

50 to 15,000 c.p.s. (±2 db) at 15 in/sec
50 to 7,500 c.p.s. (±2 db) at 7½ in/sec

COMPLETE—with motor board, plug-in type recording amplifier, plug-in playback amplifier, two standard NAB reels, power supply and panel and shelf.

- Split-second start and stop
- Push-button operation
- Extremely accurate timing—with synchronous capstan
- Smooth tape runs—via sapphire guides
- Automatic tape lift for fast "forwards" and rewinds
- Microswitch "tape-break" control—no tape spills, snarls
- Remote control of all operations
- Rack or console mounting
- Plug-in amplifiers
- Interlock system for vital controls
- 3 heads—Erase—Record—Playback



PUSH-BUTTON CONTROL puts tape reco facilities at your fingertips.

NEW—

High-Fidelity Tape Recorder

—the finest money can buy!

Remote Control Unit, MI-11948. Available extra.

This is the world's foremost professional tape recorder, the one recorder that has *everything*—accurate timing, low wow and flutter, plus quick starting. All operations are push-button controlled. All functions—including cueing—can be extended to remote positions.

Designed for applications where operating TIME and RELIABILITY are prime factors, the new Type RT-11A Recorder offers a number of exclusive features. For example, you can start or stop the tape in 0.1 second. You can jockey the tape back and forth for cueing without stopping. You can rewind a standard 10½-inch reel in one minute!

A synchronous capstan makes it practical to hold recording time to ±2½ seconds in a 30-minute run. And with synchronizing equipment . . . for which provision is made . . . *timing can be held to 0.3 second on any length program!*

Many more important features, too. Self-centering "snap-on" hub adaptors assure perfect reel alignment with either RMA or NAB reels. A complete system of control interlocking virtually eliminates the possibility of accidentally erasing a program—makes it impossible to snarl or "spill" the tape. "Microswitch" control stops the machine if the tape is severed—applies reel brakes instantaneously. The tape automatically lifts *free and clear* of heads during fast forward runs or rewinds. Tape alignment over the heads is held precisely by a floating casting. Starting wow is reduced to the vanishing point.

BY ALL MEANS, *call your RCA Broadcast Sales Engineer for complete details. Or mail the coupon.*

RCA

AUDIO BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

RCA Engineering Products,
Department 87J,
Camden, New Jersey

Send me more information (including price and delivery) on your new De Luxe Tape Recorder, Type RT-11A.

NAME .....

ADDRESS .....

STATION OR FIRM .....

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

TECHNICAL MEETINGS

Audio Engineering Society to Conduct Fair, Oct. 26-28

The Audio Engineering Society will be host again this year to audio engineers and manufacturers at the annual "Audio Fair" which will be held at the Hotel New Yorker, New York City on Oct. 26-28. Installation of new officers and annual business meeting will take place the morning of the 26th. Technical sessions will be conducted every day and manufacturers' exhibits will be open on Thursday the 26th from 9 to 6, Friday from 9 to 9 and Saturday from 9 to 6 P.M. A banquet will be held on Thursday, Oct. 26th.

Following is a list of some of the technical papers to be presented.

"Symposium On High Fidelity Audio Systems For The Home"; "Proposed Standard Method of Calibrating Cutters & Pickups"; "RMA Standards Covering Loudspeaker Systems and Associated Equipment"; "Educational Audio Requirements"; "Application of Square Wave Testing To Disc Recording"; "New Developments in Radio Tubes and Their Application to Audio Circuits"; "A Consideration of Intensity-Loudness Function and its Bearing Upon the Judgment of Tonal Range and Volume Level"; "CBS Television Studio Intercommunication Facilities; "Report of the A. E. S. Standards Committee on Playback Characteristic"; "Free Field Audiometry"; "The Measurement of Audio Volume"; "A New Low Cost Inter-modulation Measurement and Analysis Technique"; "Loudspeaker Damping"; "Multi-Channel Magnetic Tape Recording"; "A Solution to Magnetic Tape Timing Problems; "Action of A. C. Bias in Magnetic Tape Recordings"; "Sprocket Hole Magnetic Tape Recording".

Exhibitors at the Fair include:

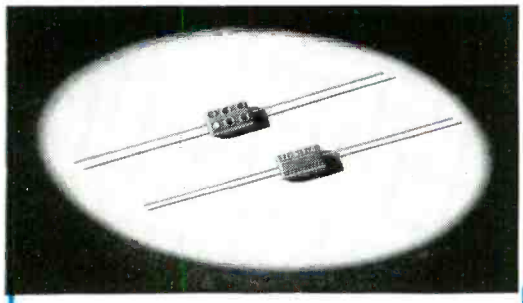
Radio Corporation of America, Camden, N. J.; General Electric Co., Schenectady, N. Y.; Gates Radio Co., Quincy, Ill.; Somerset Laboratories, Union City, N. J.; Audak Co., New York 18, N. Y.; Hewlett-Packard Co., Palo Alto, Calif.; Brush Development Co., Cleveland 14, Ohio; Tektronix, Inc., Portland 14, Ore.; Milo Radio & Electronics Corp., New York, N. Y.; Permoflux Corp., Glendale 5, Calif.; Langevin Mfg. Corp., New York, N. Y.; Rek-O-Kut Co., Long Island City, N. Y.; Presto Recording Corp., Paramus, N. J.; Harvey Radio Co., New York 18, N. Y.; Reeves Soundcraft Co., New York, N. Y.; Panoramic Radio Products, New York, N. Y.; Cinema Engineering Co., Burbank, Calif.; Altec Lansing Corp., Hollywood, Calif.; Peerless Transformer, Los Angeles, Calif.; Amplifier Corp. of America, New York, N. Y.; Electro-Voice Inc., Buchanan, Mich.; Allen B. Du Mont Laboratories, Inc., Clifton, N. J.; Ballantine Laboratories, Inc., Boonton, N. J.; Daven Co., Newark 4, N. J.; Measurements Corp., Boonton, N. J.; Audio Devices Inc., New York 22, N. Y.; Hermon Hosmer Scott, Inc., Cambridge, Mass.; British Industries Corp., London, England; Garrard Sales Corp., New York, N. Y.; Pickering & Co., Oceanside, N. Y.; Stephens Mfg. Corp., Culver City, Calif.; Magnecord, Inc., Chicago, Ill.; Audio Instrument Co., New York, N. Y.; Sonar Radio Corp., Brooklyn, N. Y.; Rangertone, Inc., Newark, N. J.; James B. Lansing Sound, Inc., Venice, Calif.; Audio & Video Products Corp., New York, N. Y.; Ampex Electric Corp., San Carlos, Calif.; Fairchild Recording Equipment Co., New York, N. Y.; McIntosh Engineering Laboratories, Silver Springs, Md.

(*See page 48 for new products to be displayed at Audio Fair*).

Kansas City IRE, Nov. 3-4

The Kansas City Section of the Institute of Radio Engineers is planning its second annual Regional Papers Conference to be held at the President Hotel in Kansas City, Mo., on November 3 and 4. The general theme of the conference is "UHF—Applications and Techniques". Five sessions covering the topics of transmitters, receivers, antennas, television, and test equipment will be held during the two-day period. J. H. Van Horn is chairman of the Conference Committee.

THIS GEM-SIZED UNIT DOES A GIGANTIC JOB



CM-15 MINIATURE CAPACITOR

Actual Size 9/32" x 1/2" x 3/16"
For Television, Radio and other Electronic Applications.
2 to 420 mmf. cap. at 500v DCw.
2 to 525 mmf. cap. at 300v DCw.
Temp. Co-efficient ± 50 parts per million per degree C for most capacity values.
6-dot color coded.

Each tiny El-Menco CM-15 capacitor performs at maximum efficiency regardless of climate or critical operating conditions. Before leaving the factory, it is tested for dielectric strength at *double* working voltage—for insulation resistance and capacity value. Every gem-sized El-Menco capacitor meets and beats the strictest Army-Navy standards. That's why *you* can always depend on this tiny condenser to give gigantic performance in your product.

A COMPLETE LINE OF CAPACITORS TO MEET EVERY REQUIREMENT

THE ELECTRO MOTIVE MFG. CO., Inc.
WILLIMANTIC **CONNECTICUT**

Write on your firm letterhead for Catalog and Samples.

MOLDED MICA El-Menco MICA TRIMMER CAPACITORS

FOREIGN RADIO AND ELECTRONIC MANUFACTURERS COMMUNICATE DIRECT WITH OUR EXPORT DEPT. AT WILLIMANTIC, CONN. FOR INFORMATION.

ARCO ELECTRONICS, INC. 135 Liberty St., New York, N. Y.—Sole Agent for Jobbers and Distributors in U.S. and Canada

TELE-TIPS

SPEEDED SPEECH—The Air Force has released through the Technical Services Office of the Commerce Department a report of a study on "speeded speech" which gives details of successful experiments to speed communication by chopping and eliminating segments of recorded speech on a plastic tape. Intelligibility scores of 90% were secured on samples when the rate of communication was speeded to two-and-one-half times the original recording.

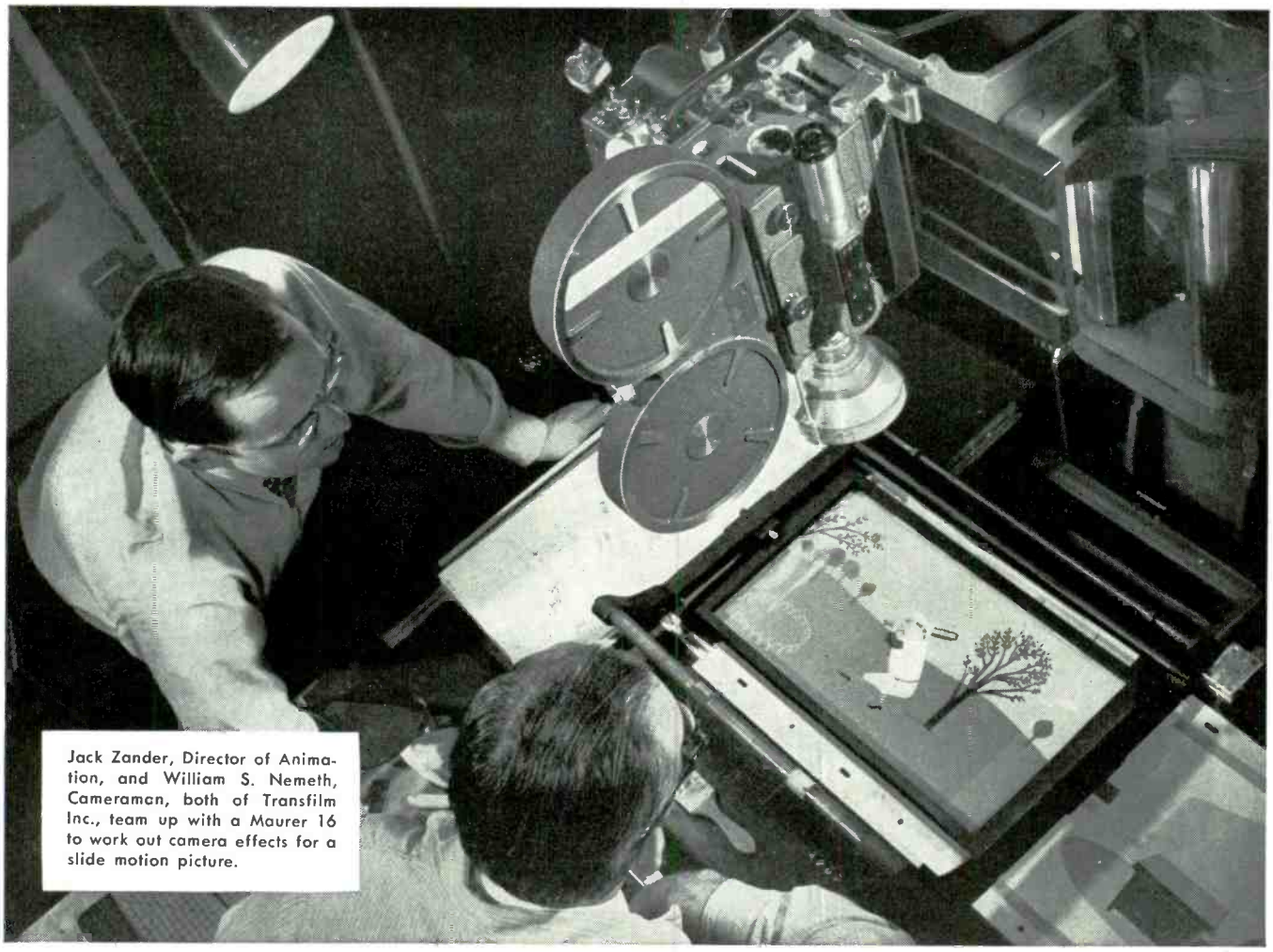
PRACTICAL BIGNESS — Witty tidbit now in circulation tells of a recent visitor noting a sketch on the office wall belonging to an executive of a major TV glass tube-blank manufacturer. On expressing interest as to what the sketch represented he was informed that it showed the structural detail of their new 33-in. picture tube. In turn, the visitor asked why such an odd number as 33-in. had been chosen. "Well," said the executive, "because of the way in which current demand has been constantly pressuring for larger and larger picture tube sizes, we decided that we would have to establish some practical size limitation. Accordingly, we averaged the sizes of the doors in homes and in various buildings and found this to be 36-in. Our 33-in. tube will, of course, just go through."

WASHINGTON DECALOGUE—Radio manufacturers are now visiting Washington in increasing numbers. The head of Selvage & Lee which has been Washington public-relations consultant to RMA, besides 16 other industrial accounts, offers these "ten commandments":

1. Don't be gagged. Give your story to the press.
2. Don't think you gain by appeasing petty bureaucrats.
3. Know your stuff and prepare carefully.
4. Be as alert to express your appreciation to your Senator or Congressman as your indignation.
5. Keep your representatives in Congress informed.
6. Know your Congressional committees, not only the members, but the counsel, the investigators.
7. Be as vigilant in defending your prerogatives as is a Communist.
8. Don't depend on lobbying. Take your story back to the people where Government propaganda goes.
9. If you must retain an Administration pal, check him first with more established contacts. It may cost you half as much for twice the service.
10. Take a turtle along for observation. He progresses only when he has his neck out.

FOR RADIO BLIND—Robert W. Gunderson, thirty-one, blind since birth but a successful radio engineer, inventor and teacher has just sent to press the seventh monthly issue of "The Braille Technical Press," a radio magazine for the blind. The sixty-page magazine is made of heavy cardboard-like paper in an eleven-by-fourteen-inch format. So far Mr. Gunderson has had to write most of the articles himself. He keeps up on technical news by having his wife, Lillian, read the technical magazines to him. When an important article appears, he makes a tape recording on a machine he has built, and plays it back when he wishes to reread it. He types the articles and his wife retypes a perfect copy of the contents for the American Printing House for the Blind, Louisville, Ky., which produces the magazine. Gunderson is retained as a designing engineer by Hudson Electronics in Mt. Vernon, N. Y.

TV GLARE ELIMINATED—Latest wrinkle in the manufacture of TV picture tubes is to sand-blast both sides of the filter-glass face-plates and then etch them with hydrofluoric acid. This additional processing, it is said, practically eliminates any and all glare.



Jack Zander, Director of Animation, and William S. Nemeth, Cameraman, both of Transfilm Inc., team up with a Maurer 16 to work out camera effects for a slide motion picture.

Where hair-line ACCURACY counts..

At Transfilm Incorporated. where animated motion pictures and slide films are produced in volume, hair-line *accuracy* is of utmost importance. Inevitably, this leading commercial film company selected Maurer as the 16 mm. camera that best supplies this vital quality.

In Maurer **VERSATILITY** they found *accurate* registration of each individual frame, along with precise high-power focusing and large clear direct-through-the-lens viewing.

In Maurer **DEPENDABILITY** they found consistently *accurate* performance under all conditions, insured by years of rigorous testing by top industry technicians.

And in Maurer **EXCLUSIVE FEATURES**, such as the 235° dissolving shutter, they found fast *accurate* changes of exposure while shooting.

Because it meets so many varied needs, more and more producers like Transfilm are turning to the Maurer 16 mm. as the ideal camera for every phase of professional motion picture production.

For details on these and other *exclusive* Maurer features, write

The Maurer 16 mm., designed specifically for professional use, is equipped with precision high-power focusing and the finest view-finder made. Standard equipment includes: 235° dissolving shutter, automatic fade contral, view-finder, sunshade and filter holder, one 400 foot gear-driven film magazine, a 60-cycle 115-volt synchronous motor, one 8-frame handcrank, power cable and a lightweight carrying case.

J. A. MAURER, INC.

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

16mm maurer

CABLE ADDRESS:
JAMAURER

How to be sure you get the Best Capacitor

YOU CAN test the paper for density . . . thickness . . . porosity . . . power factor . . . chloride content . . . dielectric constant . . . dielectric strength.

And then test the foil for thickness . . . purity . . . softness of the anneal . . . freedom from oil . . . cleanliness of surface . . . absolute smoothness.

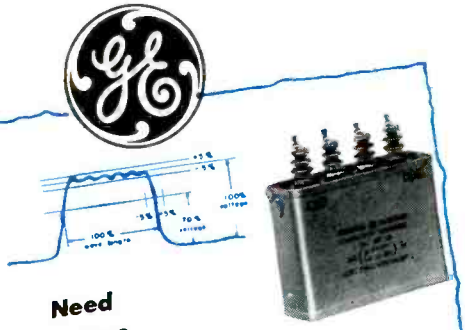
And then test the liquid dielectric for specific gravity . . . viscosity . . . power factor . . . color . . . acidity . . . flash point . . . dielectric strength . . . dielectric constant . . . insulation resistance . . . water content.

And after that, test every single finished capacitor for shorts, grounds, and opens at overvoltage between terminals and between terminals and case . . . and measure the capacitance of every single unit . . . and then check every single capacitor to see that it has a leak-proof hermetic seal.

OR YOU CAN buy General Electric capacitors . . . product of outstanding research and know-how . . . which have already passed every one of these tests

. . . on the materials when they were made.
. . . and again before they were used.
. . . and on the capacitors during manufacture.
. . . and then, finally, on every single capacitor before shipment.

For full information on types, ratings, dimensions, types of mounting, and prices of capacitors, address the nearest *General Electric Sales Office or Apparatus Department, General Electric Company, Schenectady 5, N. Y.*



Need square waves?

Pulse-forming networks are used where the normal capacitor discharge wave shape is not suitable, and where an impulse must have definite energy content and duration. Their design involves several tricky problems—one being suitability for high temperature operation. Nevertheless, networks are one of our specialties—we have built them by the thousands, and our experienced and capable engineers will be glad to discuss any of your design problems. We invite your inquiries.

GENERAL ELECTRIC

407-170

Saving energy for better low-cost telephone service

Arrow points to tube containing a wire specimen under test for surface conductivity. The tube and wire are excited to resonance by microwaves from generator at extreme left. Conductivity is calculated from frequency values indicated by barrel-shaped wavemeter (top center) and resonance curves traced on an oscilloscope screen (not shown).

In the waveguides which conduct microwaves to and from the antennas of radio relay systems, current is concentrated in a surface layer less than 1/10,000 inch thick, on the inner surface of the waveguide. When these surfaces conduct poorly, energy is lost.

To investigate, Bell radio scientists devised exact methods to explore this skin effect at microwave frequencies.

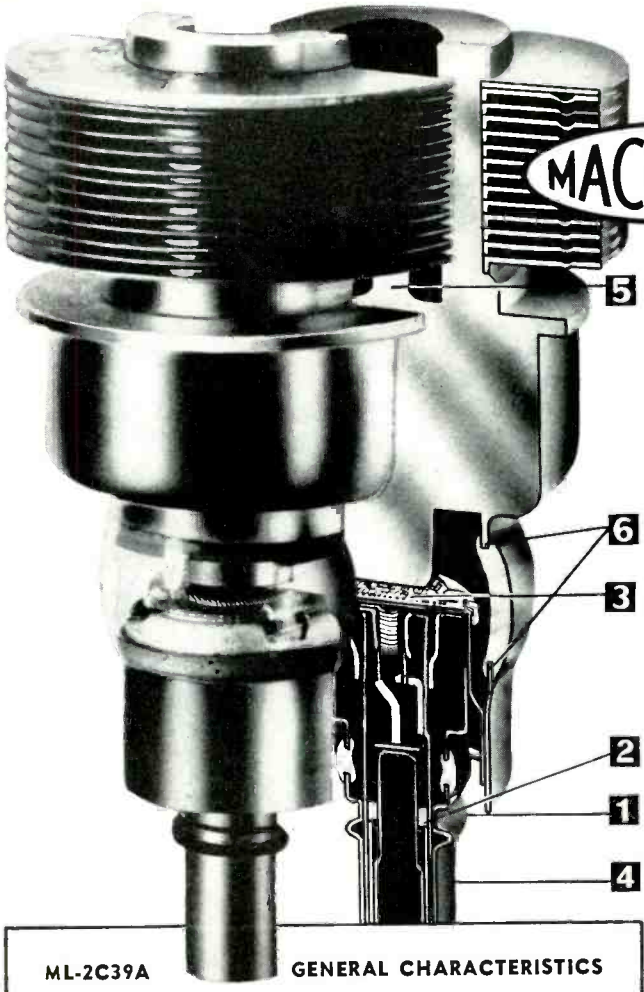
Scratches and corrosion, they found, increase losses by 50 per cent or more. Even silver plating, smooth to the eye, can more than double the losses of a polished metal. Very smooth conductors, like electropolished copper, are best. An inexpensive coat of clear lacquer preserves initial high conductivity for many months.

Energy saved *inside* a microwave station is available for use in the radio-relay path *outside*. So stations can sometimes be spaced farther apart, and there will always be more of a margin against fading. Here is another example of the practical value of research at Bell Telephone Laboratories.

BELL TELEPHONE LABORATORIES

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

The New ML-2C39A* . . .



Proving once again that MACHLETT ..makes the Difference

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

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

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

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

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

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

* *Conforms with recently issued JAN specifications.*

ML-2C39A GENERAL CHARACTERISTICS

Electrical

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

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

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

ML-381 FOR PULSED APPLICATIONS

Maximum Ratings (Tentative)

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

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

"Look to the Tube Specialist"

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

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

Distributed by GraybaR ELECTRIC COMPANY

MACHLETT OVER 50 YEARS OF ELECTRON TUBE EXPERIENCE

SENSATIONAL...

* Records on discs

* Records on tape

* Plays back both tape and discs

* Plays any 78 R.P.M. Record

GENERAL INDUSTRIES MODEL 250

TAPE-DISC RECORDER

* *when connected with the proper amplifier.*

Sensational, indeed . . . at a cost which enables it to be incorporated in moderately-priced radio and TV combinations . . . the first *complete* home recording and play-back assembly for both tape and disc use.

The Model 250 Tape-Disc Recording Assembly is General Industries' newest development in the sound reproduction field. Already thoroughly tried and tested in actual use, it contains many new design innovations, including foolproof operating features that anyone can understand.

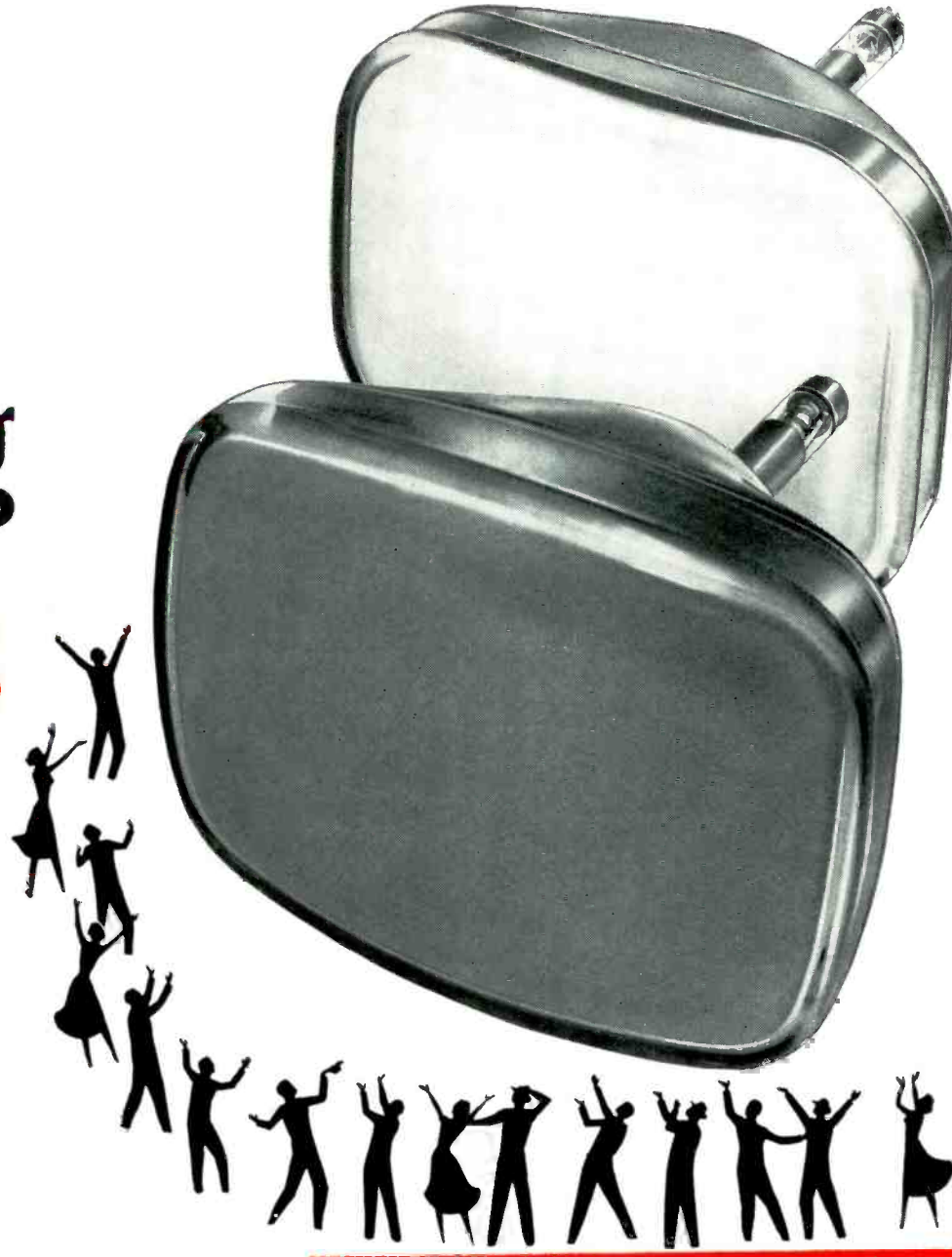
A very complete service manual is included with each unit. It also contains a suggested amplifier circuit as well as a complete amplifier parts list.

A new catalog sheet, describing all of the recording and play-back features of the GI Model 250, will be sent upon request. Write, wire or phone for your copy *today.*

The GENERAL INDUSTRIES Co.

DEPARTMENT L • ELYRIA, OHIO

your viewing public's first choice



Du Mont Teletrons, of course! "Just Right" pictures — not too bright, not boresomely dull; black-blacks, white-whites, with rich life-like gradations; picture sizes the public wants; finest workmanship and materials; and that much-copied Du Mont Bent-Gun Design.

Typical of Du Mont's leadership in cathode-ray tubes, all these features are now offered in their new line of rectangular Teletrons.

Definitely the universally-acknowledged "First With the Finest in Teletrons."

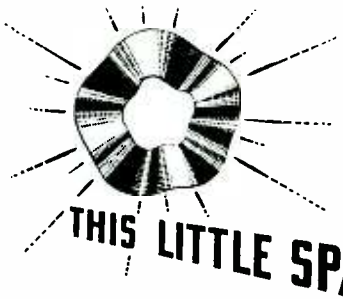
DETAILED LITERATURE ON REQUEST.
LET US QUOTE ON YOUR REQUIREMENTS.

DU MONT

Teletrons

ALLEN B. DU MONT LABORATORIES, INC.
CATHODE-RAY TUBE DIVISION
CLIFTON, NEW JERSEY

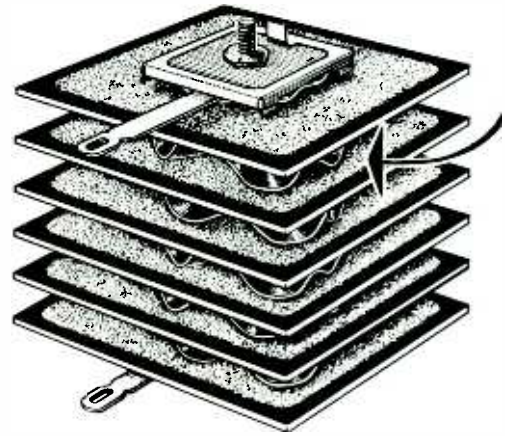
**Trade-Mark*



THIS LITTLE SPACER IS THE BIG DIFFERENCE

"Centre-Kooled"© SELENIUM RECTIFIERS

operate COOLER



OPERATING TEMPERATURES are lower because this revolutionary spacer allows the free circulation of air to the center of the assembly.

PROGRESSIVE DESIGN ENGINEERS have accepted the "Centre-Kooled" rectifier as a standard component in their sets and have eliminated heat producing transformers and rectifier tubes.

THOROUGHLY ENGINEERED for rugged service and rated for use at high ambient temperatures.

Used by leading manufacturers in the radio and television field —over a million now in use.

Take advantage of our free engineering service on Selenium Rectifier power supply design.

Compare These Features

1. Constant assembly pressure.
2. Improved convection cooling.
3. Rigid mechanical construction.
4. Light weight per unit of power output.
5. Stud mounting on request.
6. Locating lug on request.

THE SARKES TARZIAN
HEAVY DUTY
(to 50,000 Amps.)
SELENIUM RECTIFIER
incorporates the
center cooling feature.
Engineering and design data
supplied on request.

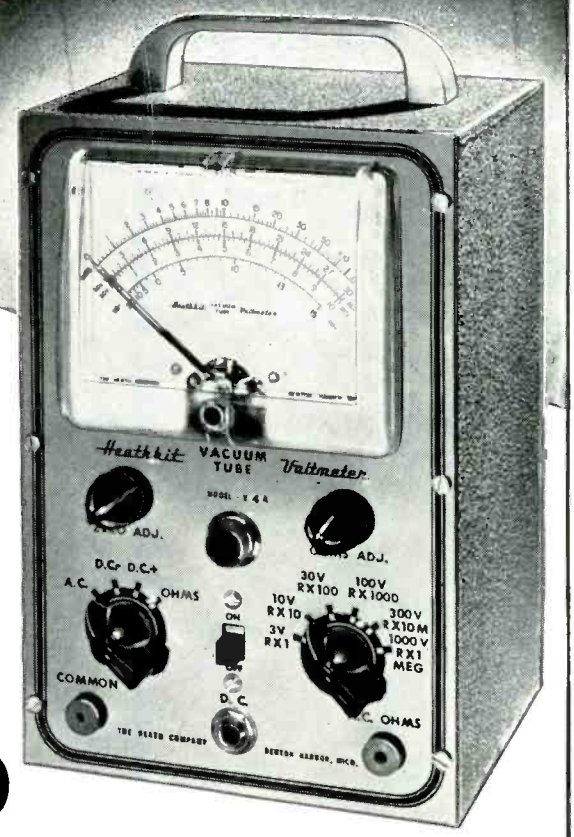
Sarkes Tarzian INC.
RECTIFIER DIVISION

415 NORTH COLLEGE AVENUE, DEPT. F, BLOOMINGTON, INDIANA

New 1951 • • MODEL V-4A

Heathkit VTVM KIT

HAS EVERY EXPENSIVE *Feature*



- ★ Higher AC input impedance, (greater than 1 megohm at 1000 cycles).
- ★ New AC voltmeter flat within 1 db 20 cycles to 2 megacycles (600 ohm source).
- ★ New accessory probe (extra) extends DC range to 30,000 Volts.
- ★ New high quality Simpson 200 microampere meter.
- ★ New ½% voltage divider resistors (finest available).
- ★ 24 Complete ranges.
- ★ Low voltage range 3 Volts full scale (⅓ of scale per volt).
- ★ Crystal probe (extra) extends RF range to 250 megacycles.
- ★ Modern push-pull electronic voltmeter on both AC and DC.
- ★ Completely transformer operated isolated from line for safety.
- ★ Largest scale available on streamline 4½ inch meter.
- ★ Burn-out proof meter circuit.
- ★ Isolated probe for dynamic testing no circuit loading.
- ★ New simplified switches for easy assembly.

New LOW PRICE **$23.50**

The new Heathkit Model V-4A VTVM Kit measures to 30,000 Volts DC and 250 megacycles with accessory probes — think of it, all in one electronic instrument more useful than ever before. The AC voltmeter is so flat and extended in its response it eliminates the need for separate expensive AC VTVM's. + or − db from 20 cycles to 2 megacycles. Meter has decibel ranges for direct reading. New zero center on meter scale for quick FM alignment.

There are six complete ranges for each function. Four functions give total of 24 ranges. The 3 Volt range allows 33⅓% of the scale for reading one volt as against only 20% of the scale on 5 Volt types.

The ranges decade for quick reading.

New ½% ceramic precision are the most accurate commercial resistors available — you find the same make and quality in the finest laboratory equipment selling for thousands of dollars. The entire voltage divider decade uses these ½% resistors.

New 200 microampere 4½" streamline meter with Simpson quality movement. Five times as sensitive as commonly used 1 MA meters.

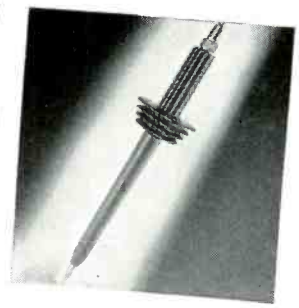
Shatterproof plastic meter face for maximum protection.

Both AC and DC voltmeter use push-pull electronic voltmeter circuit with *burn-out* proof meter circuit.

Electronic ohmmeter circuit measures resistance over the amazing range of 1/10 ohm to one billion ohms all with internal 3 Volt battery. Ohmmeter batteries mount on the chassis in snap-in mounting for easy replacement.

Voltage ranges are full scale 3 Volts, 10 Volts, 30 Volts, 100 Volts, 300 Volts, 1000 Volts. Complete decading coverage without gaps.

The DC probe is isolated for dynamic measurements. Negligible circuit loading. Gets the accurate reading without disturbing the operation of the instrument under test. Kit comes complete, cabinet, transformer, Simpson meter, test leads, complete assembly and instruction manual. Compare it with all others and you will buy a Heathkit. Model V-4A. Shipping Wt., 8 lbs. Note new low price, $23.50



New 30,000 VOLT DC PROBE KIT

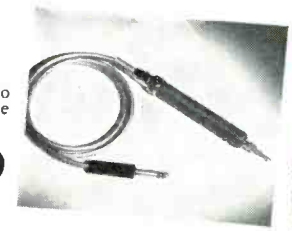
Beautiful new red and black plastic high voltage probe. Increases input resistance to 1100 megohms, reads 30,000 Volts on 300 Volt range. High input impedance for minimum loading of weak television voltages. Has large plastic insulator rings between handle and point for maximum safety. Comes complete with PL55 type plug.

No. 3366 High Voltage Probe Kit. Shipping Wt., 2 pounds. **$5.50**

Heathkit RF PROBE KIT

Crystal diode probe kit extends range to 250 megacycles ± 10% comes complete with all parts, crystal, cable and PL55 type plug.

No. 309 RF Probe Kit. Shipping Wt., 1 lb. **$5.50**



EXPORT DEPT.
13 East 40th St.
NEW YORK CITY (16)
CABLE: ARLAB—N.Y.

The HEATH COMPANY
. . . BENTON HARBOR 24, MICHIGAN

a complete line of hermetically sealed oil-filled HIGH-VOLTAGE COMPONENTS

Rectifiers

Small, lightweight a-c to d-c power supply units for use with cathode-ray tubes, television camera tubes and radar indicator scopes, electron microscopes, and similar jobs. Typical outputs are 7, 9 and 13 kv. Low regulation—the 7-kv unit illustrated does not exceed 3.5% regulation per 0.1 milliampere load, holds ripple on output voltage to less than 1%. Size, only 6" x 6" x 7"; weight 8 lb.

Pulse Transformers

Pulse transformers for use with either hard-tube or line-type modulators. Available in voltage ratings of 10 kv or above. These units are ideal for radar applications, stepping up or down, impedance matching, phase reversing and plate-current measurements. Also suitable for nuclear physics research work, television and numerous special applications in and out of the communications fields.

Resonant Reactors

Resonant-charging reactors, accurately designed and constructed for radar service. Usually required in ratings of 40 kv and below, 1 ampere and below and 300 henries and below. Higher ratings are being built, and can be considered. When required, small- and medium-size designs can be provided with 3 to 1 range of inductance adjustment.

Filament Transformers

Filament transformers available with or without tube socket mounted integral with the high-voltage terminal. Low capacitance. Ratings to match any tubes; insulated to practically any required level.

Illustrated here are typical high-voltage components manufactured by General Electric. They can be built to meet Armed Services requirements. All are oil-filled and hermetically sealed—with excellent ability to withstand mechanical shocks and to operate continuously for long periods in widely varying temperatures. Apparatus Dept., General Electric Company, Schenectady, N. Y.

Your inquiries will receive prompt attention. Since these components are usually tailored to individual jobs, please include with your inquiry, functional requirements and any physical limitations. *Write to Apparatus Dept., 42-328A, General Electric Co., Pittsfield, Mass.*

GENERAL ELECTRIC

401-63

These Leaders look to SYLVANIA for dependable TV Picture Tubes

Admiral
Emerson Television
Meck
PHILCO
STROMBERG CARLSON
air king
PILOT
SYLVANIA
FADA
Tele King
Arvin
hallicrafters
Motorola
SCOTT
Tele-tone
Bendix Television
Hoffman
National
Sentinel
TRAV-LER
Silvertone
Calbest
INDUSTRIAL TELEVISION Inc
Olympic
Westinghouse
Sparton
CONRAC
Kaye-Halbart
Packard Bell
CROSLEY
Starrett
Magnavox
phaostron
DEWALD

• The trade-marks shown here identify the television leaders now choosing and using Sylvania TV Picture Tubes in their sets.

The reasons behind today's acceptance of Sylvania tubes include greater clarity, consistent color, dependability, and longer life.

Remember, your dealers as well as set owners recognize Sylvania as a symbol of distinction —a name associated with the very finest in radio and television.

For full descriptions and ratings of all Sylvania TV Picture Tubes, write today to Sylvania Electric Products Inc., Dept. R-2410. Emporium, Pa.

SYLVANIA ELECTRIC

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

CLEVELITE* AND COSMALITE*

LAMINATED PHENOLIC TUBING

is used also for many other electrical products at a considerable saving where exacting specifications must be carefully followed.

For the best . . . "Call Cleveland."

Those in the Radio and Television Industries know from actual use the fine performance of these Tubes.

They also know that our large production capacity assures them of a dependable source of supply with prompt delivery.

★

*Trade Marks

Ask us about these spirally laminated paper base phenolic tubes in diameters, wall thicknesses and lengths that will meet your needs.

The CLEVELAND CONTAINER Co.
6201 BARBERTON AVE. CLEVELAND 2, OHIO

PLANTS AND SALES OFFICES at Plymouth, Wisc., Chicago, Detroit, Ogdensburg, N.Y., Jamesburg, N.J.
ABRASIVE DIVISION at Cleveland, Ohio
CANADIAN PLANT: The Cleveland Container, Canada, Ltd., Prescott, Ontario

REPRESENTATIVES

NEW YORK AREA	R. T. MURRAY, 614 CENTRAL AVE., EAST ORANGE, N. J.
NEW ENGLAND	R. S. PETTIGREW & CO., 968 FARMINGTON AVE. WEST HARTFORD, CONN.
CANADA	WM. T. BARRON, EIGHTH LINE, RR #1, OAKVILLE, ONTARIO

Another exclusive GPL Development

New GPL VIDEO RECORDER

WITH

Electronic Shutter

These Exclusive Features put the GPL Video Recorder In a Class by Itself

ELECTRONIC SHUTTER — Limits exposure of each film frame to 525-line scanning of tube, with accuracy better than 1% of one line. Stays in adjustment; does not require camera to be locked in synchronization with video signal.

GPL VIDEOGAM — A gray scale correction amplifier that provides better video pictures than normally possible. In addition, a special deflection yoke provides perfect focus across entire screen.

GPL FILM GATE — Permits over 30 minutes of continuous camera operation without film abrasion, emulsion pile-up and consequent difficulties.

HIGH FIDELITY SOUND is recorded simultaneously. Essentially flat recording to 7 kilocycles, with low harmonic and intermodulation distortion, gives results comparable to finest 35-mm sound.

Live Show Quality -Picture and Sound- on Delayed Telecasts

This new 16-mm Video Recorder makes possible, for the first time, delayed telecasts that are consistently as good as the original. GPL's exclusive new shutter — electronic instead of mechanical — is coupled with improvements in picture resolution, film gate design, and sound fidelity. The projected recording is markedly better than the picture obtainable on most receivers. Re-telecast with good equipment, the picture looks and sounds like a live show.

The GPL Video Recorder may be used with the GPL rapid processor to produce finished film, positive or negative, less than a minute after the program is received either over a closed circuit or from the air.

WRITE FOR RECORDINGS made on this equipment for study by studios, advertisers, agencies.

TV Camera Chains • TV Film Chains
TV Field and Studio Equipment
Theatre TV Equipment

GENERAL PRECISION LABORATORY INCORPORATED

General Precision Laboratory

INCORPORATED

PLEASANTVILLE NEW YORK

Mr. Isberg Proves A Point . . .

. . . regardless of how tough the service, Eimac 4E27A pentodes perform better—longer.

R. A. ISBERG, CHIEF ENGINEER, KRON-TV

TV AND FM SERVICES OF THE SAN FRANCISCO CHRONICLE

KRON-TV KRON-FM

CHANNEL 4 DIAL 96.5

TELEVISION AFFILIATE OF THE NATIONAL BROADCASTING CO.

June 13, 1950

Mr. O. H. Brown
Eitel-McCullough, Inc.
San Bruno, California

Dear Hank;

You will be interested to learn that the six Eimac 4E27A/5-125B tubes which were installed in the video modulator of our RCA TT-5A transmitter on March 11, 1950 are still functioning normally even though they have operated for nearly one thousand hours, and from all indications they will continue to give good service for many more hours.

The life history of 4E27/8001 tubes prior to the development of the improved version was uncertain; some tubes would fail within 100 hours of their installation and few would last more than 700 hours. This situation was especially aggravating in the picture modulator where six tubes are operated in parallel and the malfunctioning of any one tube could seriously degrade the picture or interrupt operation.

Following is a tabulation of the individual plate currents of the six tubes after approximately 1000 hours service in the picture modulator.

Tube No.	Plate Current
807	.178 Amperes
808	.171 "
809	.190 "
810	.173 "
811	.175 "
812	.185 "

We are happy that KRON-TV has been able to assist you in the "field test" of the new 4E27A and we feel that it will be welcomed by the television broadcasters because it will afford more reliable operation, reduce tube replacement costs, and promote greater satisfaction and confidence on the part of the operating personnel.

Kindest personal regards,

Sincerely,

Al Isberg

R. A. Isberg
Chief Engineer

RAI/md

901 MISSION STREET SAN FRANCISCO 19 GARFIELD 1-1100

The 4E27A is by no means limited to service in TV transmitters. Its rugged internal structures and pyrovac plate provide, in conventional amplifier or oscillator service, even far greater tube life than is indicated in the severe tests reported by Mr. Isberg.

This new Eimac pentode is rated at 125 watts of plate dissipation. Low grid-plate capacitances make it exceptionally stable and its high power-gain characteristics enable delivery of relatively large output with low driving power.

COMPLETE DATA ON THE EIMAC 4E27A BEAM POWER PENTODE IS AVAILABLE UPON REQUEST.

Follow the Leaders to Eimac TUBES The Power for R-F

EITEL-McCULLOUGH, INC.
San Bruno, California
Export Agents: Frazar & Hansen, 301 Clay St., San Francisco, California

263

TELE-TECH
Formerly ELECTRONIC INDUSTRIES
TELEVISION • TELECOMMUNICATIONS • RADIO

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

An Analysis of Television Receivers, 1951

Here Are Some Interesting Percentages Showing Trends in Engineering Design of Television Sets for This Fall and Next Year. These Figures Have Been Developed After a Careful Review of Over 700 Technical Specifications Supplied the Publishers* of Tele-Tech by Some 71 Set Manufacturers

Sixty-two per cent of the available models are consoles, 23% are table models and 10% are consolettes.

Of the table types 55% use 16-in. picture tubes, 20% use 12-in., 16% use 14-in., and 7% use tubes larger than 16-in.

Of the console types 52% are 16-in. picture tubes, 25% are 19-in., 11% are 17-in., 5% are 12-in., and 3% are 20-in. or larger.

Of the consolette types 59% have 16-in. picture tubes, 21% have 19-in., 10% have 12-in., and 7% have 14-in.

In addition to television, 13% of the models offer AM and FM, 6% offer AM only, 4% offer FM only, and approximately 1% offer AM, FM and short wave, with another 1% offering FM and short wave only.

The table below shows average prices for table, console and consolette types by picture tube sizes.

Picture Tube (In.)	*Table Model*	*Consolette*	*Console*
12	$180.92	$202.80	$249.39
14	195.95	227.85	283.39
16	245.25	311.53	365.14
17	239.95	254.95	394.61
19	342.98	405.25	473.78
20	——	——	562.84
21	——	——	795.00

82% of the models were indicated as possessing a built-in antenna and of these 30% were tuneable by the customer.

18% of the models (almost all consoles) contain 3 speed automatic record changers while an additional 8% have provision for a phonograph attachment.

The average television receiver was found to use 21 tubes plus 3 power rectifiers.

70% of the receivers now being marketed use intercarrier IF sysems, and of these 18% have intermediate frequencies above 30 MC.

The average receiver provides an audio power output of 3.5 watts, and 90% of the receivers use PM speakers. 7% of the speakers employed are oval, 39% of which are of the 6 x 9 size and 33% are 4 x 6 size. Of the round type speakers 42% are 12 in., 28% are 10 in., 13% are 6 in., and 10% are 5 in.

*A compilation of these specifications appears in the sister Caldwell-Clements magazine Radio & Television Retailing for September, and a limited number of reprints are available for Tele-Tech readers on request to the editors of Tele-Tech.

The RADARSCOPE

Revealing at a Glance

REARMAMENT

INDUSTRY ADVISORY COMMITTEE MEETING—With the electronic-radio manufacturing industry fully cooperating with the Armed Services and the Munitions Board and also demonstrating its desires to serve the Nation probably as well or better than any other industry, the pattern of the flow of military procurement and production has now become rather well defined. It will be pin-pointed in full-fledged fashion at the next meeting of the 20-member Munitions Electronics Equipment Industry Advisory Committee Oct. 17 when Western Electric Vice President Frederick R. Lack, as chairman of the group, together with Robert C. Sprague, President of the Radio-Television Manufacturers Association and the Sprague Electric Co., will again assemble the leading figures in the end-equipment and components phases of the industry for an all-day session such as occurred Aug. 14.

THE PENTAGON

TOP DEFENSE FIGURES—At the Oct. 17 meeting the industry advisory group will submit its recommendations and suggestions to the top defense-armed services leadership concerned with electronics-radio military equipment requirements. Indicative of the importance of the industry's advisory committee to the defense authorities is the attendance at the meetings of Munitions Board Chairman Hubert Howard, Maj. Gen. T. J. Matejka, Munitions Board Acting Director of Production and Management, Maj. Gen. H. M. McClelland, Director of Communications-Electronics of the Joint Chiefs of Staff, MB Electronics Division Chief Marvin Hobbs and the top officers of the three Armed Services.

Both radio and jeep operate submerged as well as ever, even with water up to the driver's shoulders. This official U. S. Marine Corps photo shows one of the new units being developed for the Marine Corps Equipment Board

AUDIO

DISC SUBSTITUTES—So far the recording disc industry has not felt any effects from the Korean situation, but some of the disc manufacturers are already considering substitutes for aluminum. Glass, which was used during World War II, is not regarded too favorably by many since it is quite fragile and while producing perfect surfaces and recording characteristics is difficult to handle, necessitating readjustment of existing coating and handling systems. A further disadvantage is that of increased difficulty in handling when mixed batches of glass and aluminum are used. Substitutes for aluminum are being tried, among them a strong non-warping plastic base which is reported to be made from non-critical materials. More may be heard of this.

AVIATION

HIGHER POWER for aviation transmitters was urged by Dr. Edwin H. Armstrong, pioneer radio inventor, in a letter to the RTMA receivers committee, with copies to the FCC. "Why," demands Dr. Armstrong," is the guidance of a ship and its passengers entrusted to a transmitter having the peanut-like power of 200 watts—just about a quarter-horsepower,—when thousands of horsepower are employed in the other part of the transportation problem; that of keeping the ship in the air? Sound engineering judgment would dictate the use of sufficient power from ground transmitters to over-ride even chance radiations from damaged FM or TV sets or diathermy sets out of control. Equal lack of foresight came to light a few years ago when planes were provided with superheterodynes for instrument landing operation with insufficient image rejection against FM transmitters in the center of the band."

TV PICTURE TUBES

SIMPLIFY TYPES!—The industry and trade are coming to recognize that one of TV's greatest problems today is the large number of *different picture-tube types* now being made and marketed. For example, there are more than 20 different types of 16-in, round tubes and four types of 16-in. rectangular tubes. Likewise, there are seven different 19-in, round types and two rectangulars.

The sad part of the story is that none of the different types in a given size is directly interchangeable, and therefore, aside from the pyramiding of manufacturing facilities required to produce them, the situation in the replacement market is rapidly approaching the chaotic.

Such a wide variety of available tube types, which do the same job, is certainly inconsistent for efficient mass production and completely out of line when considered in the light of the current national emergency. Distributors, dealers and servicemen are confronted with either heavy inventories, shortages, or loss of consumer goodwill, because "adapting" can be costly procedure. Yet, oddly enough, the differences between the various types in any given size are relatively small, only involving a slight change in a physical dimension.

Recent announcements refer to an entirely new crop of picture tubes, such as the 17-in. "diagonal" metal rectangular (about the same screen size as a 16-in. round), 19, 22, 24 and 30 in. sizes as becoming available during the latter part of 1950 and during 1951. If past experience is any basis for judgment, so far as production and consumer demand is concerned, then it is high time that some protective and adequate standards be developed. We believe that such standards could well restrict the number of tube types to no more than two for any given tube size.

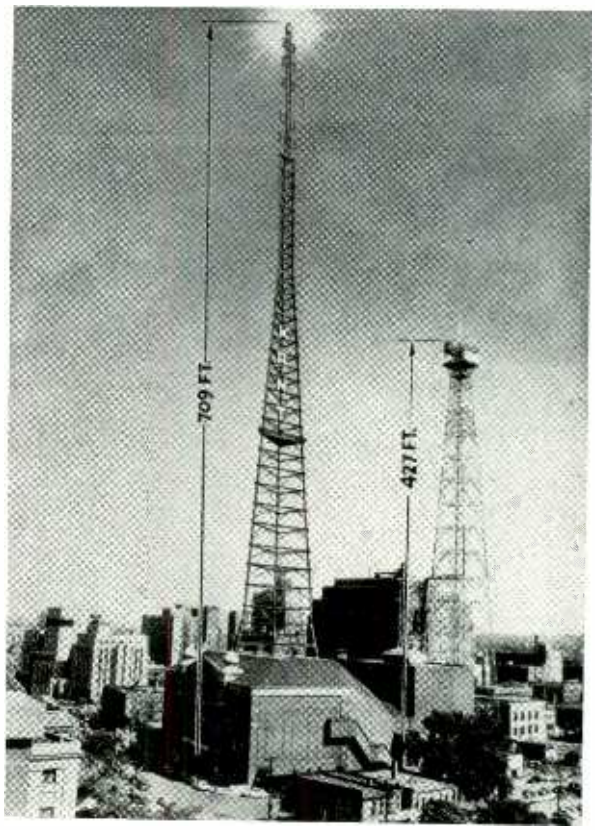
AM-FM

SPRING vs. SUMMER RECEPTION—When our FM-reception map appeared with our July issue, several well-wishers of FM commented that if our survey of AM-vs-FM reception had been made during the hot humid weather of August, the preponderance would have been even more strikingly in FM's favor, than in the survey obviously made at the end of May. So to test out this idea, on August 1 we mailed a second set of questionnaires to all of the sampling areas shown on our July map. Returns were scanty, but the five observers replying, reporting on number of AM and FM Stations clearly received, demonstrated how uniform are reception conditions spring and summer:

Stations Satisfactorily Heard at:	MAY 1950 AM	MAY 1950 FM	AUGUST 1950 AM	AUGUST 1950 FM
Long Beach, Calif.	12	14	12	14
Worcester, Mass.	4	31	4	32
Pittsburgh, Pa.	6	22	5	24
Nashua, N. H.	0	12	0	12
Albany, Oregon	2	6	2	6
Claburne, Tex.	3	7	3	7

MANAGEMENT

DEVELOPING EXECUTIVES—"We cannot govern industry today, with nothing but a group of specialists at the top, unless we are prepared to call a committee meeting every time there is a management decision to be made," declares Ralph J. Cordiner, executive vice president of the General Electric Co. As a solution he suggests building "second and third teams" of reserve executives under special development programs. Such programs should include regular rotation of selected specialists on jobs of different nature, establishment of more assistant managerial jobs, writing of managerial job descriptions to help determine qualifications, off-the-job management training, and periodic review of such programs by the chief executive.



Changing skyline of American cities in the TV-FM era is illustrated by this sketch of 709-ft. tower KRNT is constructing over its 4200-seat theatre in downtown Des Moines, Iowa. At right is the network television-relay tower built by the telephone company.

PARTS

NO SHORTAGE FOR TV SERVICING—There is no serious shortage of replacement parts for servicing television and radio receivers, reports President Robert C. Sprague of the Radio-Television Manufacturers Association. Distributors contacted by RTMA in New York reported that they are generally well stocked with replacement parts for TV requirements. Allocations were brought on by a small minority of dealers and servicemen who were trying to hoard some of the components in short supply. Receiving tubes, resistors, antennas, television tubes, and condensers are being allocated by parts distributors in the New York area. "Despite heavy demand from set manufacturers who are at a peak production pace, and regardless of large anticipated military requirements for electronic components, the industry by reason of its expanded capacity can keep its distribution outlets adequately supplied for any normal requirements of set servicing," concluded President Sprague.

The FCC Color-TV Decision—

Majority of radio-television industry aghast at Commission's proposed field-sequential system

COLOR-TELEVISION hearings before the FCC began in September, 1949, and were concluded eight months later, producing nearly 10,000 pages of testimony. These hearings led to the issuance on September 1 of the first report by the Federal Communications Commission on Color-Television. This 59-page document, written by Commissioners Coy, Webster, Walker and Sterling was endorsed, with exceptions, by Commissioners Hennock, Hyde and Jones. At long last we know what the Commissioners think about the Color *controversy*. Also it is revealed that what should have been treated as an engineering problem has emerged as a controversy between factions—the FCC on one hand, and the Industry and RTMA on the other.

Here is what the FCC has announced:

No final color standards are being proposed now.

But if a decision were made now, the FCC explains, the Field Sequential System (CBS) would be selected because the FCC believes that neither the Line Sequential (CTI) nor the Dot Sequential System (RCA) meet the FCC criteria.

These criteria are: Color fidelity; adequate apparent definition; good picture texture; no marring by misregistration, line crawl, jitter or unduly prominent dot structure; brightness sufficient for adequate contrast range and for normal home viewing without objectionable flicker; receiver cheap and simple to operate; reasonable transmitter costs and operating skill, not restrictive; system not unduly susceptible to interference; operation over inter-city relays cutting off at 2.7Mc.

COMPATIBILITY. This most important requirement in the minds of most TV engineers, FCC has omitted from its above list of criteria. The Commissioners say they have not seen a satisfactory compatible system demonstrated, and that to secure compatibility either the system gives poor picture quality or is complex or both. The report states that compatibility "is too high a price to put on color". The majority of the industry's TV engineers do not agree with FCC.

FCC Proposes "Bracket" Standards

Regardless of comments minimizing the importance of compatibility the Commissioners must be worried on this score. They propose "bracket" standards in our present monochrome systems as follows:

Scanning-line Frequency....15,000 to 32,000 per sec. (Now 15,750)
Field Frequency .....50 to 150 per sec. (Now 60 per sec.)

A receiver built to receive these "bracket" standards, hereafter called a BRACKET receiver, would operate on the present black-white standards, and then, at the turn of the BRACKET switch, give monochrome pictures on CBS color transmissions. For reception of color the further addition of a converter, say, a rotating color disc and motor, would have to be made to the TV set.

Why "bracket" standards? If all future TV sets were BRACKET sets, then the FCC's responsibility of seeing that set owners enjoy monochrome service from all transmitters within range would be limited to only (!) the present 7 million owners! (This will be 10 million at the end of 1950). The FCC will not have to continue to worry about the compatibility problem growing worse when and if receiver manufacturers promise, at the request of the Commission, to build dual or BRACKET standards into all their sets. And that is exactly what FCC has asked the manufacturers to do. By Sept. 29 the set-makers were asked to tell the Commission whether they will build BRACKET receivers, starting 30 days after the FCC order is published in the Federal Register.

What will happen if they do not so promise? If the FCC does not receive sufficient assurances that the great majority of sets produced

CALAMITY! Destructive Effects on TV Industry, as Most TV Engineers Interpret Ruling

It is believed that the majority of TV broadcasters do not desire to transmit an incompatible signal. First, because during the transition period they would lose part of their audience and thereby suffer financially. Second, because their engineers have appraised the performance of the CBS system and advise against the use of a system which gives only 185-line, degraded pictures, inferior to a present monochrome system which yields at least 325-line effective resolution.

Effect on TV Manufacturer

During the Color Hearing no large manufacturer testified he was in favor of the CBS system; therefore, unless forced by the FCC, none will want to make provisions for field-sequential reception. The majority testified that they were ready to make color receivers as soon as there was commercial broadcasting and a public demand. Why should they desire to do otherwise, to hold back color? There will be more profit in the more expensive color receivers.

Most of these manufacturers, through RMA and NTSC, have taken part in the formulation of the present TV standards (which, unfortunately the present Commissioners have not), and therefore they realize that permanent standards must be set high; that an electronic system capable of further development, regardless of current shortcomings, is preferable to a fully-developed but limited system. If the FCC's arguments based on today's performance, cheapness, simplicity, easy operation, etc., were used in a parallel case in 1930 when we progressed from mechanical, 50-line scanning discs to electronic television we would still be stuck with the scanning disk and the FCC would have no billion-dollar industry to approve color standards for.

Effect on TV Set-Owners

The home-set owner does not know what this is all about—yet. When he comes to realize what FCC's endorsement of an incompatible color system may mean to him in reduction of TV service and greater receiver costs, he won't like it. He likes his present TV program. How FCC can claim there is a public clamor for color now is not clear. Of course he likes TV in color, regardless of system or picture quality, but when the novelty has worn off, he may rebel at the poor, 185-resolution, markedly inferior to his standard monochrome pictures, just as he now complains when a hazy film-recording is shown.

Effect on TV Trade

There is a place where lack of compatability will hit hard. How can a dealer explain the BRACKET switch to a prospect? If color is coming Mr. Prospect will wait, not buy. If the FCC report is brought to the attention of the mass of TV buyers, receiver sales will be adversely effected in spite of the fact that the report indicates black-white transmission will be on the air for several years. Of course there will be some unfavorable reaction experienced, regardless of how color is introduced. If the prospect, desiring a new monochrome receiver, knew that BRACKET receivers, at increased costs, would be the only sets available after a certain date, there might be a rush of buying to beat this deadline.

An Engineer's Comments

1. For other than technical reasons it appears that the FCC members decided they would not endorse the RCA system, but would select the CBS system. Having so

(Continued on page 56)

—Calamity or Opportunity?

Manufacturers and engineers outraged at FCC attempt to control factory output by "Bracket" requirement

will be BRACKET receivers, then the Commission declares it will not postpone final decision but will adopt CBS Color Standards in one month! A rather clever but high-handed method of forcing, or attempting to force, manufacturers, over whom the FCC has no jurisdiction, to help carry out the Commission's present intent regarding color.

What is the reward if the manufacturers agree to produce BRACKET receivers? The FCC will then postpone its decision and witness tests of color systems, provided they satisfy the criteria mentioned above and provided the receiving equipment is delivered to the FCC Laboratory by Dec. 5 and a suitable signal is on the air in Washington for test and that the tests terminate by Jan. 5, 1951. (According to Commissioner Hennock's view the decision date should be moved ahead to June 30, 1951. She wisely points out that newly-developed, all-electronic systems, some of which have not yet been shown to the FCC, may bring the realization of an acceptable COMPATIBLE system.)

CTI has a new system to show; RCA has greatly improved the performance of its system since the last demonstration that FCC officially recognizes; there is the Lawrence tube to see; Hazeltine has improvements; G. E. also has a new system. How will these have a chance to be included in the line-up when the color system for USA is chosen? Only if in the meantime all the large manufacturers of TV sets promise to add BRACKET equipment to their receivers, upping each receiver by at least $10 to $30. What will the customer get in return? A wider adjustment of horizontal and vertical scanning speeds; wide enough to include CBS standards; an addition which may *never be used.* It is possible that 3 million TV sets would be manufactured before the final FCC decision. This would mean $90 million of customers' money thrown away on a useless addition to their receivers if a better, compatible system is eventually chosen instead of the CBS system, Certainly, this is too high a price to pay. Let the people buy what they want. Do not force them to pay extra for a dual standard set. Possibly CBS color will never be broadcast from the stations they receive.

Vision Needed

Here is a clear example of where *faith in the future,* possessed by the scientific researcher, the dreamer, pointed out the way to success. It is unfortunate that there is no such guiding personality on the Commission nor is there is a single experienced television researcher on the FCC engineering staff. The important matter of future color standards is an ENGINEERING problem. Where is the needed type of experience and judgment to be found? Among engineering personnel who have been or are with the large TV companies where extensive research laboratories are available and where color systems of the future can be worked out and tested. Of the many capable TV engineers appearing as witnesses during the FCC hearings, a large majority were not in favor of the CBS system. Why was this? Not because they were biased but because their experience allowed them to evaluate color systems. They have testified under oath that Dot Sequential standards can produce better performance than Field Sequential standards. Some have proven this in their laboratories.

Why has FCC disregarded their testimony? Why has there been a "fight" in progress during the color hearing between the manufacturers and the FCC? The FCC report has not helped restore peace. It has shown what Bureaucracy can do to Industry. Millions of TV users may be saddled with an inferior system when Bureaucracy attempts the difficult technical problem of TV transmission standards. This problem should be assigned to Industry engineers.

OPPORTUNITY!

Favorable Interpretation of FCC as Seen by ex-CBS TV Engineer

From the point of view of the broadcast engineer who is not concerned with the political and industrial implications of the FCC announcement concerning color TV, the situation is comparatively uncomplicated, and he will be free to go ahead and experiment with the transmissions. However, the situation facing the design engineer is somewhat different. According to the FCC notice if the industry proceeds to build receivers capable of handling both scanning frequencies the final decision will be delayed; but if the industry does not do this standards for the CBS sequential system will be set immediately.

In making its decision the FCC has recognized the fact that the sequential system is the only system presently capable of producing satisfactory color television. At last, four years late, it has been realized that the American public will have an indefinite time to wait if color TV is not authorized until the perfect" system is disclosed. The question of compatibility is one which will have to be faced—and solved if possible—by the broadcasters. Assuming that a broadcaster decides to transmit color TV it seems reasonable to expect that class A time will not be used, unless the sponsor happens to be color-TV minded, and hopes to influence people to convert to color. Therefore color may be expected in the "off hours" when time is cheaper and there are less viewers.

Circuit for Automatic Adapter

If the engineer designs to receive sequential color in monochrome he can make an adapter. This can be either manually or automatically operated. If the former the probability is that it need not cost more than a few dollars since in most sets it will only be necessary to add a resistor and or condensers to the vertical and horizontal oscillators to increase the latter's and decrease the former's frequency, in order to receive 405 lines at 144 fields. A simple switch can be used to short or insert these components to select the proper scanning frequencies. If automatic operation is desired a frequency selective relay circuit similar to that designed by E. W. Chapin of the FCC Research Division (Described in TELE-TECH, April, 1950, page 68), can easily be developed.

Converter-Disk or Tri-color Tube

On the other hand if color pictures are required it will be necessary to provide a converter in addition to the adapter. In its simplest form the converter need consist of no more than a synchronous motor driving a disc with six color segments, two each of red, blue and green, at 1440 rpm. Automatic phasing can be introduced by a more complex circuit, but this is not essential since manual braking can accomplish the same thing at lower cost.

All electronic operation is possible by the use of the direct view tri-phosphor tube which is under development by RCA and other organizations. However, thus far the sequential system has not been demonstrated using this tube. Should such a demonstration be held, the record would be reopened to permit thorough examination of the situation's possibilities.

CBS's All-Electronic Color

In April, 1950, CBS demonstrated an all-electronic color receiver thus confounding the critics who said it could not be done. The receiver utilized a single 5 inch projection tube with three separate screen coatings —red, blue and green. Three pictures ap-

(Continued on page 57)

A Simultaneous

Custom designed and built ally fabricated console to

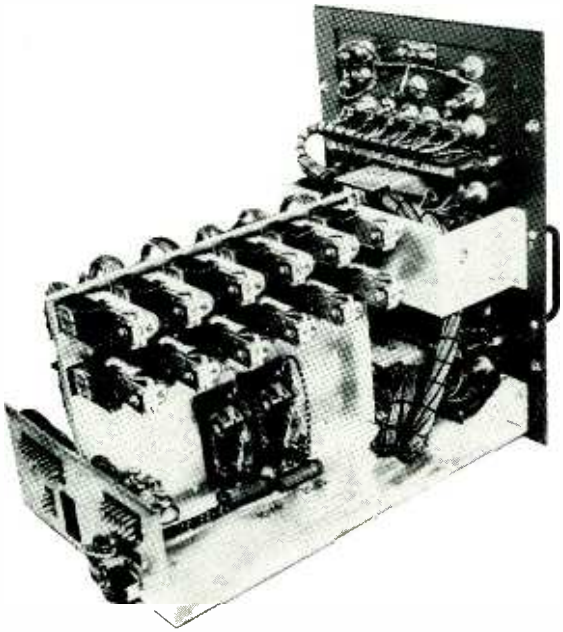


Fig. 1: Rear view of switching panel, shows relay mounting. K 13 and K 14 appear in lower center

By C. J. AUDITORE, TV Facilities Engineer, WOR-TV, New York City

A NETWORK type television master control demands elaborate switching requirements. The basic problem is to provide a rapid and flexible means for switching multiple audio and video program sources to multiple outgoing channels. Further complications are added by the many program combinations and variations in timing resulting from accepted broadcast technics.

A partial solution to the television master control switching problem has been offered to the industry by RCA[1]. This is the TS-20A type video switching relay system. The hand in glove relationship existing between audio and video in television is acknowledged by all. Unfortunately, none of the commercial equipment manufacturers have as yet seen fit to integrate the two into one relay switching system.

At the studio level, experience has shown that it is still desirable to produce a television program in two parts, as audio plus video. The familiar audio broadcasting studio technics apply equally to television, and the equipment manufacturers offer the tools for unlimited solutions to the individual broadcaster's problems. There are several video switching systems on the studio level offered by the various manufacturers. The RCA video switching relays are used as the basis for the WOR-TV studio switching system.

It is apparent that the outgoing master control channel must switch simultaneously two separate program sources, one audio and the other video. It does not necessarily follow that the audio and video program sources will always be paired in a fixed relationship.

With these and other basic considerations in mind, the WOR-TV master control switching system was evolved. It was decided that the following functions should be provided:

Six independent audio and video inputs.

Four audio-video outgoing program channels.

Two video preview channels.

Audio and video monitoring facilities and program level control at each outgoing program channel.

Provision for independent switching and presetting each of the six audio and video inputs.

Provision for combined video plus audio switching and presetting each of the six normally paired inputs, video carrying the audio with it.

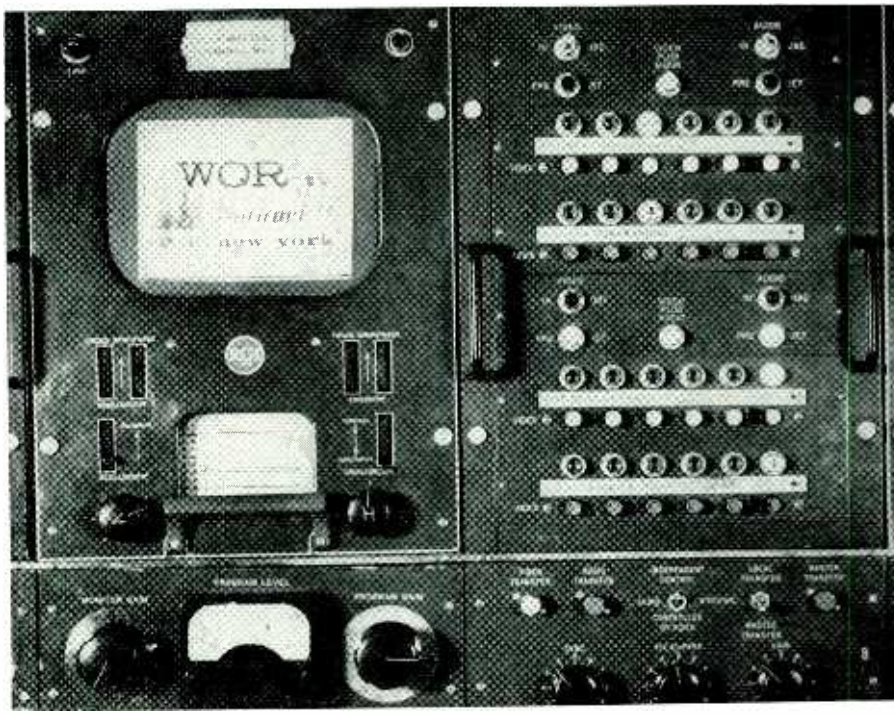
Provision for local independent video and audio transfer, or combined video plus audio transfer, to the present position.

Provision for master transfer to any or all, of the preset positions from any of the four outgoing channel switching panels.

Suitable tally lights to indicate at all times the status of the individual channels.

The factors of cost, materials and the element of time were prime considerations in the development

Fig. 2: General view of one complete switching unit. Normal picture monitor is on left. On right controls can be identified by comparison with diagram shown in Fig. 3



[1]TV Remote Control Switching, by W. E. Tucker and C. R. Monro—TELE-TECH, p. 24, August, 1949.

Video and Audio Master Switcher

control equipment uses combination of catalog items an speci-effect automatic, or manual switching of picture sound signals

of this project. The overall cost was kept to a minimum by the judicious selection of standard RCA component assemblies as a foundation. This at once solved problems of availability and standardization of materials. A detailed circuit analysis resulted in further simplifications and the system reduced to the following essentials:

A standard six by six inch basic video switching relay chassis, a catalog item.

Two master monitor console sections per channel, catalog items.

Two custom fabricated master monitor console extension pieces per channel. These extension pieces provide space for an audio program control panel under the master monitor, and a combined transfer and video program control panel under the channel switching panel.

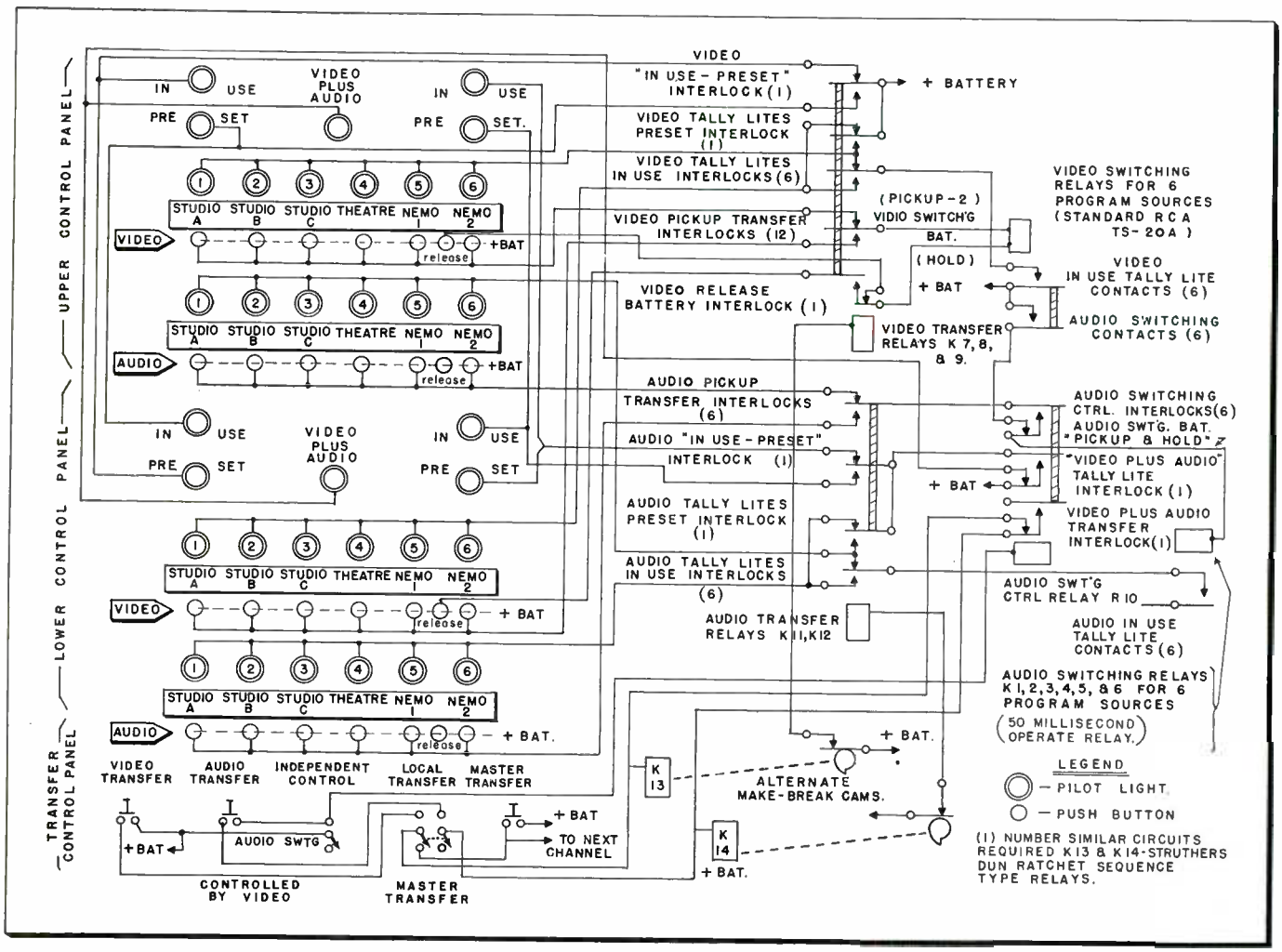
One custom built plug-in relay chassis and switching panel per channel. The chassis was designed to occupy the same console housing as a standard master monitor. All of the added interlocking, transfer and audio switching relays are located in this unit. Slightly modified standard push-button switching assemblies and custom tally panels form the operating face of this switching unit. Inter-wiring of all the components on this chassis removes the necessity for complicated external wiring. The external connections are made with Jones plugs and consist of an audio program cable, a cable to the transfer control panel and a switching control cable to the video relay chassis. Extra leads should be provided in the latter cable for studio "air light" and other miscellaneous circuits. A telephone type terminal block is mounted in the bottom of the console housing to facilitate cross connection and maintenance.

Master monitors, audio and video amplifiers, etc.

Since the basis of this system is the type TS-20A switcher, familiarity with its operation is desirable. The complete control and switching function is demonstrated in the accompanying simplified schematic. As shown, there is no video output, and the switcher is in a "released" condition. (See next page)

It will be seen that the operation of Key 1 causes the "A" PICKUP COIL of K3 to become energized and all the K3 contacts transferred. The K2 TRANSFER relay then be-

Fig. 3: Semi-schematic diagram of one switching panel identifying controls seen on right of Fig. 2 and sequence of operations



MASTER SWITCHER (Continued)

comes energized through K1 and K3 ON contacts. The "A" HOLDING COIL of K3 holds through the transferred K2 contacts. At the same time the K2V contacts transfer the 6J6 cathode follower input to the "A" VIDEO BUS, where INPUT 1 has been placed by K3.

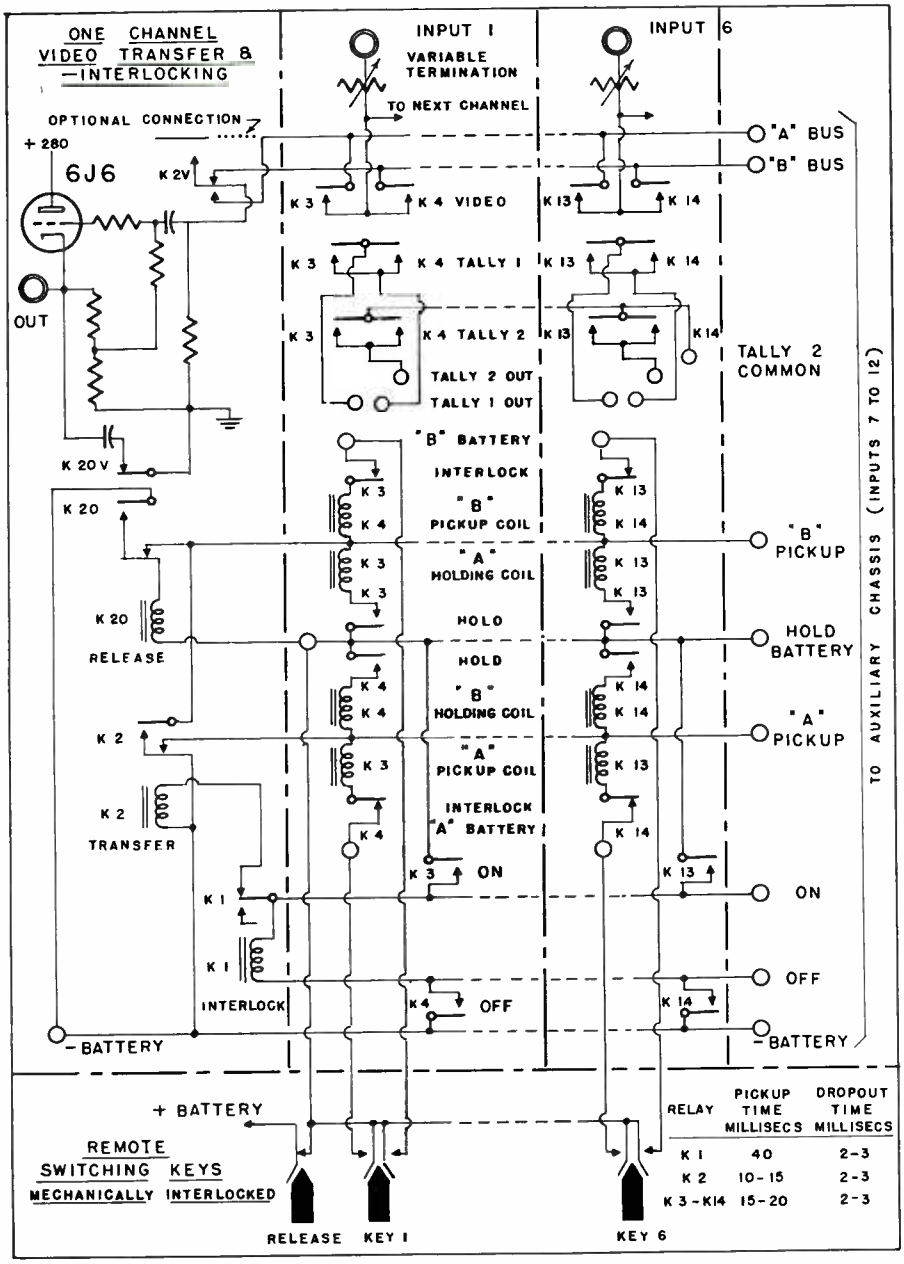
On the first switching cyle (A cycle) following the "released" condition, energization of the K2 TRANSFER relay causes the K20 RELEASE relay to pickup and hold until the next "release" operation. With relay K20 operated, the K20V contacts remove the parasitic suppression bypass capacitor across the cathode follower output.

Under the "A" cycle conditions, the K2 TRANSFER relay remains energized and the next switching operation is a "B" cycle. Key 6 causes the "B" PICKUP COIL of K14 to become energized (K2 contacts transferred). The K14 OFF contacts in series with the "A" cycle K3 ON contacts cause delayed pickup of the K1 INTERLOCK relay. The K2 TRANSFER relay now drops out establishing a hold circuit for the "B" HOLDING COIL of K14. At the same time, the K2V contacts transfer the cathode follower input to the "B" VIDEO BUS where INPUT 6 has been placed by K14. K1 INTERLOCK relay holds momentarily, until the "B" cycle holding circuit has been established and the "A" cycle relay drops-out.

Thus, the operation will repeat itself with an "A" cycle followed by a "B" cycle followed by an "A" cycle and so forth. An "A" cycle will always follow the "released" condition. The ultimate video switching is controlled by a single set of contacts, K2V on the TRANSFER relay. This reduces the timing problem to one set of critical contacts. Overlap (make before break) video switching may be obtained by using the optional connection on the K2V contacts. However, this is not desired for master control operation where the switching takes place across active signal buses, and the gap (break before make) connection is used.

Note the two sets of tally contacts. One set of contacts is usually connected to provide a positive tally light, indicative of the relay operation. The remaining set of contacts may be used for some other control function, such as audio switching.

Fig. 4: Simplified schematic of one channel in "released" condition with no output.



Addition of Relays

An analysis of the master control one channel simplified functional switching diagram shows how the audio program relays, K1 to K6, the interlocking relays, K7 to K12, and the transfer relays, K13 and K14, were added to produce an integrated audio-video switching system. Relays K1 to K6 are telephone types with copper slugs for delayed pickup. This is necessary to prevent overlap audio switching, since the video tally circuits, used to control the audio switching, make before the released circuit breaks. Relays K7 to K12 are conventional telephone types with maximum spring loading to reduce their number and at the same time provide all of the required circuits. Relays K13 and K14 are the Struthers-Dunn ratchet sequence type, providing an alternate make and break circuit on alternate energizing cycles.

Each master control channel consists of duplicate upper and lower program switching panels, plus a common transfer switching panel. One pair of audio plus video selector push-buttons provides an outgoing program, while the remaining pair are available for presetting the next program switch. The transfer to the preset program is made by means of the appropriate transfer switches. It is possible to operate the switcher so that the audio and video switching controls are out of step, i.e. audio PRESET and video IN

(*Continued on page* 62)

Monostable Multivibrator Design

How to calculate values for a circuit generating rectangular pulses of constant amplitude and duration in response to triggering pulses whose shape and frequency vary

By G. FRANKLIN MONTGOMERY,
Ionospheric Research Section, Central Radio Propagation Laboratory, National Bureau of Standards, Washington, D. C.

THE monostable cathode-coupled multivibrator, shown in Fig. 1, is a circuit which generates a rectangular pulse of constant amplitude and duration in response to a triggering pulse whose shape and frequency may vary. Excellent descriptions of the operation of this flip-flop circuit have appeared before.[1,2] The purpose of this paper is to develop a method which will allow the designer to choose several parameters, such as plate-supply voltage and pulse length, and then calculate the necessary circuit values in logical fashion.

In the circuit of Fig. 1, a positive rectangular pulse is produced at the plate of triode (1) when the grid of triode (2) is properly triggered; a corresponding negative pulse is produced at the plate of triode (2). The action is as follows: It is assumed that triode (1) is normally conducting and that sufficient bias is developed across R_K to cut off plate current in triode (2). If a short positive trigger pulse of sufficient amplitude is now applied to the grid of (2), plate current will start in (2), and the drop across R_2 will be transferred to the grid of (1). The drop in the grid potential of (1) will decrease the common cathode potential and increase the drop across R_2; if the gain of (2) is sufficient, the grid of (1) will be driven beyond cutoff. Triode (2) will now remain conducting until the coupling capacitor C has discharged sufficiently to raise the grid potential of (1) to the cutoff point. Plate current will then start in (1), the regenerative action just described will proceed in the opposite sense, and the circuit will be restored to its original condition.

If the circuit is designed to generate a pulse of length T, it will not, of course, function properly unless successive trigger pulses are spaced by intervals somewhat greater than T. The additional time is necessary to allow C to recharge through R_2, R_K, and the grid-cathode resistance of (1). Most designs will operate with a trigger separation as small as 2T.

Negative output voltages are available at both the plate of (2) and the common cathode, but the pulse length is much more sensitive to loading at these points than at the plate of (1). It is for this reason that the positive pulse amplitude at the plate of (1) has been chosen as a design parameter.

The design method to be described is exact except for the assumption of instantaneous transitions of plate current between conduction and cutoff. The calculated pulse duration will be in error because of this assumption; the error will be serious only for pulses less than several microseconds long.

The symbols used in the step-by-step method are defined in the following list:

- C = coupling capacitance in farads.
- E_B = supply potential in volts.
- E_C = grid bias in volts.
- E_O = output pulse amplitude at plate of (1) in volts.
- E_P = plate to cathode potential in volts.
- E_T = required amplitude of trigger pulse in volts.
- E_2 = plate to cathode potential of (2) in volts.
- e = base of natural logarithms, 2.718.
- I_P = plate current in amperes.
- I_1 = plate current of (1) in amperes.
- I_2 = plate current of (2) in amperes.
- R = grid leak resistance in ohms.
- R_K = cathode resistance in ohms.
- R_1 = load resistance of (1) in ohms.
- R_2 = load resistance of (2) in ohms.
- S = ratio of peak grid-cathode potential to cutoff bias of (1).
- T = pulse duration in seconds.

(*Continued on page* 60)

Fig. 1: Diagram of the multivibrator circuit

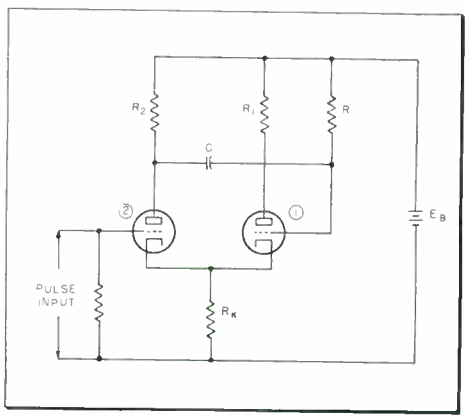


Fig. 2: Triode (2) plate curve construction

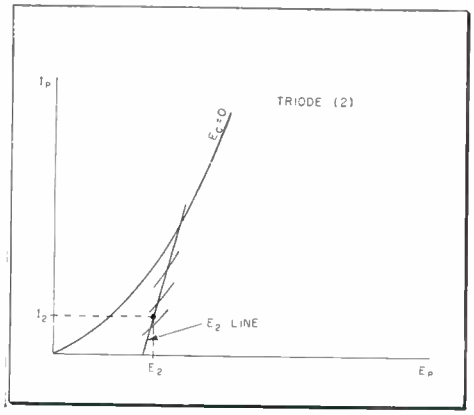
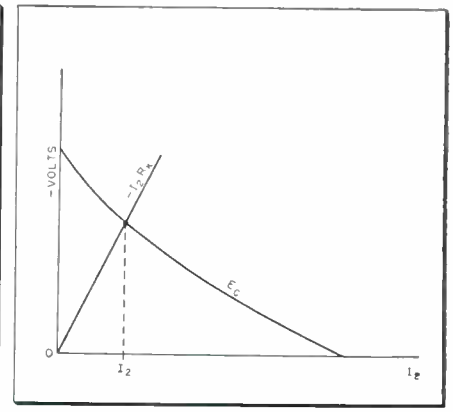


Fig. 3: Triode (2) bias-curve construction



Simple Design of Multi-Output,

A method for connecting the single output of an audio amplifier Shorted or open-circuited legs have no material effect

By ROBERT G. MASCHING,
4280 Sierra Drive, Honolulu, T. H.

OFTEN it becomes necessary to connect to the single output of an amplifier, a number of loads of the same impedance with provision that a short or open circuit in any output will not materially affect either the impedances in the other outputs, or the impedance presented to the amplifier output. This may be achieved by the use of several transformers, or isolation amplifiers, but here is a simple method of accomplishing the desired results using only resistances.

In Fig. 1:

Z_{IN}—output impedance of amplifier, or input impedance of network

Z_O—output impedance of any leg of network, to which a load is to be connected

x—one of two equal series resistors in each leg of network

Z_n—impedance of any leg of network, including series resistors

Z_{eq}—equivalent impedance of "n" parallel legs of network

n—number of legs in network (excluding input leg), or the number of output impedances desired

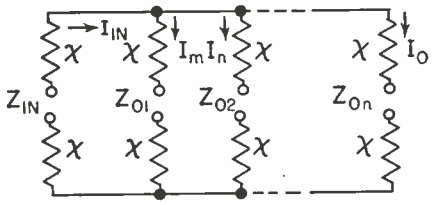


Fig. 1: Diagram showing network configuration for an amplifier feeding (Z_{IN}) n same impedance legs, all of which are in parallel.

Since all output impedances are equal and equal to the input impedance,

$$Z_{O1} = Z_{O2} = Z_{On} = Z_{IN}$$

Then,

$$Z_n = Z_{O1} + 2x$$
$$= Z_{O2} + 2x$$
$$= Z_{On} + 2x$$
$$= Z_{IN} + 2x$$

The equivalent impedance of "n" equal impedances in parallel is the impedance of one divided by "n",

$$Z_{eq} = \frac{2x + Z_{IN}}{n}$$

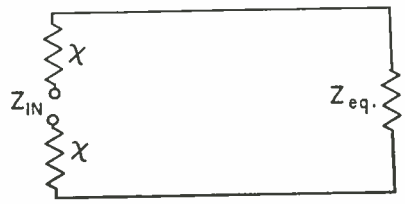


Fig. 2: Equivalent diagram of Fig. 1 network

Fig. 1 can now be simplified to Fig. 2

The impedance looking into the network is,

$$Z_{IN} = x + Z_{eq} + x$$
$$= 2x + Z_{eq}$$
$$= 2x + \frac{2x + Z_{IN}}{n}$$

Simplifying:

$$n Z_{IN} = n(2x) + 2x + Z_{IN}$$
$$n Z_{IN} - Z_{IN} = n(2x) + 2x$$
$$Z_{IN}(n-1) = 2x(n+1)$$
$$x = \frac{Z_{IN}(n-1)}{2(n+1)} \qquad (1)$$

This equation, in conjunction with Fig. 1, gives the design of the network.

The db loss to be expected from the input of the network to an individual load is found as follows:

Input current to network is input voltage divided by input impedance:

$$I_{IN} = \frac{E_{IN}}{Z_{IN}}$$

Since all legs have equal impedance, this current divides equally in each leg. The current in any one leg is therefore 1/n of the total current.

$$I_n = I_O = \frac{I_{IN}}{n} = \frac{E_{IN}}{n Z_{IN}} \qquad (2)$$

The ratio of input to output current is,

$$\frac{I_{IN}}{I_O} = \frac{E_{IN}}{Z_{IN}} \div \frac{E_{IN}}{n Z_{IN}} = n$$

Since the input impedance equals the output impedance, the db loss is

$$20 \log_{10} \frac{I_{IN}}{I_O},$$

or, db loss $= 20 \log_{10} n$ (3)

Equations (1) and (3), then, give the value of "x", and the db loss to be expected at each individual load with this design.

Example: Design a network of resistances to match a 600 ohm output of an amplifier to 22 loads of 600 ohms each.

From equation (1),

$$x = \frac{Z_{IN}(n-1)}{2(n+1)},$$

where $Z_{IN} = 600$; $n = 22$

$$x = \frac{600(22-1)}{2(22+1)}$$
$$= \frac{600 \times 21}{2 \times 23} = 274 \text{ ohms}$$

From equation (3),

db loss $= 20 \log_{10} 22 = 20 \times 1.342$
$= 26.86$ db

Proof: The impedance of each leg is the sum of the two resistors "x" and the 600 ohm output,

$Z_n = 274 + 600 + 274 = 1148$ ohms

The impedance of 22 parallel legs is:

$$Z_{eq} = \frac{1148}{22} = 52.2 \text{ ohms}$$

The impedance presented to the amplifier, or presented to an individual load is then,

$$Z_{IN} = Z_O = 274 + 52 + 274$$
$$= 600 \text{ ohms}$$

Design a network of resistances to match an 8 ohm output of an amplifier to four loads of 8 ohms each.

From equation (1),

$$x = \frac{8(4-1)}{2(4+1)} = \frac{8 \times 3}{2 \times 5} = 2.4 \text{ ohms}$$

From equation (3),

db loss $= 20 \log_{10} 4 = 20 \times 0.602$
$= 12$ db

Short Circuit in One Output

Since the effect of a short circuit in any output will be greatest when the number of outputs is smallest, and since this network is unnecessary if only one output is desired, the case of two outputs will be discussed.

Equal-Impedance Matching Networks

to a number of same impedance loads using resistances only. on the amplifier output impedance or on the other legs

In Fig. 3:

Z_{IN}—impedance connected to leg 1, or amplifier output impedance

Z_{IN_s}—input impedance presented to Z_{IN} with one output shorted

Z_O—impedance connected to leg 2 or leg 3, equals Z_{IN}

Z_{O_s}—output impedance presented to Z_O with one output shorted

Z_n—total impedance of any leg of network

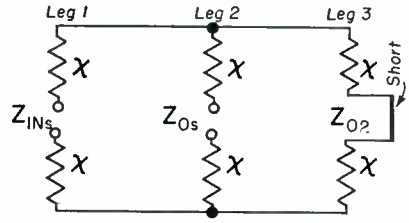


Fig. 3: Network diagram for studying the effects when the impedance in one leg is shorted

The impedance of each of the three legs is,

$Z_{n1} = Z_{IN} + 2x$

$Z_{n2} = Z_O + 2x$

$Z_{n3} = 2x$

The equivalent impedance of the usable and the shorted output legs is,

$$Z_{eq} = \frac{2x(2x + Z_O)}{2x + (2x + Z_O)} = \frac{4x^2 + 2x\,Z_O}{4x + Z_O}$$

The input impedance of the network is,

$$Z_{IN_s} = 2x + Z_{eq} = 2x + \frac{4x^2 + 2x\,Z_O}{4x + Z_O} = \frac{8x^2 + 2x\,Z_O + 4x^2 + 2x\,Z_O}{4x + Z_O} = \frac{12x^2 + 4x\,Z_O}{4x + Z_O} \qquad (4)$$

Similarly,

$$Z_{O_s} = \frac{12x^2 + 4x\,Z_{IN}}{4x + Z_{IN}}$$

And since $Z_{IN} = Z_O$, (5)a

$Z_{O_s} = Z_{IN_s}$ (5)b

From equation (1), when n = 2,

$$x = \frac{Z_{IN}(2-1)}{2(2+1)} = \frac{Z_{IN}}{6} \qquad (6)$$

Substituting in equation (4) the values of Z_O and "x" from equations (5)a and (6),

$$Z_{IN_s} = \frac{12\left(\frac{Z_{IN}}{6}\right)^2 + 4\left(\frac{Z_{IN}}{6}\right)Z_{IN}}{4\left(\frac{Z_{IN}}{6}\right) + Z_{IN}} = \frac{\frac{Z_{IN}^2}{3} + \frac{2Z_{IN}^2}{3}}{\frac{5Z_{IN}}{3}} = \frac{5Z_{IN}}{5} = 0.6\,Z_{IN} \qquad \ldots\ldots(7)$$

This equation states that the minimum impedance which will be presented to the amplifier output, or to the load of the network, will be 0.6 of the desired impedance, if an output be shorted.

As in the case of the short circuit, two desired outputs are here chosen. In Fig. 4 below,

Z_{IN_o}—impedance presented to Z_{IN} with one output open

Z_{O_o}—impedance presented to Z_O with one output open

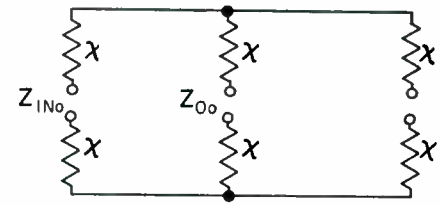


Fig. 4: Network diagram depicting conditions when impedance of one leg is open circuited

The input impedance equals the output impedance, and is:

$Z_{IN_o} = Z_{O_o} = 4x + Z_O = 4x + Z_{IN}$

From equation (6), substituting for x its value, $Z_{IN}/6$,

$Z_{IN_o} = Z_{O_o} = (4Z_{IN}/6) + Z_{IN}$

$= (5Z_{IN}/3) = 1.667\,Z_{IN}$

This equation states that the maximum impedance which will be presented to the amplifier output, or to the load of the network, will be 1.667 times the desired impedance if an output be open.

14 Cities in East and Mid-West Added to Microwave Relay and Coaxial Cable Network

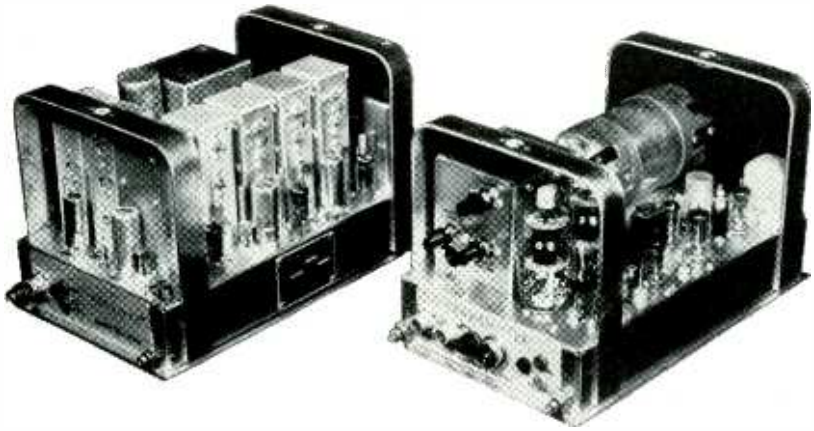
THE intercity microwave relay and coaxial cable routes have now been expanded by the American Telephone and Telegraph Co. so that fourteen additional cities in the East-Midwest area can be interconnected for a network TV program. The cities which have been added are Ames, Iowa; Atlanta, Ga.; Birmingham, Ala.; Charlotte, N. C.; Davenport, Iowa; Des Moines, Iowa; Greensboro, N. C.; Indianapolis, Ind.; Kansas City, Mo.; Louisville, Ky.; Minneapolis-St. Paul, Minn.; Omaha, Neb.; and Rock Island, Ill. In addition, a new microwave relay system has been opened between San Francisco and Los Angeles, Calif., and the existing coaxial cable route between New York City, N. Y. and Chicago, Ill., has also been supplemented with a new microwave relay system. These installations mark another milestone[1] toward the achievement of coast-to-coast TV networking, which, incidentally, is scheduled to become a reality in late 1951 or early 1952 when the Omaha to San Francisco microwave relay system has been completed. Table I shows the inter-city television facilities now available. It is to be noted that thus far TV broadcasting allocations have not been made by the FCC for either Albany, N. Y. or Des Moines, Iowa and that consequently these cities for the time being can only be considered as a possible program pickup point so far as networking is concerned.

The new microwave relay system between New York and Chicago was built at a cost of approximately 12 million dollars and consists of

(*Continued on page* 58)

Narrow-Band FM Doubles Number

20 KC channel of effecting



Mobile transmitter unit (right) and receiver unit (left) for mobile narrow band FM

By CONAN A. PRIEST, CHARLES M. HEIDEN, and DAVID C. PINKERTON,

Commercial Equipment Div., Electronics Dept., General Electric Co., Syracuse, N. Y.

PART TWO

OF TWO PARTS

Receiver intermodulation spurious attenuation is defined as the measured amount of the receiver's ability to receive a desired signal to which it is resonant in the presence of two interfering signals so separated from the desired signal and from each other that the *nth* order mixing of the two undesired signals can occur in the non-linear elements of the receiver producing a third signal whose frequency is equal to that of the desired signal.

To illustrate with a specific example, suppose the case that is most likely to give trouble is considered. Suppose it is necessary to operate at some frequency F in the presence of two strong signals at F + 40 KC and F + 80 KC. The two undesired strong signals can mix in the first stages of the receiver producing modulation components, one of which falls directly on the frequency of the desired signal.

The intermodulation characteristic of the narrow-band receiver, Type ER-6-A (Fig. 3), shows the signal strength required for the undesired signals in order to obtain 20 db quieting. Here two curves are shown, one entitled, "40 KC Separation" for the case where the strong undesired signals differ from the desired signal by 40 KC for the adjacent signal and 80 KC for the alternate signal, and the second curve entitled, "80 KC Separation" where the adjacent signal is 80 KC away and the alternate signal is 160 KC away.

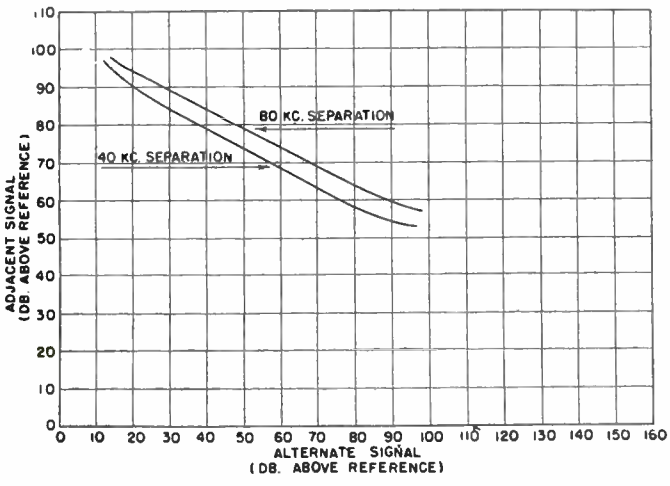
Spurious and Harmonic Radiation

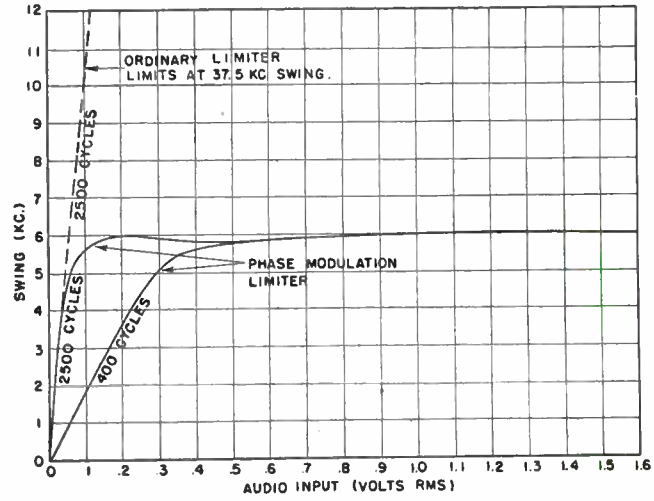
Phase modulation transmitters, consisting of an oscillator, a phase modulator, a number of multipliers, and a power amplifier, will radiate an extensive spectrum of frequencies containing many harmonics of the crystal frequency.

In designing the new equipment, spurious effects were reduced by two design improvements: Better modulation characteristics — far exceeding the RMA requirements— were obtained with a lower multiplication factor, and the double-tuned circuits between stages were improved and tuned circuits were added.

The new wide-band transmitter, Type ET-6-B, has a multiplication factor of 24, and its spectrum (Fig. 4) was improved in that the highest spurious in the 25-50 MC band is now 76 db below the carrier as compared to 50 db on previous equipment. The second harmonic is

Fig. 3: (left) Intermodulation characteristics of receiver type ER-6-A. (right) Limiter characteristics of phase modulator stage





# of VHF Channels for Mobile Use

assignments demonstrate unquestioned feasibility of new methods spectrum economy in the Land Transportation Radio Services

66 db down compared to 46 db before.

The narrow-band transmitter, Type ET-6-A, has a multiplication factor of 12, thus giving a further improvement. The highest spurious in the 25-50 MC band (Fig. 4) is 88 db down, and the spurious adjacent to the carrier are now at least 95 db below the carrier. Also note that the narrow-band and wide-band transmitters have spurious and harmonics above 50 MC that are identical. These are a function of the final stages alone and in this respect the transmitters are the same.

FCC STRESSES NEED FOR NARROW-BAND CHANNELS

The proposed FCC Rules and Regulation of May 6, 1949 did not retain the 20 KC channel assignment plan for the 44-50 MC band contained in the June 30, 1948 proposal. The need of such assignments, however, is strongly emphasized in the following quoted statement:

"In acting upon that proposal herein, it is to be noted, we have considered the arguments addressed to the subject of frequency spacing and have established the assignments in the 44-50 MC band on a 40 KC interval, rather than on 20 KC as proposed originally. However, we wish to emphasize that the ultimate ultimation of this band, which is urgently required to take care of the anticipated overflow from the 152-162 MC band, will necessitate the development of technics and equipments which will operate on a closer spacing than 40 KC"

Phase Modulation Limiting

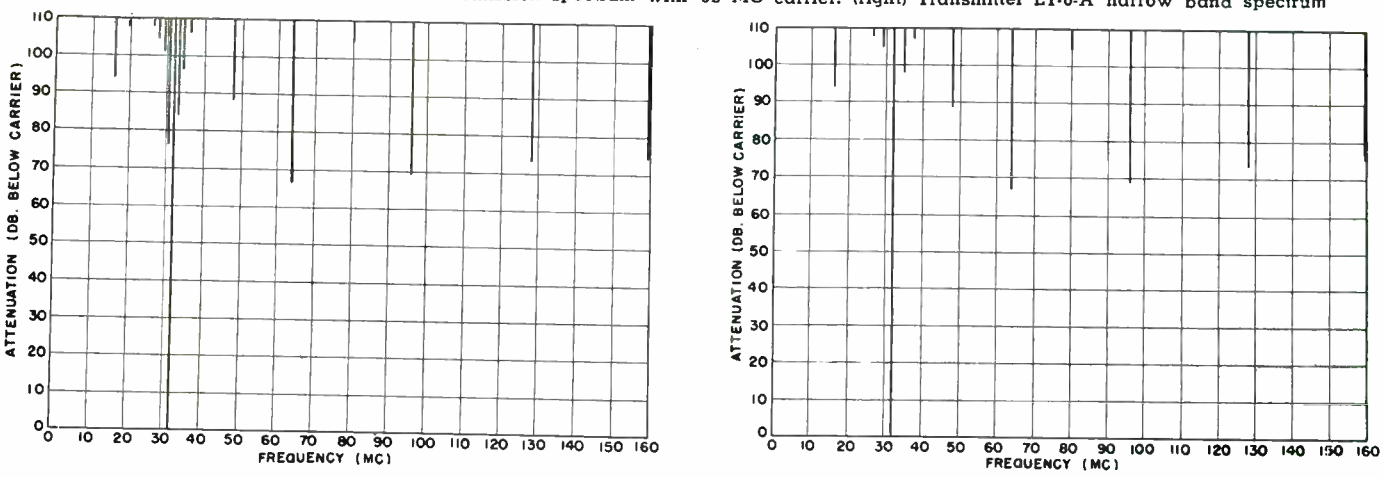
The limiting of the swing of a phase modulation transmitter poses one problem not encountered in transmitters having amplitude or frequency modulation in that with phase modulation the swing is proportional to the audio modulating frequency. Thus a phase modulation limiter must be capable of limiting the various components of the audio input in inverse proportion to its frequency. A simple mathematical analysis shows that this is equivalent to limiting the slope of the audio wave.

To accomplish this, the phase modulation limiter employed in these transmitters simply changes the audio input wave into a wave having an amplitude proportional to the slope of the original wave before it is limited in the usual manner. This change is accomplished by a simple pre-emphasis circuit. After limiting the wave is returned to its original form by de-emphasis so that, below limiting, the input wave is unchanged except for an insignificant phase shift between components. With such a limiter as this, it is not possible to swing the frequency outside of the assigned channel and yet satisfactory intelligibility is preserved under very heavy modulation.

Fig. 3 shows the modulation limiter characteristics and compares the phase modulation limiter with an ordinary amplitude limiter employed in a phase modulation transmitter. For the phase modulation limiter, both 400 cycles and 2500 cycles are limited to the same swing while for amplitude limiting the 400-cycle note may be limited to 6 KC while the 2500 note will reach 37.5 KC swing.

A swing of 6 KC has been used in this narrow-band equipment in order to limit the modulation components outside the 20 KC channel to the same percent that 15 KC allows outside of a 40 KC channel. The classical analysis using Bessel functions show that 6 KC is the correct value to use for this requirement instead of 7.5 KC. As previously explained, 6 KC has been used throughout the development and field tests.

Fig. 4: (left) Wideband transmitter ET-6-B emission spectrum with 32 MC carrier. (right) Transmitter ET-6-A narrow band spectrum



The Work of the Radio-

How voluntary cooperative efforts produce valuable standardization, educational

By ROBERT C. SPRAGUE,
President of The Radio-Television Manufacturers Association

A TRADE association like the Radio - Television Manufacturers Association is an example of democracy at work. No manufacturer is compelled to belong—as he might be in a totalitarian state. He also is free to—and often does—criticize its activities, its officers, and its members.

Yet, because it is a voluntary association of business men with common interests, RTMA provides the most practical medium through which manufacturers in the radio-electronic industry can take cooperative action and make known in Washington and thruout the industry the prevailing opinions and recommendations of a majority of the industry.

"RMA" for 26 Years

Until last June RTMA was known for 26 years as the Radio Manufacturers Association. It has been long recognized as the spokesman for the industry. It has survived lean and fat years, a world war, reconversion, and price controls. And now RTMA seems to be entering another period of partial mobilization with inevitable Government curbs on industry operations.

When RMA was founded in 1924, the radio industry was little more than a group of pioneering parts manufacturers. The completed receiver of today was still in a developmental stage. Annual sales could be measured in the hundreds of thousands of dollars. Today radio-TV is one of the nation's foremost industries with annual sales of around two billion dollars in peacetime and a wartime capacity several times that figure. Hundreds of manufacturers are engaged in the production of equipment and parts.

RTMA's membership and organization, while they do not include all radio-television manufacturers, are fully representative of all types of manufacturers. RTMA has five divisions, comprising set, tube, parts, transmitter and amplifier and sound equipment manufacturers. Thus the Association is not only in a position to speak authoritatively for the radio and television industry but also is able to resolve many industry problems involving any of these groups separately or collectively. These problems range from highly technical standardization proposals to advertising codes for set manufacturers.

Perhaps RTMA is most effective, however, when it speaks for industry on broad policy issues such as color television, industry mobilization, and legislation directly affecting radio-television manufacturers. RTMA, through the testimony of its President and the work of its engineering committees, assumed an important role in the recent television inquiry of the Federal Communications Commission.

Two years ago RTMA initiated an industry mobilization plan which resulted in the formation of an Electronics Industry Advisory Committee by the Munitions Board and the National Security Resources Board and thus paved the way for a prompt industry response to a substantial increase in military requirements for electronic equipment and parts when the Korean war began. Only recently, in cooperation with the National Security Industrial Association, RTMA established the Joint Electronics Industry committee which will coordinate industry mobilization activities and make itself available in an advisory capacity to top defense officials in Washington.

During World War II the Association, thanks to the unselfish and tireless efforts of many of its officers and members, did an outstanding job for the industry and the Government in expediting the transition from civilian to military production. It did an equally effective job after the war in smoothing out the transition from war to peace through a maze of regulatory controls, shortages, et cetera.

From War into Peace

Since reconversion, RTMA has consistently expanded its services to members and assisted manufacturers in many ways as the industry expanded from radio to radio-television. Its membership has grown with the industry so that today it has 314 members compared with slightly over 100 just before World War II. Brief descriptions of a few of these expanded services and activities will illustrate what I mean.

Weekly Industry Report—This weekly news letter, started toward the end of the War, is a factual, concise presentation of information on Washington developments directly affecting radio-television manufacturers. The report does not compete with the radio trade press, but it promptly provides members with much valuable information not obtainable from any other source.

Industry Statistics—RTMA since the war has greatly expanded its statistical service so that today it covers all segments of the industry and provides members with data that is invaluable in their own planning. These statistics include tabulations on radio and TV set production, sales of TV receivers to dealers by counties, a breakdown of sizes of TV picture tubes sold to manufacturers and to distributors, and sales of transmitting and am-

Engineering Standardization and Planning

The varied constructive activities of the many engineering committees of RTMA operating with RTMA's Engineering Division, under the direction of GE's Dr. W. R. G. Baker, were described and diagrammed in Tele-Tech for March, 1950, pages 24, 25, 26, under the title "How Competitors Cooperate".

Television Manufacturers Assn.

and promotional services for the whole radio-TV industry

plifying and sound equipment. In addition, Parts Division members assemble much valuable information on sales and production of particular components and industry trends.

Engineering Standards—Practically all pre-war RMA engineering standards have been revised or replaced by newer standards during the past few years. The best available engineering talent in the industry is engaged constantly in studies of standards proposals and other activities of great value to the industry in simplifying production techniques and thus reducing manufacturing cost.

Through the cooperation of the Armed Services Electro Standards Agency, the RTMA Engineering Department also has worked out practical procedure by which RTMA members may comment on proposed revisions of JAN specifications for electronic components before they become operative.

"Town Meetings"—The rapid rise of television has brought with it many problems of adjustment and expansion. One of the most acute of these has been the shortage of trained service technicians. Recognizing this situation, RTMA took the initiative and sponsored a series of "Town Meetings" in seven major cities to focus attention on this vital need. Since then the Association has financed the preparation of a score of films for TV broadcasting to make the service technician's job easier. It is now sponsoring, through voluntary subscriptions by set manufacturers, smaller "Town Meetings" in about 60 TV market areas. Those "Town Meetings" are invaluable aids to servicemen and dealers in improving their service and their profits simultaneously, and in building their TV markets.

Radio and Television Week—For the past six years RTMA, in cooperation with the National Association of Broadcasters, has sponsored an annual merchandising program designed to increase set sales. Out of this has come the phenomenally successful "Voice of Democracy" contest for high school students, in which the U. S. Junior Chamber of Commerce and the U. S. Office of Education also participate. Last year this contest drew one million student entries.

Other Promotion Programs—The RTMA Advertising Committee has directed several industry promotion campaigns, other than Radio and Television Week, the most successful of which was the merchandising drive with the slogan "A Radio for Every Room . . . A Radio for Everyone . . . Everywhere". To this was added later "Television for Every Home."

Other RTMA Activities

The RTMA School Equipment Committee, working jointly with the U. S. Office of Education, has published three booklets designed to guide public and private school teachers and executives in the wider use of radio and sound equipment. A recently-organized Phonograph Industry Committee is now campaigning to increase the sales of phonographs in combination with both TV and radio sets.

Industrial Relations—RTMA immediately after the war recognized the important place of industrial relations in modern industry. Its Industrial Relations Committee has held periodic conferences on timely problems and has collected invaluable information on practices in the radio industry. RTMA currently is engaged in conferences with the U. S. Labor Department preparatory to determining a minimum wage for the industry under the Walsh-Healey Act.

The above listings are only the major services which RTMA provides for its members. There are many others, such as collection aids and credit information, that in themselves are often worth the membership dues. There are many RTMA committees, like the Traffic, Service, and Excise Tax Committees, which by reason of their continual efforts save radio-television manufacturers millions of dollars annually.

Leaving aside the practical value of membership in the Radio-Television Manufacturers Association, perhaps the most valuable benefits are the intangible ones. Benefits that come from voluntary association and cooperative efforts with other manufacturers cannot be measured in dollars and cents. Such blending of efforts and thinking by members have important long-range effects on the industry as a whole. Those are the rewards that sometimes may be even more compensating than the practical benefits listed above.

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

Remotely Controlled

Solution to problem of lining up remote-pickup receiving description of a professionally-constructed unit. In use for many

By HUGH D. LaCROSSE, Television Engineering Supervisor
JOHN B. LEDBETTER, Engineer, WKRC-TV, Cincinnati, Ohio

MOST television broadcast stations use remote telecasting of football, baseball, boxing, wrestling, and other sports events as a means of supplementing their regular studio, film, and network presentations. Many of these events require the use of microwave relay equipment. While there are numerous technical problems in a schedule involving a great number of remote microwave pickups, one of the most troublesome and time-consuming is the setting up and adjustment of the microwave relay equipment. Panning adjustments at the relay transmitter are not particularly difficult because this unit ordinarily is set upon the mobile truck or within reasonable distance of the microwave control engineer. The necessary panning adjustments are made at the time the unit is set up and checked through, hence no additional time or manpower is required.

Adjustment of the receiver unit, however, is another matter. In order to establish line-of-sight conditions over the widest possible area, the relay receiver and parabola usually are mounted on the highest practical level of the regular transmitting tower. This solves the problem of obtaining maximum coverage insofar as the receiver location is concerned, but it does not remove the necessity for readjusting the receiving parabola for different remote pickup points. This requires the scheduling of an extra engineer, who must climb the tower prior to each remote pickup and perform the necessary panning adjustments. This not only involves a considerable amount of time for each remote, but under certain conditions may actually become dangerous. At WKRC-TV, the parabola and Klystron of the RCA microwave receiver are located at the 300-foot level of the 560-foot Blaw-Knox tower. In icy or wet weather, climbing the 300-foot steel ladder involves definite hazards, especially during periods of high wind velocity.

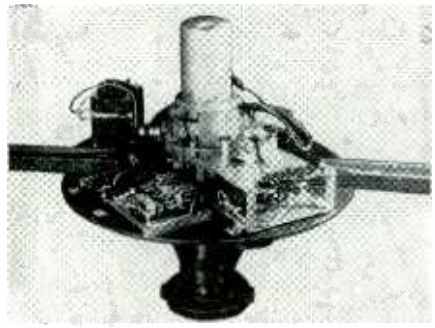


Fig. 1: Mechanical details of rotator base

Fig. 2: Rotator and horizontal drive gear

At the larger stations, this problem usually is overcome through the installation of commercial or custom-built rotator units. Many of the smaller, independently - operated stations, however, still rely on manual operation of the receiver parabola, due in part to the feeling that a practical rotational system would prove too expensive for limited operating budgets.

This paper shows that a remote-controlled rotating system, completely maneuverable from the transmitting console or equipment rack, can be constructed at a very reasonable cost. The complete system will more than pay for itself within a very short time by reducing the regular alignment time to minutes instead of hours. Extreme flexibility in remote programming also is made possible, since the parabola can be directed from one remote pickup point to another in a matter of minutes.

The unit to be described was designed and constructed by Hugh D. LaCrosse, co-author of this paper and TV Engineering Supervisor of WKRC-TV, and has been in use at WKRC-TV for several months. Its design allows panning over a horizontal span of 400 degrees, and a vertical span of 90 degrees.

Driving Motors

Horizontal panning is accomplished in a somewhat unique manner. The horizontal driving motor is a surplus aircraft propeller pitch change motor with a gear reduction ratio of 9576 to 1. Since this motor is anchored to the rotator frame and the shaft coupled directly to the rotator base, the motor shaft remains stationary while the motor revolves with the rotator. Vertical panning is controlled with a similar motor mounted on the side of the rotator frame. Operation of this unit is conventional, with the shaft coupled directly to the vertical drive shaft of the parabola. Since these motors were obtained on the surplus market, a third unit was also purchased as a source of spare parts to facilitate future repairs when identical units might no longer be available. The cost of each motor was approximately $20.

The motors originally were designed to operate on the 24-v. d-c supply of an airplane. They will operate satisfactorily on about 18 v. a-c, however, if the following conversion steps are taken: (1) *Remove the rotation stop.* (2) *Remove the brake.* First, remove the dome enclosing the motor and pull out the cotter pin in the end of the shaft. Unscrew the ⅝″ castle nut and pull off the toothed metal wheel. Be sure to shake out the loose washers on the shaft. Complete by soldering a #12 wire jumper across the brake screw solenoid terminals.

Dig the wax out of the four holes and remove the small screw in each. Then pull the wires out of their channels in the gear case. If the motor is labeled "Left Hand", the

Microwave Antenna Orientation

antennas mounted on high transmitter towers is offered in this months, it has reduced time required for scheduling remotes

wire nearest the oil fill plug is the common lead. The two wires closest together are for rotation in each direction. The fourth wire is not used and should be taped. If the label on the side of the gear case reads "Right Hand", the wire nearest the oil fill plug is not used, and the other single wire is the common lead.

Mechanical details and gear arrangement of the rotator assembly are shown in Fig. 1. A close-up of the rotator base and horizontal base and horizontal drive gear is shown in Fig. 2. The large bevel gear shown directly under the base plate in Fig. 2 has no function. It was part of the main drive shaft when purchased and was not removed. The shaft of the horizontal driving motor is anchored directly to it. The main bearing is an alemite fitting, through which the main support shaft passes. This fitting is the only movable element exposed to the elements and hence should be greased occasionally.

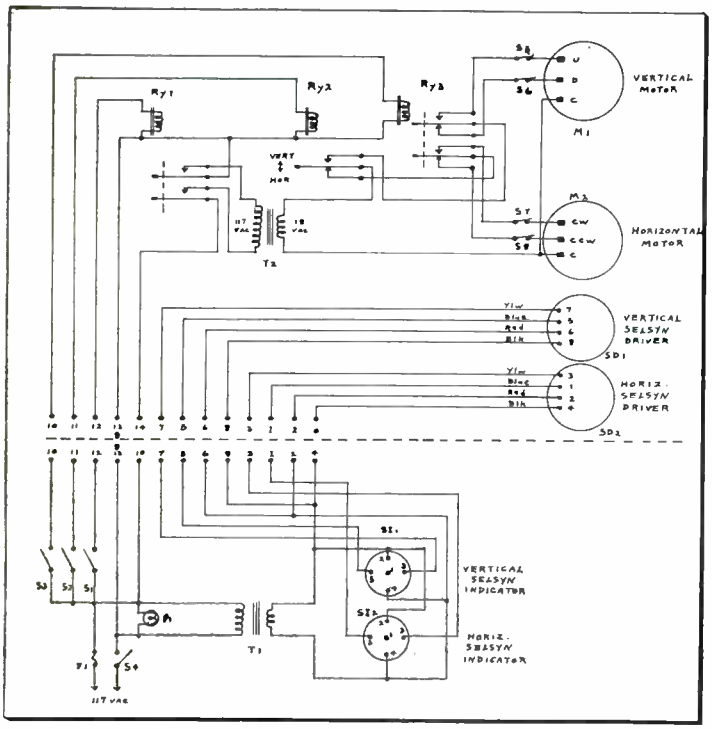
The rotator frame is constructed of 3 x 1½ x ¼ in. channel iron, cut at shown and welded at a local machine shop. The strap iron anchor support (bridging the top of the parabola) helps strengthen the frame assembly and provides a means of securing the top of the rotator frame. As can be seen in the mechanical drawing (Fig. 4), a bushing and anchor flange at the top center of the support allow the entire rotator assembly to rotate freely.

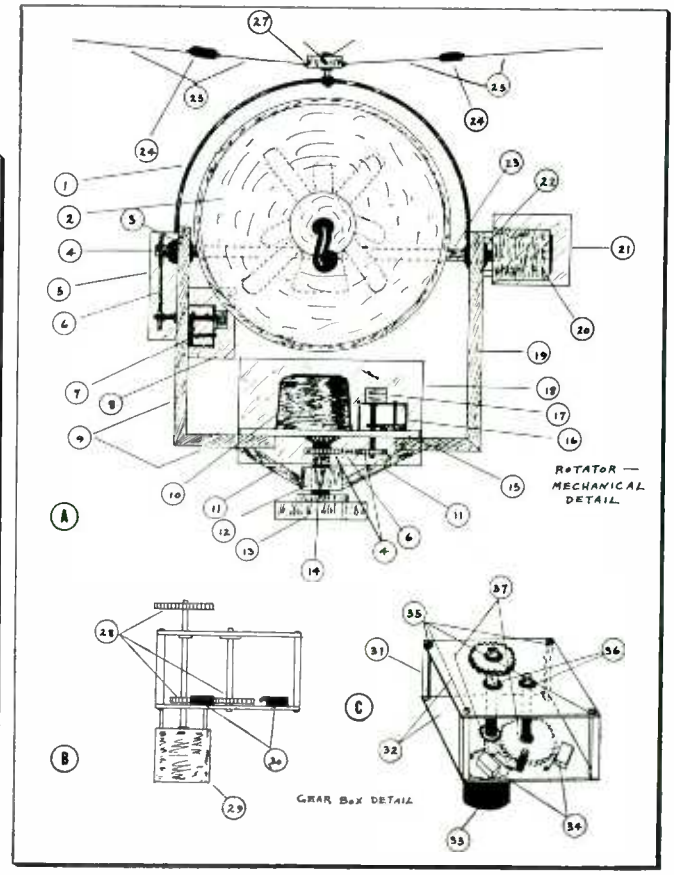
Airplane-type #18 strut wire is run from the anchor flange to each leg of the transmitting tower and kept taut with airplane-type turnbuckles. This prevents undesirable side-play in the rotator assembly and keeps the parabola steady, even in high winds.

The bottom of the channel iron frame is welded to a ⅜" steel plate, which supports the horizontal driving motor, the selsyn gear box assembly, and the main drive bearings. The cable terminal fittings and relays also are mounted on this plate. The two base supports (items 11 and 15 in Fig. 4) are 1" x ¼" strap iron, welded to the channel frame to provide extra strength. The rotator base is an ordinary pipe flange with inside diameter to fit the main drive shaft. It can be of any size, shape, or material so long as it is rugged enough to bear the combined weight of the rotator assembly, microwave receiver and parabola. The portion of the channel iron frame extending from the bottom right half of the rotator frame to the horizontal motor is completely enclosed to form a weatherproof housing for the AC

(*Continued on page* 58)

Fig. 3: (left) Circuit of control and selsyn indicating circuits, section below broken line is control panel wiring. Fig. 4: (right) Mechanical construction details of the rotator and antenna mounting cradle. B and C referred to in text are selsyn transmitters





Front End

Circuit utilizes a matched tion. Subminiature tubes

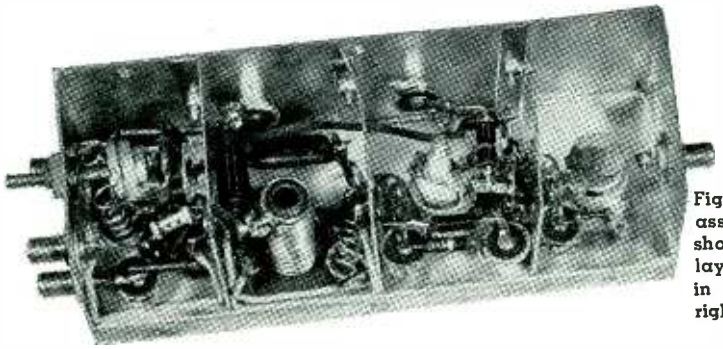


Fig. 4: Underside of assembled chassis showing component layout. Tuners are in two r-f stages at right and local oscillator at left.

By VERNON H. ASKE, Sylvania Electric Products, Inc., Kew Gardens, N. Y.

PART TWO

OF TWO PARTS

The chassis was laid out with 1/32-inch tolerances between most component parts in order to minimize lead length and stray capacitance. The stray capacitance was also kept to a minimum by mounting the coils one-half inch off the chassis. This necessitated submounting the tube sockets with respect to the chassis in order to maintain minimum lead length. The shields were centered over the tube sockets so that feedback could be kept to a minimum. The chassis layout may be seen in Fig. 4.

The conversion transconductance of the mixer tube used was 1200 micromhos with five volts rms applied to the No. 3 grid, and 100 volts on the plate and screen. The cathode resistor is 150 ohms. The plate impedance of this stage consisted of the plate resistance of the tube, a 78,000-ohm resistor simulating the input resistance of a following i-f tube, a shunt type r-f probe and the dynamic impedance of the i-f coil. The Q of the i-f coil loaded with the 78,000-ohm resistor measured 80. The associated capacitance was 29 micromicrofarads. The dynamic resistance of this coil and 78,000-ohm resistor is:

$$R = \frac{Q}{\omega C} = \frac{80}{2\pi\, 30\times10^{6}(29\times10^{-12})}$$

$$= 14{,}600 \text{ ohms}$$

This impedance is paralleled by the shunt-type detector and the plate resistance of the i-f tube. Each of these impedances is approximately 150,000 ohms so the effective plate impedance is 12,200 ohms, and the voltage gain will be 14.6. The i-f bandwidth Δf is $\frac{1}{2}\pi CR_{eff}$, or 0.449 MC. Since this is the narrowest bandwidth of the front end it will be the effective bandwidth of this receiver system.

As noted in the circuit diagram, an inductance is connected from the oscillator grid of the mixer to ground. This coil provides the dc return path of the grid and allows the No. 3 grid to operate at the bias determined by the cathode and thereby decreases transit-time current in the No. 1 grid circuit as well as increasing the gain of the mixer tube by allowing the mixer to operate at a point favorable to high conversion transconductance.

Oscillator Section

A type 5718 tube is used as the oscillator tube with 100 volts on the plate. Measurements have indicated that less than 50 milliwatts are sufficient to drive the No. 3 grid of the type 5636 tube. Since 20 per cent plate efficiency is obtained easily under these conditions at this frequency, the available power will be 400 mw. This gives desirable leeway in using a grid resistor which will limit the current to less than 20 milliamperes. In addition, it allows for lowered efficiency due to the close proximity of components as used in this design.

Capacitive coupling was chosen to couple the oscillator voltage to the mixer tube. This method is very convenient since the bottom plate of the tuner may be used for one plate of the coupling capacitor. The other plate is a half-inch diameter brass plate soldered to the center conductor of a coaxial line. The outer conductor is mounted in the shield so that the spacing between plates may be varied, thus varying the coupling.

The type 5840 tube was operated with 100 volts on the plate and screen, and with a 150-ohm cathode resistor. The output of this tube is coupled to the mixer input with a double-tuned circuit. The construction of this circuit is similar to that of the tuners previously discussed. In order to obtain a proper match between these circuits, the primary of the transformer was mounted on its periphery so that the mutual inductance between the primary and secondary may be varied. It was mounted on the r-f ground side so that loss would not occur in this mounting and to keep the stray capacitance at a minimum. The voltage gain of this stage is[3]:

$$\text{Gain (r-f stage)} = (gm/^{2})(R_pR_s)^{\frac{1}{2}}$$

$$= 5000/2(5000\times437)^{\frac{1}{2}}\times10^{-6} = 3.7$$

in which R_p and R_s are the primary and secondary resistances, respectively.

Since the dynamic resonant impedance of the primary is much greater than that of the other r-f selective circuits, it will determine the effective r-f bandwidth. This bandwidth is $\Delta f(rf) = \frac{1}{2}\pi R_{eff}C$. R_{eff} is one-half of the dynamic resistance of the primary when matched for maximum voltage gain and C is the total primary capacitance consisting of 4.0 micromicrofarads tube capacitance and approximately 0.5 micromicrofarads stray capacitance. Thus, $\Delta f(rf) =$ 14.1 MC.

Input Circuit

The input resistance of the type 5840 tube is matched to the 52-ohm input coaxial line by tapping down on the input coil. The maximum voltage gain under matched conditions is:

$$\text{Gain (r-f input)} = \left(\frac{R_{\text{input type SN-1039A}}}{R_{\text{cable characteristic impedance}}}\right)^{\frac{1}{2}}$$

$$= (437/52)^{\frac{1}{2}} = 2.9$$

From this, the over-all gain of the receiver should be $2.9 \times 3.7 \times 14.6 = 156$.

The measured over-all gain of this receiver was 105. The i-f bandwidth as seen in Fig. 5 is somewhat greater than calculated. Likewise, the r-f bandwidth as seen on Fig. 6

Design for a 400 MC Receiver

single-tuned input that features new type construc- and new miniature tuned circuits employed throughout

is greater than calculated. This bandwidth was observed at 355 MC since the receiver tuned most efficiently at this frequency. The image response was down about 24 db from the signal response. Since the bandwidth was greater than calculated, the measured voltage gain will be correspondingly less. In addition, the mixer gain was somewhat lower than calculated even at the measured bandwidth.

Mixer Design

Further examination of the mixer circuit showed that the calculated gain could be obtained with care in circuit design. In general, the circuit should be designed so that little coupling occurs between the oscillator grid and the signal and plate circuits of the mixer. This can be obtained best by using approximately 50 micromicrofarads screen by-pass capacitor (button type) with very short leads. This series resonated in part with the screen-load inductance and thus tends to bring it closer to ground. Failure to do this will result in reduced gain since some of the oscillator power will be coupled to the No. 1 grid circuit, thereby reducing the No. 3 grid drive. In addition, the oscillator voltage on the No. 1 grid may alter the tube characteristics appreciable, especially if grid current results. Reduction of the oscillator power dissipated in the plate circuit may be obtained by using a button type capacitor of approximately 20 micromicrofarads, and short leads to the plate circuit.

Very similar results were obtained with the other units. The unit using a type 6AK5 as the r-f tube, a type 6AS6 as mixer, and a type 6J6 as the oscillator, had slightly less gain. The reduced gain may have been due to circuit differences only, since these miniature tubes have characteristics similar to those of the subminiature tubes that were used in the unit which has been described.

Especial care was exercised in the use of by-pass capacitors in the r-f section of all units. These capacitors and their associated leads may display resonance within the r-f band, which could result in unsymmetrical r-f response.

Conclusions

In general, the receiver satisfied the initial objective from the standpoint of performance. For the narrow bandwidth considered, the r-f tubes did not rigorously meet the requirements due to their large bandwidth when compared with that of the i.f. This excess bandwidth is of no utility. If tubes were available which would permit obtaining a narrow bandwidth, the gain could be increased considerably. This would be very desirable both from the standpoint of noise and gain. Possible further improvement could be achieved by improving the Q of the tuned circuit and by improving the plate resistance of the tube. Improved tube design would mean reducing the output capacitance or increasing the high-frequency plate resistance or both.

The units discussed served to show that tubes have been developed which have utility beyond 400 MC. The r-f tube has a voltage gain at 400 MC of approximately 3.5 when matched to an impedance equivalent to its input resistance at that frequency. The mixer tube satisfied requirements to a marked degree.

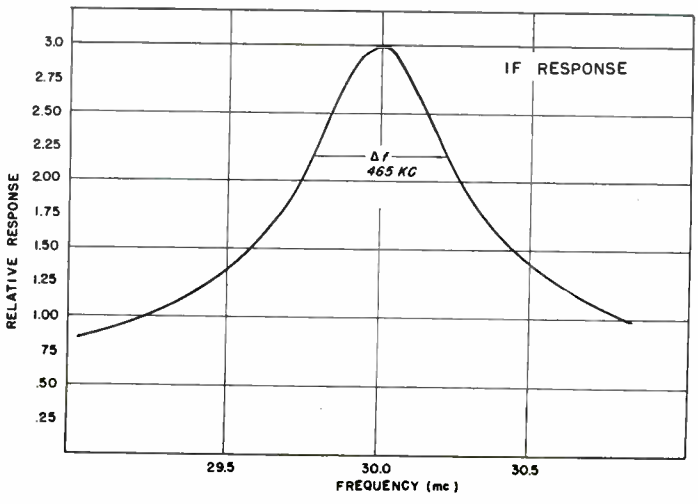
[3] W. R. Ferris, "Some Notes on Coupled Circuits", **R.C.A. Review**, Oct., 1940; p. 226.

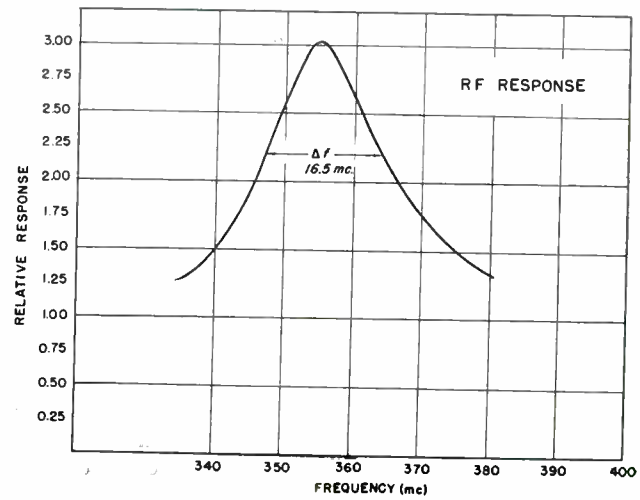
Appendix I

Tentative Characteristics of type 5718 Tubes	
Heater Voltage	6.3 volts
Heater Current	150 milliamperes
Plate Voltage	100 volts
Cathode Bias Resistor	150 ohms
Transconductance	5800 micromhos
Plate Resistance	4650 ohms
Amplification factor	27

Fig. 5: (Left) Curve showing I-F response with constant input voltage. A scale convenient for measurement was used on the ordinate axis

Fig. 6: (Right) Curve showing r-f response with constant input voltage. A scale convenient for measurement was used on ordinate axis





Ferrite-Core Yoke for

Design and construction details of newly picture tubes with up to 70° deflection

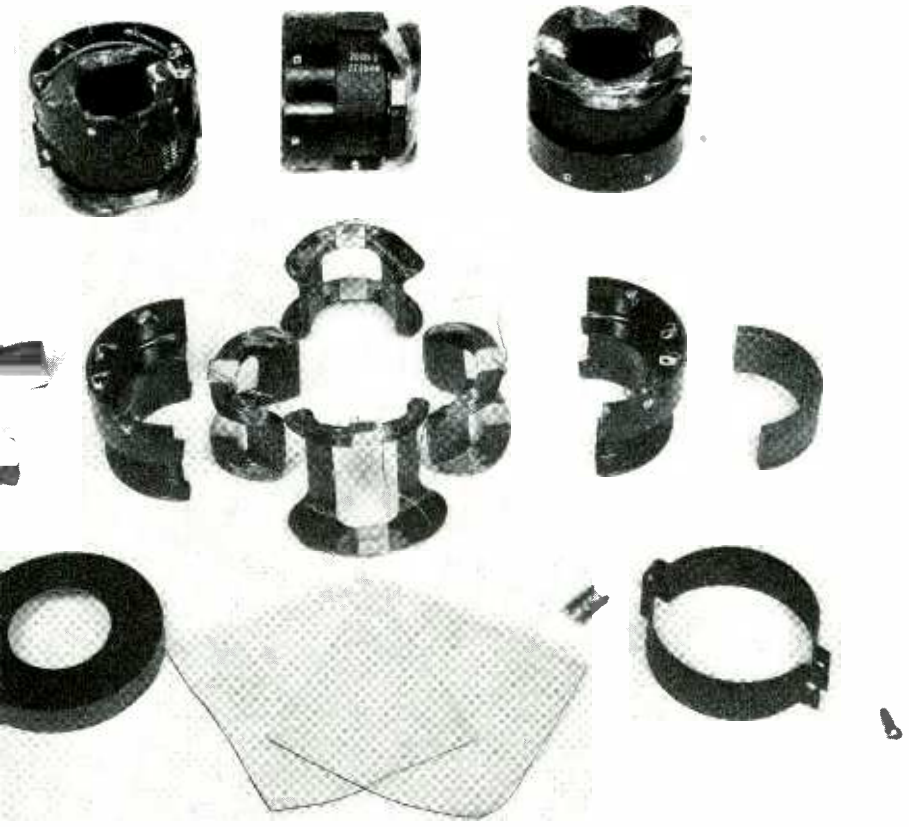


Fig. 1: Photograph showing the assembled and disassembled views of the type 206D1 yoke

By M. J. OBERT and W. A. NEEDS
Tube Dept., Radio Corporation of America, Camden, N. J.

PUBLIC demand for larger, directly viewed television pictures at lower cost resulted in the development of the new, wide-angle kinescopes (up to 70°) used in many 1950 model receivers. As a result of improvements in kinescope design, and the availability of efficient circuit components for the deflection of kinescopes having deflection angles of 70°, the new large screen kinescopes are short enough to mount in a chassis with reduced depth, resulting in lower-cost cabinets and more attractive designs.

The RCA Type 206D1 deflecting yoke was designed for use with kinescopes having deflection angles up to 70° and requiring anode voltages up to 14 KV. The inductance and insulation characteristics of the yoke are designed for use in the auto-transformer type of deflection circuit having improved efficiency. Similar yokes having horizontal deflection windings with higher inductance and increased insulation between horizontal and vertical coils are made with the same tools for use in direct-drive circuits. Fig. 1 shows assembled and disassembled views of the yoke.

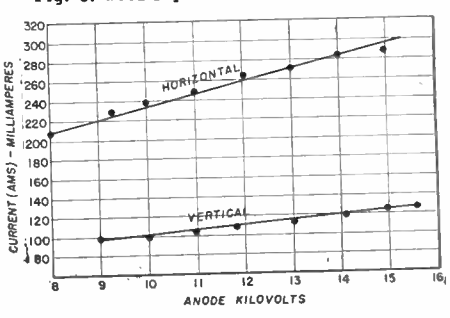
The coils of the ferrite-core yoke 206D1 are designed to produce a magnetic deflecting field across the cone end of the kinescope neck to provide the required raster for the 16GP4 kinescope. On this kinescope, which has a face plate with a radius of curvature of approximately 40 in., the normal raster will be straight at the top and bottom, with approximately ¼% pincushion on each side. If the yoke is used on a wide-angle kinescope with a face plate having a radius of curvature of 26 in., the raster will be slightly barrelled.

Maximum deflection sensitivity for yoke coils of the shape shown in Fig. 2 is obtained when the coils are snug on the kinescope neck and are as long as practicable. With reference to Fig. 2, the approximate length of the horizontal coil of this yoke is determined by the geometry of the kinescope and the yoke structures, and can be calculated from the following relation: $l = r/\tan \theta$, where $\theta = 90° - (180° - 35°)/2 = 17.5°$ and r = clearance radius at yoke neck. l therefore approximates 1⅞-in.

Final determination of the coil length was made by experiment on a kinescope having approximately "limit" characteristics. Some allowance was made for the effect of tilting the focusing coil to obtain centering of the pattern, and for kinescope and yoke production tolerances. The result is a length between the inside surfaces of the turned-up ends of the horizontal deflecting coils of 1.683 in.

An increase in this effective length would produce a "beam-strikes-neck" effect with some kinescopes, and a resulting shadow in the pattern corners. When used

Fig. 3: 206D1 yoke current requirements



Wide Deflection Angle Kinescopes

developed yoke assembly for use with angles; and up to 14 KV anode voltage

with an average kinescope, the yoke may be pulled back 5/32 in. from its maximum forward position before this effect occurs.

Power required for horizontal deflection is greater than that required for vertical deflection because of the higher scanning frequency and, in most cases, the larger scanned dimension. The horizontal deflecting coils are, therefore, made to maximum length, with the necessarily shorter vertical coils fitted inside the horizontal coils.

Newly developed deflection systems of improved efficiency require deflecting yokes having a horizontal-coil inductance of approximately 8 to 30 millihenries, with the coils connected in series. Vertical-deflection-output transformers of small size and low cost (RCA Type 222T1) match the impedance of the yoke vertical coils. The current required in the 206D1 yoke for full deflection of the 16GP4 with different values of anode voltage is shown in Fig. 3. Wire sizes which keep current density well within safe limits are used.

The following tabulation gives the ampere turns, wire size, and current density of the coils of the 206D1 yoke:

	Horizontal	Vertical
Required *Ampere (RMS)—Turns	105	93.6
Wire Size	#26 Quad. Formvar	#29 Heavy Formvar
Coil Current Density—Amperes (RMS) per square inch	1465	1140

*For full scan on 16GP4 kinescope operated with an anode voltage of 13 kilovolts and having a 4:3 aspect ratio.

The procedure developed for winding and forming these coils is usable in production with A.W.G. wire sizes from #23 to #30 on the vertical coils, and from #25 to #30 on the horizontal deflection coils. The use of wire sizes outside of these ranges may result in loss in production due to difficulties in winding or in forming the coils.

NEMA standards for vinyl-acetal-insulated round copper magnet wire, (Oct. 29, 1943), include detailed specifications for wire of the type used in the 206D1. These standards were adhered to in the development of this yoke. Quadruple coatings used on the horizontal coils, and single or heavy coatings used on the vertical coils have the characteristics required, provided turns are kept in their approximately correct position during winding. Maximum rated operating peak pulse voltages across each coil is 1250 volts for each horizontal coil, and 400 volts for each vertical coil.

The material used as insulation

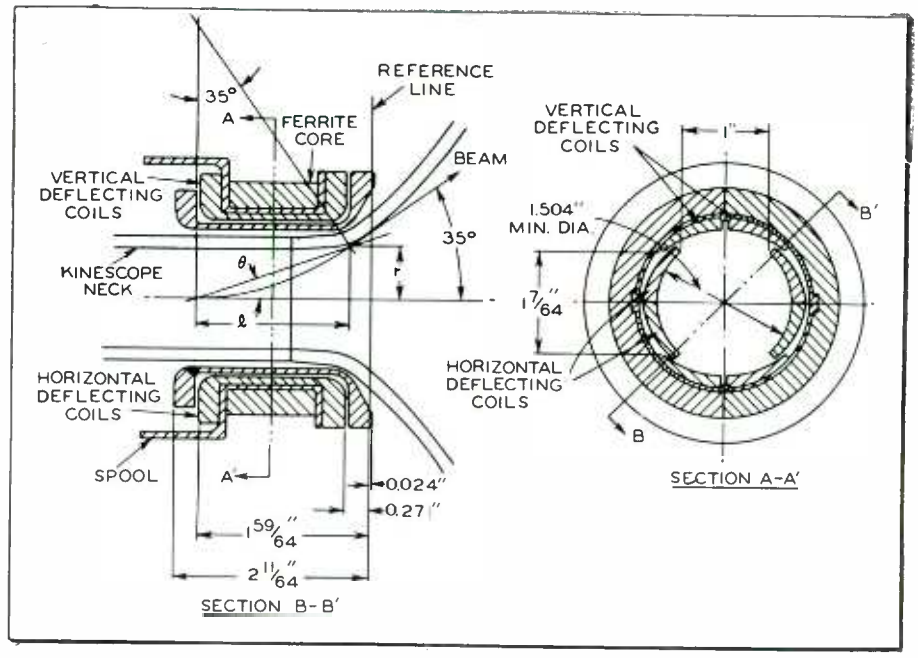


Fig. 2: Diagram providing a cross-sectional view of the yoke coil assembly

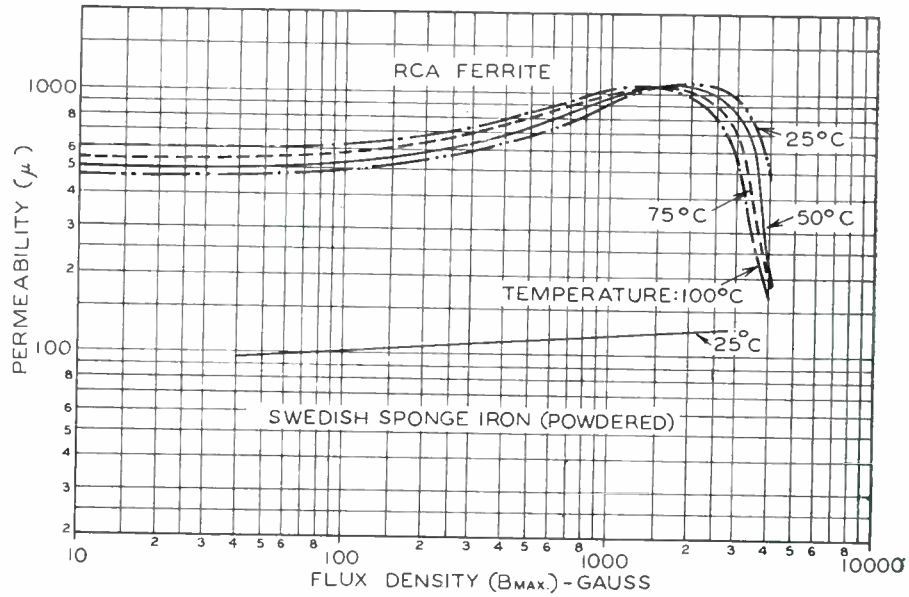


Fig. 4: Curves showing variation of permeability with flux density and temperature

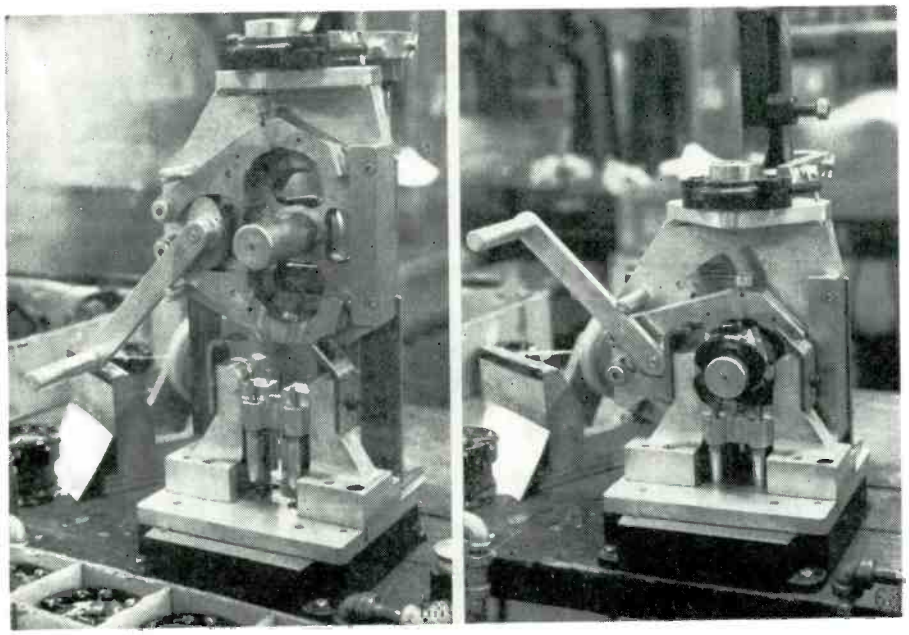


Fig. 5: (Left) Coil assembly fixture open and (Right) coil assembly fixture closed

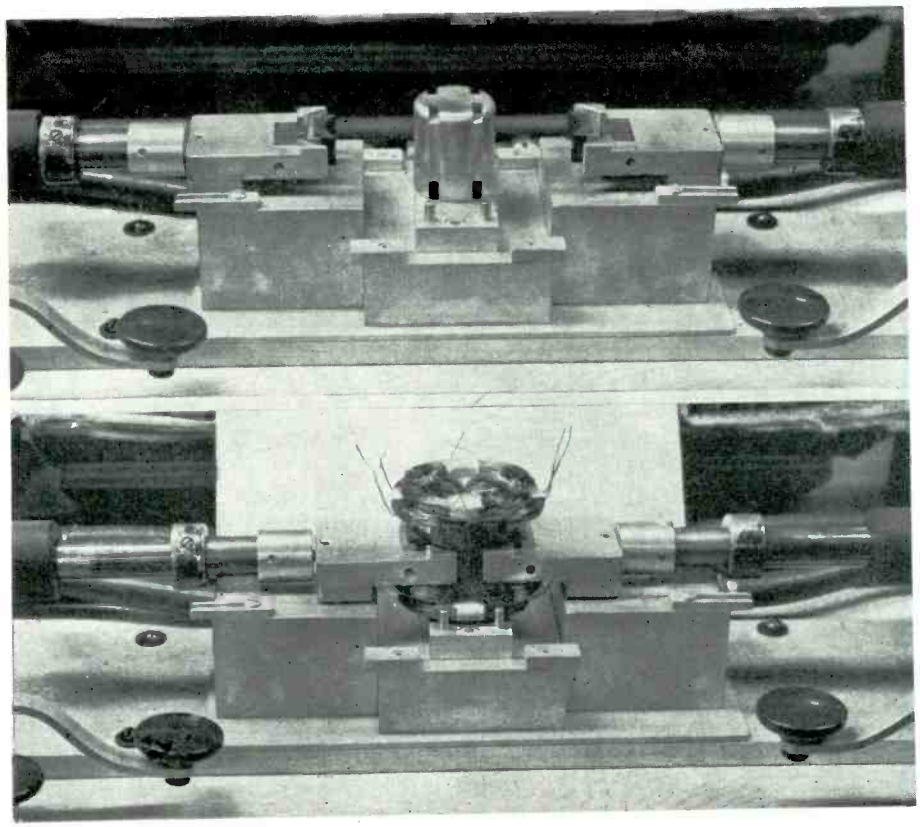


Fig. 6: (Above) Final assembly fixture open; (Below) final assembly fixture closed

between horizontal and vertical coils must withstand both low and high temperatures to retain its insulation properties. It must be tough and pliable to meet the requirements of mechanized assembly, and have adequate dielectric strength and moisture resistance.

Oriented polyvinylidene chloride film, (Saran Type M, Dow Chemical Co.), in multiple thicknesses of 0.0022″ was chosen for the design of the first post-war yoke. Since then, it has consistently met requirements for insulation between yoke coils. Its chemical resistance is excellent, and it permits the use of solvent-bearing adhesives when necessary, with no damage to the insulation. Multiple thicknesses are used to provide a large factor of safety in voltage insulation. Any one complete film, undamaged, will withstand a voltage of 2500 volts RMS at 60 cps (hipot test). This material does not become brittle, materially change in characteristics, or support combustion.

Core Design Features

The need for improved deflection sensitivity in this wide-angle yoke made it desirable to use high-permeability, low-loss magnetic material for the core. The final core design used ferromagnetic ferrite material formed approximately in the shape of two semi-circular "C" 's, (Fig. 1) which are assembled closely around the insulated case covering the yoke coils.

The core was designed in two segments for low cost and high efficiency. The two necessary joints in the core structure are positioned at the center section of the vertical coils, since vertical deflection is less difficult to obtain than horizontal deflection.

The amount of core material was chosen to provide the highest deflection sensitivity with a low yoke cost. Concentricity of the core and coils is required for a rectangular pattern. Because the ferrite used has mechanical characteristics similar to those of a ceramic, being hard and brittle, it was anticipated that some cores would crack at the keyway during assembly. Performance well within specifications is also obtained from yokes having cores made of three or four pieces. The small additional gaps in the core have relatively little effect on the magnetic circuit because of the greater effect of the large gap in the flux path across the middle section of the yoke.

At the low flux density (below 100 gausses) at which the 206D1 yoke is operated, ferrite permeability is relatively stable. Careful observation of the performance of a receiver during heat runs in which a bar generator was used to check horizontal and vertical linearity, indicated no appreciable performance changes at temperatures from 25°C to 85°C. Fig. 4 shows the variation of permeability with temperature for the type of RCA ferrite used in this yoke. This ferrite has higher permeability and lower core loss than powdered iron, with resulting increased deflecting yoke sensitivity.

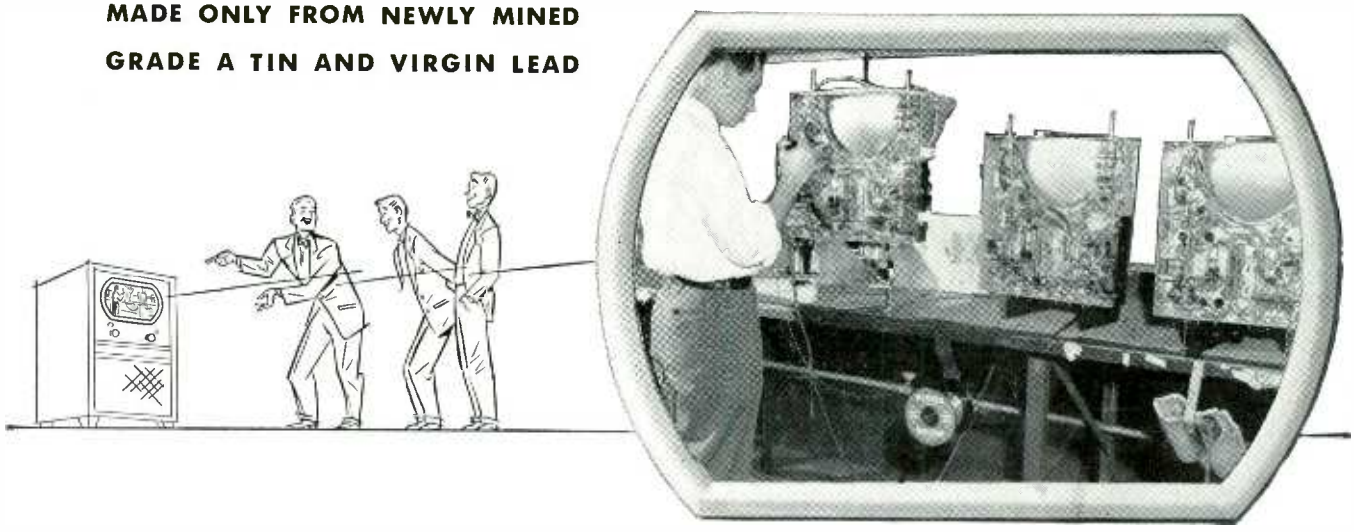
(*Continued on page 66*)

KESTER SOLDER

Build more quality into your TV sets with Kester "Resin-Five" Core Solder

TV—the nation's fastest growing business demands the nation's number 1 solder. Kester "Resin-Five" Core Solder, formulated especially for TV, will out perform any solder of the rosin-core type. It easily solders such metals as brass, zinc, nickel-plate, copper, and ferrous alloys.

MADE ONLY FROM NEWLY MINED GRADE A TIN AND VIRGIN LEAD



'Resin-Five' Core Solder

non-corrosive • • • non-conductive

"Resin-Five" flux is more active and stable than any other rosin-type flux. Yet it is absolutely non-corrosive and non-conductive.

FREE TECHNICAL MANUAL—*Send for Your Copy of—SOLDER and Soldering Technique.*

Kester Solder Company
4210 Wrightwood Avenue • Chicago 39, Illinois
Newark, New Jersey • Brantford, Canada

Kester...Standard for the TV and Radio Fields

Kester "Resin-Five" Core Solder, which is available in the usual single-core type, can now also be had in a 3-core form.

WASHINGTON
News Letter

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

DEFENSE IMPACT ON TELEVISION—Outlook of the impact on the nation's television manufacturing field may be authoritatively forecast as follows: Inroads on television-receiver production not until late this year; the peak of the impact on TV production will not come until late summer and fall of 1951 when entire $1.5 billion and probably up to $2.4 billion (with the added $900 million being future delivery equipment) will be in production; some components even in short supply such as capacitators, resistors, transformers and particularly certain categories of tubes, including some cathode types. Shortages of critical components hitting television production will come late this year and will pick up in impact during next winter, spring and early summer. Aircraft and tank electronics-radio equipment to be installed during 1952 is expected to make up almost one billion dollars worth of procurement slated for future delivery.

COLOR TELEVISION—Even though FCC leadership and Chairman Johnson of the Senate Interstate and Foreign Commerce Committee had properly desired the speediest determination possible for the troublesome color-television issue, realistically with the international situation and the fact of large military electronics-radio procurement requirements, the Commission's decision and color television itself can hardly be started on its road toward implementation as a public service. The manufacturers and the television broadcasters themselves cannot embark on any wide-scale color television program with the national defense as the No. 1 task of the country.

CONTINUE "FREEZE" INDEFINITELY?—In addition, the national defense preparedness calls upon the electronic-radio manufacturing industry are such that it also seems most likely that the FCC will have to continue the black-and-white television station construction "freeze" indefinitely. Or, even, if it were lifted, it would be rather academic in any great stimulus of television station growth except where equipment had already been ordered. In connection with color television, the existing systems might well be greatly changed with new developments and improvements in the next few years while the international-war tension prevails. Changes come rapidly as was already proved by the new Color Television Inc. development of its new Uniplex system submitted to the FCC on the eve of its decision.

GEN. HARRISON HEADS PRIORITIES—An outstanding figure in the communications-electronics industry who is thoroughly familiar by his World War II service through his direction of the Army Signal Corps' huge (approximately $7 billion) procurement program, Major General William H. Harrison, president of the International Telephone and Telegraph Corp. and former vice president—operations and engineering of the American Telephone and Telegraph Co., has taken the helm of the new Defense Production Administration which is handling the priorities and allocations of critical materials control under the Department of Commerce. Because of his thorough familiarity with the radio manufacturing industry both in his wartime service and in the past two years in directing two major I. T. & T. affiliates, Federal Telephone and Radio and Capehart-Farnsworth Corp., General Harrison will be certain to render decisions on the allocations of critical materials to civilian radio, television and electronics production which will be entirely sound and in conformity with the national defense needs. In addition, General Harrison has a close personal acquaintanceship with the leaders of the electronic-radio industry.

MOBILE RADIO SERVICES GROWING—Because frequencies above 50 megacycles have the characteristics of short range distance and due to the vital role of most mobile radio services in civilian defense and in the operation of industries important to the military economy, the concensus is that the mobile radio equipment manufacturing operations and the use of mobile radio services will not be disturbed to any great extent by the war picture. In fact, one highly important mobile radio field—Railroad Radio is slated to expand substantially in the next year or two and the blueprints for the future expansion and use of radio by the railroads will be described at the annual convention of the Communications Section of the Association of American Railroads at French Lick Springs, Ind., Oct. 17-19.

INDUSTRIAL MOBILE RADIO — Another field which promises large expansion is Special Industrial Radio, and the FCC staff is now revising its proposed rules to remove the limitation of power and the ban against operation of this service's mobile units in cities and communities. The Commission got an excellent education in what a valuable service was the Special Industrial Radio when it received protests about its proposed rules from scores of companies, ranging from the Hawaiian pineapple and sugar associations, to industries vital to the petroleum, steel, construction industries and huge livestock ranching enterprises.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

Television camera with the eyes of a cat!

Why an image orthicon camera can see with only the light of a match

No. 9 in a series outlining high points in television history

Photos from the historical collection of RCA

Although dramatic action, *in television plays, is often presented in the dimmest light – no detail is missed by the RCA image orthicon camera.*

• Show any camera fan the things a television camera is asked to do, and you'll leave him gasping!

Accustomed to using flash bulbs and floodlights—or taking time exposures in dim light—the still photographer is tied to the limitations of lens ratings and film speed. But a television cameraman operating the RCA image orthicon camera gets sharp, clear pictures—*in motion*—in places where lack of light would *paralyze* the most costly "still" camera.

The secret, of course, is that the picture signals created within the RCA image orthicon camera can be intensified millions of times for transmission.

Youthful ancestor of this supersensitive instrument is the *iconoscope tube* invented by Dr. V. K. Zworykin, of RCA Laboratories. It was television's first all-electronic "eye"—without any moving parts, presenting no mechanical problems.

Here, in a testing battery *at RCA Tube Plant in Lancaster, Pa., RCA image orthicon pick-up tubes get the final seal of approval from an engineer.*

Basing their research on principles uncovered by Dr. Zworykin's iconoscope, RCA scientists were then able to develop the image orthicon pick-up tube. Although simple to operate, and virtually fool-proof, it is actually one of the most complex and compact electronic devices ever developed.

Within its slim length—not much bigger than a flashlight—are the essentials of three tubes, a phototube, a cathode ray tube, an electron multiplier. The phototube converts a light image into an electron image, which is electrically transferred to a target and scanned by an electron beam to create a radio signal. The electron multiplier then takes the signal and greatly amplifies its strength so that it may travel over circuits leading to the broadcast transmitter.

Inside the image orthicon tube, more than 200 parts are meticulously assembled. There's a glass plate thinner than a soap bubble . . . a copper mesh pierced with 250,000 tiny holes to the square inch. A piece of polished nickel pierced with a hole so small you couldn't thread it with a human hair!

The image orthicon television camera, as it has been developed by scientists at RCA Laboratories, is now 100 to 1000 times as sensitive as its parent—the iconoscope . . . and in the dark, sees almost as clearly as the keenest eyed cat!

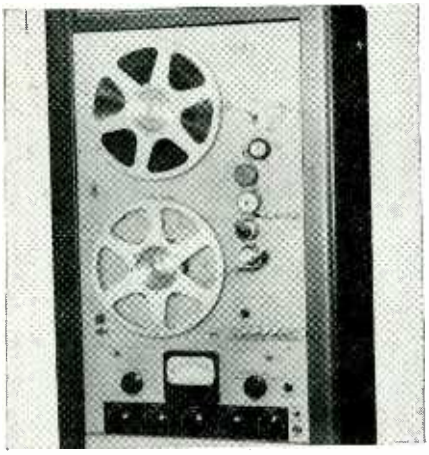
Radio Corporation of America
WORLD LEADER IN RADIO—FIRST IN TELEVISION

NEW EQUIPMENT for Designers and Engineers

To be displayed at the Audio Fair, October 26-28, Hotel New Yorker, New York City

Tape Recorder

A three-motor drive system is used on the RC-10 tape recorder. Two of these motors are of the "torque" type and drive the reels



directly with no mechanical reduction or slipping devices. The third motor is the capstan motor. The RC-10 takes either the 7 in. RMA reel or the standard NAB hub with 10½ in. flanges. The speeds normally provided are 7½ and 15 in./sec. The Presto RC-10 actually is manufactured in two forms designated as RC-10-14 and RC-10-24. The former is constructed on a 19 x 14 in. panel and may be either rack mounted or installed in a carrying case or in a console. Its selector switch is a combination rotary electrical switch and mechanical cam, the latter actuating the capstan pressure pulley. The RC-10-24 is constructed on a 19 x 24½ in. panel and, although it may be mounted in any manner, it is primarily intended for rack installation. This unit does not have the rotary type selector switch but is completely push-button controlled with a solenoid actuating the capstan pressure pulley. With this arrangement the push-button switch may be paralleled with relays and the whole unit operated by remote control.—**Presto Recording Corp., P. O. Box 500, Hackensack, N. J.**—TELE-TECH.

Laboratory Amplifier

An improved Dynaural noise suppressor virtually eliminates record surface noise on the 210-B laboratory amplifier without affecting

musical highs or overtones. Output is rated at 20 watts, in the 12 to 22,000 cycle frequency range. Harmonic distortion is less than half of 1% at 20 watt output. Difference-tone intermodulation distortion less than 1/10 of 1% at 20 watt output. Maximum bass boost is 32 db at 30 cycles, in addition to preamplifier bass compensation. Maximum treble boost is 23 db at 15,000 cycles. Hum level is 80 db below full output at maximum loudness setting, 84 db below full output at low loudness setting. Adjustable filter control limits range when input signal is distorted. Individual bass and treble controls are calibrated to allow compensation for different turnover characteristics and varying degrees of pre-emphasis. Special automatic loudness control maintains constant apparent quality at all volume levels without causing boominess on speech.—**Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge, Mass.**—TELE-TECH

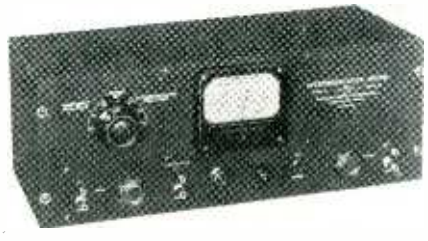
Magnetic Tape Recorder

The model 400 magnetic tape recorder includes simultaneous erase, record and playback. Its performance permits very sub-

stantial savings in tape requirements with no lowering of program quality. Over two hours (132 minutes) of program material can be recorded on a single ten-inch standard reel. Model 400 is supplied with a single portable case weighing approximately sixty-two pounds. It is also available in console cabinets and for standard rack mounting. Other features include three magnetic heads shielded in a single housing, a built-in VU meter, and a single control switch for fast forward, fast rewind, and record. The machine also provides fifteen inch per second tape speeds by simply turning a switch. At 7½ i.p.s. flutter and wow is less than one-quarter of one percent; frequency response is plus or minus 4 db, 30 to 15,000 cycles. At 15 i.p.s. flutter and wow is less than one-fifth of one percent; frequency response is plus or minus 2 db., 50 to 15,000 cycles.—**Ampex Electric Corp., San Carlos, Calif.**—TELE-TECH

Intermodulation Meter

Development of a compact, completely self-contained intermodulation meter has been completed. Known as model 31, it consists



of two principal sections, a test signal generator and an analyzer. A built-in supply provides power for both units. The generator section produces two sinusoidal voltages, one a low frequency and the other a high frequency, which are mixed in a 4/1 voltage ratio and applied to the apparatus under test. The signal from the equipment being tested is then received by the analyzer section of the model 31 to be filtered, amplified, demodulated and metered. The meter is direct-reading in percentage of intermodulation and input volts. This instrument is extremely useful for evaluating the performance of audio systems; for the correct adjustment and maintenance of AM and FM receivers and transmitters; for checking linearity of film and disc recordings and reproductions; for checking phonograph pickups and recording styli; for adjusting bias in tape recordings; for quality control of all audio components and equipment and many other applications. The Model 31 is 8" high x 19" wide x 9" deep and may be mounted in a standard 19" relay rack. —**Measurements Corp., Boonton, N. J.**—TELE-TECH

Magnetic Tape Recorder

Model 1401 magnetic tape recorder has equalization characteristics which conform to NAB recommended standards. Extended fre-

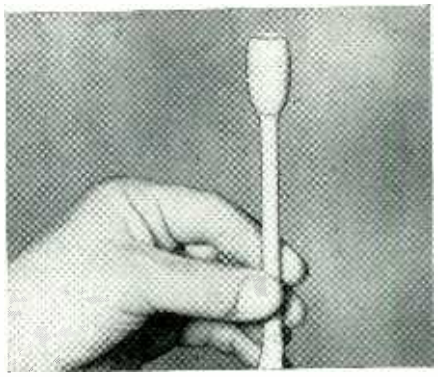
quency response is —40 to 15,000 c.p.s. ± 2 db. and tape noise is down to random level. More powerful drive motor is provided as well as an improved braking system. It monitors directly from tape while recording and plays up to 10-½" NAB reels.—**Berlant Associates, 4917 West Jefferson Blvd., Los Angeles 16, Calif.**—TELE-TECH

Intermodulation Meter

A redesign of the model 166 intermodulation meter has made it possible to manufacture the unit at a lower cost than meter which are presently available, without loss of accuracy. It has provisions for adjustable table test frequency, adjustable ratio of the two test voltages, and adjustable meter sensitivity. This is said to be the first commercial meter capable of working at 400 cps, the best low frequency for disc reproducer testing. Panel is notched for rackmounting.—**Audio Instrument Co., 133 West 14th St., New York 11, N. Y.**—TELE-TECH.

Microphone

A group of three microphone systems has been developed for swivel, stand and lapel applications. Each system uses heads of ex-



tremely small size. Essentially non-directional throughout the entire audio range, these Tru-Sonic microphones utilize the advantages of the condenser-type diaphragm. All auxiliary equipment can be used up to 400 ft. away from the head and connection is by a small (5/32 in. diameter) standard single conductor microphone cable carrying no high currents and voltages to feed critical low level circuits.—**Stephens Manufacturing Corp., 8538 Warner Drive., Culver City, Calif.**—TELE-TECH.

Military Contract Awards

Manufacturers who have received contract awards for producing of radio - radar - electronic equipment for the Armed Services are listed below by name, city, equipment and amount of contract. Subcontractors interested in bidding on performance of any part of each contract should sell their services to these prime contractors. The list is current for each month up to our press time.

Burgess Battery Co., Freeport, Ill., Batteries, $736,517.

Conn. Telephone & Electric Co., Meriden, Conn., Test Set, $376,738; Telephone System, $2,544,000.; Crosley Div., AVCO Mfg. Co., Cincinnati, Ohio, Rack Assembly, $1,143,000.

The Daven Co., Newark, N. J., Tube Tester, $234,825; Signal Generator, $243,839.

Eicor, Inc., Chicago, Ill., Inverters, $70,269; Alternators, $252,900.; Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., Amplifier, $312,760.; Espey Mfg. Co., New York, N. Y., Radio Relay Set, $726,909; Radio Terminal Sets, $1,734,569.

Federal Telephone & Radio Corp., Clifton, N. J., Radio Set $250,000; Radio Set, $3,000,000.

Garod Radio Corp., Brooklyn, N. Y., Control Equipment, $548,189.; General Electric Co., Schenectady, N. Y., Test Unit, $42,086; General Electric Co., Syracuse, N. Y., Detector Set, $2,019,577.

Hallicrafters Co., Chicago, Ill., Radio Sets, $2,206,092.; Hammarlund Mfg. Co., New York, N. Y., Radio Receiver, $100,000; Hubbell & Miller, Brooklyn, N. Y., Sound Locating Set, $530,743; Services & Materials to repair set, $1,349,913; Sound Locating Set, $29,-650.

Kelley-Koett Mfg. Co., Covington, Ky., Radiac Training Set, $29,317; Kollsman Instrument Co., Elmhurst, L. I., N. Y., Indicators, $536,524.

Lavoie Laboratories, Morganville, N. J., Oscilloscope & maintenance spare parts, $195,525.; Lear, Inc., Grand Rapids, Mich., Rip Tank Fuel Pump, $83,547; Actuators for Aircraft, $35,820.; Leland Electric Co., Dayton, Ohio, Inverters, $115,140.; Lewyt Corp., Brooklyn, N. Y., Mounting, Power Supply, Receivers, Amplifiers, Rectifiers, $12,527,137; Radio Set $200,-000.

Manufacturers Battery Co., Madison, Wisc., Batteries, $1,550,000.; W. L. Maxson Corp., New York, N. Y., Servo Unit Assembly for Aviation, $799,539.; Molded Insulation Co., Philadelphia, Pa., Radiosonde Transmitter, $67,000.; Motorola, Inc., Chicago, Ill., Receivers, $951,737.

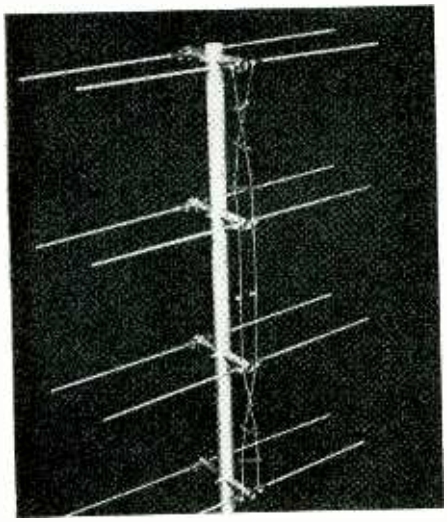
National Carbon Co., New York, N. Y., Batteries, $4,113,615.; National Union Radio Corp., Orange, N. J., Tubes, $160,497.

Radio Corp. of America, Camden, N. J., Radio Set, $270,000; Electron Tubes, $38,644.; Radio Receptor Co., Brooklyn, N. Y., Amplifier Assembly Antenna Tuning Unit, $159,102.; Rauland Borg Corp., Chicago, Ill., Power Supply, $3,196,635.; Raytheon Mfg. Co., Waltham, Mass., Tubes, $3,529,841; Capacitor Assembly & Power Transformer, $27,446.

(*Continued on page* 55)

UHF Antenna

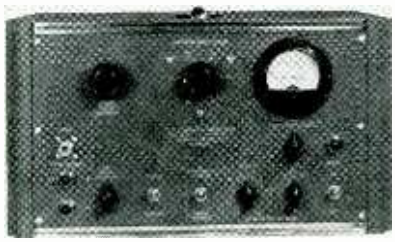
A new experimental model X-UHF antenna is claimed to have obtained excellent reception in fringe areas where other experimental ul-



tra-high frequencl antennas failed. Tests have been made on reception from the experimental NBC station KC2XAK (Stratford, Conn.) which operates on 529-535 MC. The X-UHF is a miniature version of the Vee-D-X RD-13A Super which holds every long distance TV reception record on present channels. It is a four-bay stacked array. This antenna is available on special order for experimental work.—**LaPointe Plascomold Corp., Unionville, Conn.**

UHF Impulse Generator

Model IG-102 UHF impulse generator produces a spectrum, flat within $\pm 1_2$ db, over its entire range from 10 KC to 1000 MC, cor-



responding to a pulse width of less than 0.001 μsec. Output is 70,000 μv/MC, adjustable over a 60 db range by means of a continuously variable 10 db attenuator and a resistive step attenuator. Pulse polarity is indicated on the front panel and automatically reverses every 10 sec. Continuously adjustable repetition rate from 2.5 to 2500 cps is provided. In addition, single impulses may be obtained by manual keying. This unit may be used for studying transient phenomena, ignition noise, switch and relay noise, alignment of receivers and band width determination. **Empire Devices, Inc., 38-25 Bell Blvd., Bayside, N. Y.**—TELE-TECH

Television Calibrator

The facilities of six important instruments for the accurate calibration of television receivers are provided in a new single compact, portable unit. Known as the WR-39B, the new instrument contains: a crystal-cali-

brated TV marker generator with dual markers for all TV frequencies; a bar pattern generator for making linearity adjustments; a miniature re-broadcast transmitter for checking all 12 TV channels; a heterodyne frequency meter including amplifier and speaker; a signal generator operating on fundamentals in all TV bands; and a dual crystal standard with three crystals supplied. All standard television and FM frequencies are generated with crystal accuracy. Since the output frequency is derived from fundamental-frequency oscillator operation over the entire range of the instrument, troubles from spurious responses and interactions which prevent accurate alignment of TV sets are eliminated. —**Radio Corporation of America, RCA Victor Div., Camden, N. J.**—TELE-TECH

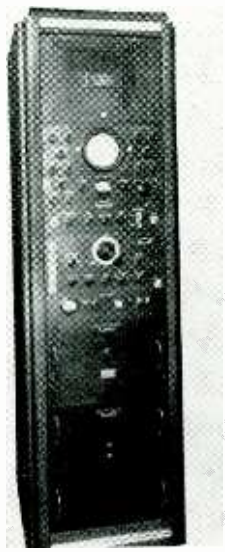
Capacitor Tester

Model 112 Challenger capacitor tester is push-button controlled and fast positive range selection for capacity and leakage tests is

provided. It checks all types of faulty capacitors: electrolytic, paper, mica, etc. There are six test voltages from 20 to 500 v. Dial is glass-enclosed and equipped with the Jackson "Scale Expander" pointer which doubles effective scale length. Power factor is measured on a direct-reading scale which doubles effective scale length.—**Jackson Electrical Instrument Co., 18 South Patterson Blvd., Dayton 1, Ohio**—TELE-TECH

Oscillosynchroscope

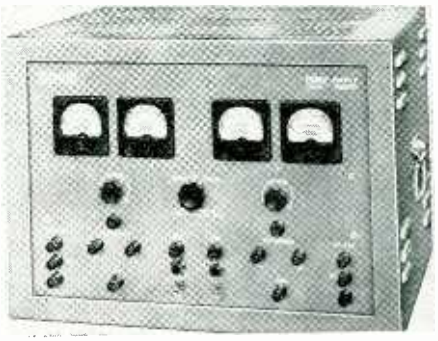
Model OJ-17 oscilloscynchroscope has two completely separate sweep systems which permit accurate display of repetitive phenomena



with recurrence rate as high as 10 MC, or transient and recurrent pulses as short as .05 μsec. Built-in trigger and delay generators are provided for synchroscopic applications such as those encountered in radar circuits. Accurate time measurements may be made by use of 0.1, 1.0 10, and 100 μsec markers. Vertical signal amplitude measurements are likewise possible using a direct reading deflection calibration system. The high-gain vertical amplifier has a respone flat from five cps to 16 MC, extending beyond 30 MC, including the use of a .2 μsec. signal delay line.—**Browning Laboratories, Inc., 750 Main St., Winchester, Mass.**—TELE-TECH

Regulated Power Supply

The Kepco model 510 features two completely independent voltage regulated power supplies with excellent regulation, low ripple



content, low output impedance, fuses on input and output circuits, and output current and voltage meters. Each dc output voltage is continuously variable from 200 to 500 v., 0 to 200 ma. For all output voltage, the output voltage variation is less than ½% for both line fluctuations from 105 to 125 v. and load regulation from minimum to maximum current. Ripple voltage is less than 5 mv.—**Kepco Laboratories, Inc., 149-14 41st Ave., Flushing, N. Y.**—TELE-TECH

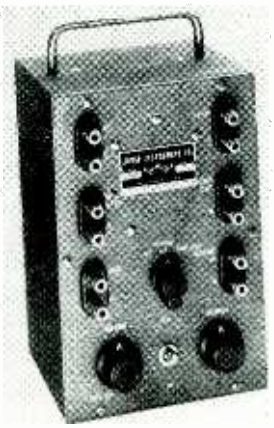
Polyphase Reproducer

The Audax L-6 polyphase reproducer is a single magnetic unit which plays 33 1/3, 45, and 78 rpm records and is being manufac-

tured with a special connector for plugging into the Webster Changer arm. Once plugged in, it becomes a permanent part of the arm, eliminating repeated plugging in and pulling out. Point pressure is 8 grams for all discs. Output is about 20 mv. Needle talk is practically nil and frequency response is from 20 cps to 10 KC.—**Audak Co., 500 Fifth Ave., New York 18, N. Y.**—TELE-TECH

Intermodulation Set

New development of an old principle is used by the model 162 intermodulation set to measure intermodulation distortion. It can be used with customer's own oscillator (for



one tone) and oscilloscope. Special oscilloscope screen supplied with the set permits direct measurement of percent intermodulation. It can be used to test amplifiers radio receivers and complete systems over the full audio range. It is helpful in the testing of phonograph pickups when operated in conjunction with a test record.—**Audio Instrument Co., 133 West 14th St., New York 11, N. Y.**—TELE-TECH

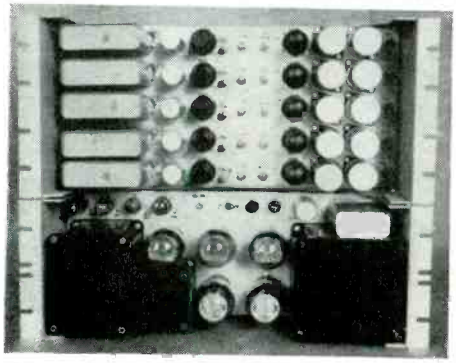
Impedometer

Compact and easy-to-use, the FTL-42A is a device for the measurement of impedance in the 50 to 500 MC range. Below 500 MC its

accuracy is ±5%. It consists of a short length of standard 1⅝ in. 52-ohm coaxial line on which are mounted two directional couplers, a voltage probe and a capacitance plunger. In addition to the capacitance button there is a switch on the control panel for selecting either of two directional couplers or the voltage probe; also a plug connected to the output of the switch. To use the FTL-42A, a signal generator is connected to one end of the line and the load to be measured is connected to the other end. A crystal detector and amplifier or a radio receiver is connected to the output plug on the panel. Then the switch is set consecutively to its three positions and the relative ouput voltage is measured for the incident and reflected waves and the total voltage on the line. A simple diagram or Smith Chart gives the impedance at the voltage probe, which can be readily transformed into the impedance at the load.—**Federal Telecommunication Laboratories, Inc., 500 Washington Ave., Nutley 10, N. J.**—TELE-TECH.

Video Distribution Amplifier

Video distribution amplifier model 1311 makes it possible for a single synchronizing signal generator and monoscope unit to han-



dle up to five separate equipments requiring such signals. It consists of five separate isolation amplifiers and a regulated power supply. The amplifiers have separate inputs and individual outputs. Each amplifier has unity gain within 10% and the frequency response is such that at low frequencies a 60 cps square wave will not be deteriorated and at high frequencies, the response is down not more than 3 db at 11 MC and 6 db at 13 MC. The inputs of this unit are of the bridging type and have a relatively high input impedance so that all of the amplifiers may be paralleled across a video line with minimum disturbance to the driving source.—**Tel Instrument Co., Inc., 50 Paterson Ave., East Rutherford, N. J.**—TELE-TECH.

Bolometer Bridge

Designed for the measurement of power in coaxial systems at ultra-high frequencies, the 1651-A bolometer bridge is a general purpose unit, flexible and adaptable in operation. It can be used not only with General Radio Co. bolometers but with those of other manufacturers as well. A wide range of bolometer resistances can be accommodated, and measurements can be made by either a substitution or a direct-reading method. Maximum power range of the instrument is from 0 to 500 mw with General Radio bolometers. A matching transformer to be used with the bridge can be easily assembled from General Radio type 874 coaxial elements. Overall accuracy of measurement is approximately ±10%.—**General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.**—TELE-TECH.

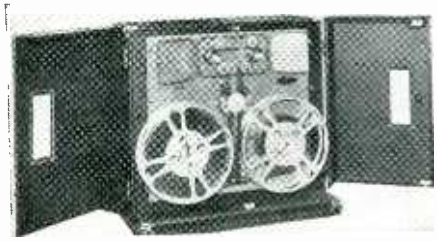
Microphone

Outstanding feature of the Synabar (model DR-10) microphone is its use of a special

sintered metal to cancel out 15 db front to back. The 50 cps to 10 KC frequency range is further enhanced by a response selector switch which provides choice of ideal pick-up characteristics for either crisp or general voice and music. The Synabar is a high impedance microphone and has an output level of —54 db. Its crystal element has a special metalseal protection against moisture and dryness. Finish is satin chrome and the unit is furnished with 20 ft. of single conductor shielded cable and detachable concentric cable connector.—**Astatic Corp., Conneaut, Ohio**—TELE-TECH

Magnetic Recording System

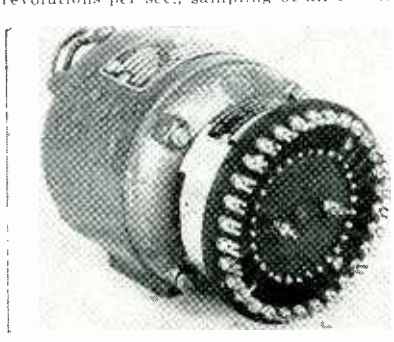
A magnetic recording system, which includes a new magnetic record-reproducer, mixer amplifier, recording amplifier assembly,



and power supply, has been designed for high quality professional magnetic recording in film production, surpassing standards set by the Motion Picture Research Council. Both 16 mm and 35 mm systems are available in portable carrying cases or rack mounted for use in the studio. Heart of the system is the magnetic record-reproduce unit, which features a unique, high-quality magnetic record-reproduce head housed in a special metal shield box. Other highlights are: simplified threading; an observation window; provision for headphone or speaker monitoring, and a torque motor take-up and fast automatic rewind. Nominal reel sizes are used on portable channels, but large capacity reels may be used on rack-mounted types.—**Radio Corporation of America, RCA Victor Div., Camden, N. J.**—TELE-TECH

Multichannel Sampling Switch

The motor and switch of the model 1-30-30S high speed multichannel sampling switch are designed as a single packaged unit weighing 53 oz. Overall dimensions are 5 x 3½ x 3 9/16 in. The synchronous driving motor is rated at 1800 rpm, 115 v., single phase, 60 cycle ac. Since the switch is driven directly by the motor shaft at a rate of 30 revolutions per sec., sampling of all 30 "break-



before-make" channels is synchronized with the ac line voltage. This synchronous switching is ideally suited for the display of the sampled information on a CR oscilloscope. The 30 active contact pins are connected to terminal lugs to facilitate wiring by the user. a similar unit is available with all 60 contacts made accessible. With its shorting type wiper, this device features great versatility in possible switching arrangements. — **The Applied Science Corporation of Princeton, P. O. Box 44, Princeton, N. J.**—TELE-TECH

Oscilloscope Tracer

An optical super-positioning device has been developed that permits tracing of cathode-ray patterns of a repetitive nature directly

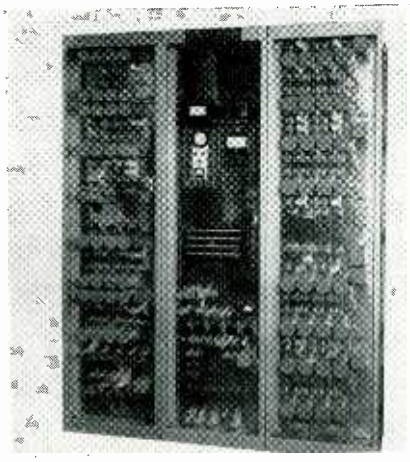
on graph paper. Known as the Oscillo-Tracer, the new unit increases viewing accuracy by eliminating parallax caused by curved-face CR tubes and flat calibrated scales. The projected pattern is exactly the size of the original trace—**Robert A. Waters, Inc., Dept. TT, 4 Gordon St., Waltham 54, Mass.**—TELE-TECH

High Voltage Probe

The 100x Kilovolter is a heavy-duty probe that multitplies the existing ranges of any standard 10- or 11- megohm vacuum tube voltmeter by a factor of one hundred. Measuring 8½ in. long and fitted with clear lucite nose piece and red barrier insulator, it is designed especially for high-voltage circuits in television receivers. It is furnished with a 5-ft. coaxial cord and a separate grounding lead. The cord terminates in a standard single-contact microphone connection. A special adapter plug is available to permit this same connector to be used with VT meters having phone jacks instead of microphone fittings.—**Insuline Corp. of America, 36-02 35th Ave., Long Island City, N. Y.**—TELE-TECH

Multiplex Terminal

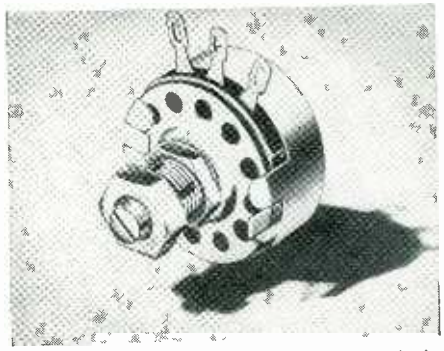
Multi-channel multiplex terminal equipment of the pulse amplitude modulation time-division type, is available in models providing 4,



8, 12, 16, 24, or 32 voice channels. It is free from crosstalk and is also useful for telegraph, telemeter or remote control applications. Composite output is less than 300 KC wide. An important feature of the equipment is its ability to drop out one or more channels at repeater stations.—**Philco Corp., Philadelphia, Pa.**—TELE-TECH

Potentiometer

A 2-watt molded composition potentiometer has been developed with a short screw driver shaft and locking nut. Known as the



type AB, the new component is particularly useful in applications where resistance adjustments are infrequent. The solid-molded resistance element, heat treated under pressure, is unaffected by heat, cold, moisture or length of service. The terminals are imbedded in the resistance element and all parts are corrosion resistant. It has a low noise level, smooth taper, high lead-carrying capacity and long life. More than 100,000 cycles of operation may be expected with less than 10% change of resistance. It is available in 16 stock resistance values from 50 ohms to 5 megohms—**Ohmite Manufacturing Co., 1974 West Flournoy St., Chicago 44, Ill.**—TELE-TECH

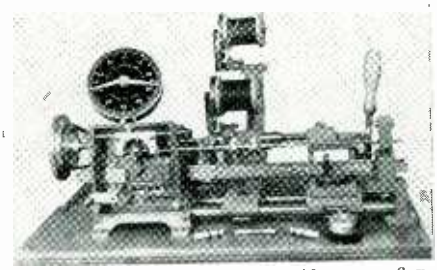
Sweep-Marker Generator

An entirely new sweep and marker generator has been developed which is suitable for production alignment of TV tuners and over-

all alignment of complete receivers. In the model RFP, a 12-position channel switch selects extremely narrow pip-type crystal positioned picture and sound carrier markers as well as the desired 15 MC wide swept oscillator output. All carriers are oscillator fundamentals. The instrument also produces a true zero amplitude reference baseline on the oscilloscope display. Sawtooth sweep eliminates phasing problems. Sweep outputs are from maxima of approximately 0.5 v. for the 70-ohm unbalanced output and 1.0 v. for the 300-ohm balanced output down to minima suitable for aligning the most sensitive receivers.—**Kay Electric Co., Maple Ave., Pine Brook, N. J.**—TELE-TECH

Coil Winding Machine

An improved coil winding machine (model 125) that winds coils and solenoids up to 8 in. long is mounted on rods instead of a



cast iron base. The rods provide more flexibility and better alignment because the tail-stock can be moved back and forth as well as from side to side. Also, instead of being fastened to one spot on the base, the tension bracket may be moved to any position to suit the winding arbor. This permits spools to be adjusted closer or farther from the winding head. The machine winds wire from 20 to 44 gauge. Progressive universal coils up to 4 in. in length and 3 in. in diameter can be wound.—**George Stevens Manufacturing Corp., Chicago 30, Ill.**—TELE-TECH

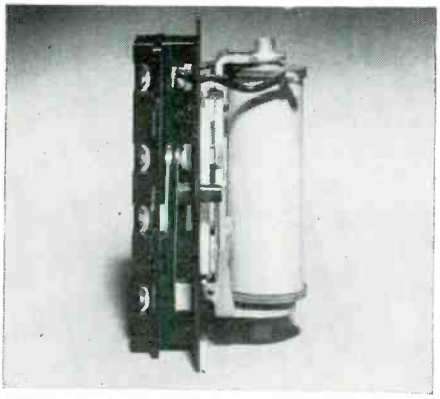
Voltmeter

Several new features have been incorporated into a recently-developed vacuum tube voltmeter. There are seven ranges of ac and

dc v. to 5000; 0 to a billion ohms in six ranges; a capacitance scale from 50 mmf to 5000 mf; and 0 to 500 ma in four ranges. The front panel of this new multitester slants upward, thus providing improved meter visibility. The instrument may be used in an upright position or flat position by removing and rotating the panel in the case. The 5½ in. meter receives the full benefit of overhead lighting and is easy to read from a standing or sitting position.—**Chicago Industrial Instrument Co., 536 West Elm St., Chicago 10.**

Power Relay

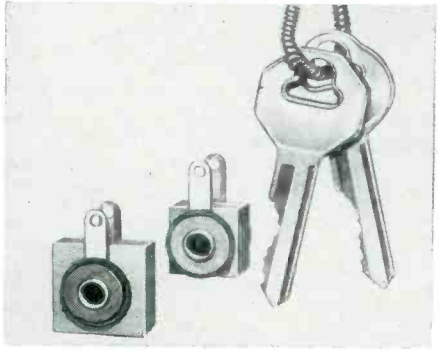
Model CP power relay (dc) is so sensitive, it will operate directly in the plate circuit of any triode, including miniatures. It is not



necessary to incorporate a high-current thyratron tube or an intermediate relay. Hundreds of different coils are available. With the proper coil, pickup current can be as low as 3 ma, and dropout current as high as 40% of pickup current. Operate time can be as fast as 30 millisec. Contacts are conservatively rated at 10 amps., 230 v. ac, proved by a half million operations at 30 amps. inrush 10 amps. break.—**C. P. Clare & Co., 4719 West Sunnyside Ave., Chicago 30, Ill.**

Selenium Rectifiers

Model 8Y1 is the smallest in a new group of additions to the Seletron line of selenium rectifiers. It measures only ½ in. sq. and is



rated at 20 ma. 130 v. Stack thickness is 11/16 in. and maximum peak inverse voltage of 380 v. Maximum input voltage is 130, R.M.S. Other bias type rectifiers up to 260 v. are also available.—**Radio Receptor Co., Inc., 251 West 19th St., New York 11, N. Y.**

TELE-TECH's NEWSCAST

SMPTE Convention to be Held Oct. 16-20

The S.M.P.T.E. is going in heavily for TV at its semi-annual convention which will be held at Lake Placid, N. Y., on October 16 to 20 inclusive. Four of the ten half-day sessions will be based on television, these are: Monday PM. television; Tuesday AM. television film; Tuesday PM. television and sound recording, Friday PM theatre television. Among the speakers are Newland Smith of WOR-TV, H. M. Gurin of N..BC. Dr. P. Goldmark, Vice President of C.B.S. Dr. T. Goldsmith of Allen B. DuMont Laboratories, J. A. Maurer, President of J. A. Maurer Inc., Col. R. H. Ranger, Rangertone Inc., R. L. Garman, Precision Laboratories, Inc.

Multiple Channel System Demonstrated on FM

The Multiplex Development Corporation demonstrated the transmission and reception of two separate programs over one FM channel in Reeves Sound Studios New York City on September 12, via the facilities of KE2XKH. This new system, which opens the way to dual use of frequencies, makes it possible to transmit a normal broadcast program for the general public, and special background music for use in offices, restaurants, etc., via the second channel. The second program is carried on a 45 kc subcarrier which can accommodate 30 to 10 kc. modulation. Also demonstrated were facsimile via the subcarrier, and, for the first time in radio history, **stereophonic** sound using the standard channel to carry one half of the orchestra and the subcarrier to carry the other half.

IRE to Award Medal of Honor to Zworykin

Dr. Vladimir K. Zworykin, Director of Electronic Research and Vice President of RCA Laboratories Division, Princeton, N. J., will be awarded the 1951 Medal of Honor, the highest award bestowed by the Institute of Radio Engineers. The Medal of Honor is awarded annually in recognition of distinguished service rendered through substantial and important advancement in the science and art of radio communication. Dr. Zworykin, noted especially for his contributions to the development of television, will be given the award at the Institute's Annual Banquet during the IRE National Convention, March 19-22, 1951, at the Waldorf-Astoria Hotel, New York City.

Sarkes Tarzian Rectifiers

A new line of selenium rectifiers is now in full production by Sarkes Tarzian, Inc., of Bloomington, Indiana. These "Centre-Kooled selenium rectifiers have been especially designed for use in radio and television equipment, and are currently available in sixteen different models.

The center cooling feature provided by a special spacer between the cells insures lower over-all operating temperatures by allowing air to reach the portions of the cells in which the current density is the greatest

Far East Communications System Expanded

Rapid expansion in the communication services available to airplanes flying the vital Pacific air routes to Korea and the Far East has been provided by Aeronautical Radio, Inc., of Washington, D. C., and the Mackay Radio and Telegraph Company, subsidiary of the American Cable & Radio System.

Mackay, under terms of a contract with ARINC, broke ground for a large extension to its radio transmitter building at Kailua, Hawaii, on June 21, and before the deadline date of August 1, had completed the structure and installation of four multichannel transmitters and associated antennas. The new equipment, which was manufactured by Federal Telephone and Radio Corporation, a subsidiary of the International Telephone and Telegraph Corporation, will enable the ARINC to cover the entire Pacific area with both radiotelephone and radiotelegraph service to aircraft and base stations.

Motorola Receives Award from City of Miami, Fla.

Pursuant to special temporary authority issued by the FCC to the City of Miami, Fla., comparative tests of FM 2-way mobile radio equipment which were submitted by leading manufacturers recently disclosed marked performance superiority of units proposed by Motorola, Inc.

City officials and their technical advisors concluded that the field tests showed Motorola radio units to be superior in range, intelligibility, and perhaps most important, in intermodulation rejection. As a result, the city awarded a contract to Motorola for 17 mobile units, 10 central stations, 4 Handie-Talkie units, and auxiliary equipment for its fire and police radio systems.

Tallest TV Tower in U. S.

Foundation work for the tallest radio and television tower to be constructed in the United States has recently been completed in Atlanta, Georgia. Designed and fabricated by International Derrick and Equipment Co., 875 Michigan Ave., Columbus, Ohio, for Station WCON, the tower will rise 1000 ft. above Atlanta. The addition of a RCA pylon on top of the tower will make the structure 1057 ft high.

Two guy wires on each side of the triangular-shaped tower will lend support to the structure, designed to withstand wind velocities of approximately 100 mph. Having 14-ft. widths (sides) to a height of 798 ft., the tower will then taper to 8½-ft. face widths.

A one-man elevator will be installed for hoisting maintenance workers up to a height of 798 ft. Circling the tower at elevations of 407 and 798 ft. will be four-foot steel platforms. Rest platforms will be built at heights of 140, 280, 546 and 686 ft.

IRE-RTMA Annual Fall Meeting at Syracuse

The latest technical developments of radio and television equipment and components will be discussed by the country's leading radio-TV engineers at a three-day gathering during the annual Radio Fall Meeting, Oct. 30-Nov. 1. The annual meeting of radio engineers is sponsored jointly by the Institute of Radio Engineers and the Radio-Television Manufacturers Association's Engineering Department. This year's meeting will be held at the Hotel Syracuse, Syracuse, N. Y.

Featuring technical sessions in both mornings and afternoons, the meeting will be climaxed by a dinner on Tuesday evening, Oct. 31. RTMA President Robert C. Sprague will deliver the feature address and Dr. W. R. G. Baker, Director of the RTMA Engineering Department will serve as toastmaster. Ralph R. Batcher, J. R. Steen, R. A. Hackbusch, D. D. Israel, and O. L. Angevine, Jr., have been named to preside at the five sessions.

Coming Events

October 3-5—AIEE, Middle Eastern District Meeting, Lord Baltimore Hotel, Baltimore Md.

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

October 17-19—Communications Section, Association of American Railroads, 27th Annual Convention, French Lick Springs Hotel, French Lick, Ind.

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

October 26-28—Second Audio Fair, Audio Engineering Society, Hotel New Yorker, New York City.

October 30-November 1 — IRE and RTMA, Radio Fall Meeting, Hotel Syracuse, Syracuse, N. Y.

BOOKS

Practical Television Engineering

By Scott Helt, Murray Hill Books Inc., 232 Madison Avenue, New York 16, N. Y., 708 Pages: price $7.50; Published June 1950.

A number of books have been written in the technical field of television, and the reviewer's first thought was that this book would turn out to be run of the mill. But this is not so. Here is a complete treatment of television from fundamentals to final station operation including lenses and lighting. The author is in charge of television at Columbia University and it is easy to see that he has written the book for use as a text. Treatment of all phases of the subject is clear and concise and the practising engineer will find much in it to warrant keeping a copy at hand.

Sound Motion Pictures, Recording and Reproducing (7th Edition)

By James R. Cameron; published 1950 by; Cameron Publishing Co., Coral Gables, Fla. 879 pages; price $12.50

This is an invaluable book for the radio or television engineer who is concerned with the functioning of film equipment. A comprehensive survey of filming and sound recording on film is included and almost everything is cevered. However, the section on sound-on-film recording which deals with the different systems could be a little more explicit at times. Not only is the history of the motion covered, but current operating practices are described in a manner which *explains* the reasons behind the changes. There is a small section on the application of movies to television, but this is quite brief. Any engineer in a field remotely connected with television is advised to read this book for most of the contents are germane to some aspect of television.

Military Contract Awards

(*Continued from page* 49)

Specialty Battery Co., Madison, Wisc., Batteries, $336,255.; Sperry Gyroscope Div., Sperry Corp., Great Neck, L. I., N. Y. Components, $1,124,-154; Analyzers, $1,080,400; Services & Materials, $50,000; Electron Tubes, $242,356; Radar Set, $2,000,000.

Telegraph Apparatus Co., Chicago, Ill., Mountings, $1,316,599. Telephonics Corp., Huntington, L. I., N. Y., Microphone & Microphone Element, $35,140.; Times Facsimile Corp., New York, N. Y., Facsimile Set, $252,860; Modification Fit for AN Facsimile Set, $28,198.; Transmitter Equipment Mfg. Co., New York, N. Y., Radio Terminal Set, $192,928.

University Loudspeaker Co., White Plains, N. Y., Loudspeakers, $160,380.; Utility Electronics Corp., Newark, N. J., Power Supply, $401,484.

Western Electric Co., New York, N. Y., Parts, Components, Radar Equipment, etc., $75,000; Radio Set, $300,000.; Wind Turbine Co., West Chester, Pa., Tower, $104,442.

Directory of Consulting Engineers and Radio and Television Associations

Alabama

Communications & Electronics Co., 219 W. Shawnee Dr. Montgomery 7—Tel: 2-0350

California

T & T Radio Measurements Co., 1228 E. Compton Blvd., Compton—Tel: NEvada 6-3170
John W. Bacon, 2001 Bay View Dr., Hermosa Beach —Tel: Frontier 2-5739
Gille Bros., 1108 N. Lillian Way, Hollywood 38
Bernard Associates, 5010 Sunset Blvd., Hollywood 27—Tel: 2-6715
Clyde H. Bond, 629 E. Maple St., Orange
Electrical Communications, Inc., 765 Clemtina St., San Francisco 3—Tel: KI 2-1947
Universal Research Labs., Knob Hill Circle, San Francisco 6—Tel: Douglas 2-5380

Connecticut

Philip Merryman & Assoc. 114 State St., Bridgeport 3 —Tel: Bridgeport 5-4144
Dr. Donald G. C. Hare, Hare Laboratories, New Cannaan
Mr. Garo W. Ray, Hilltop Dr., Stratford
Dale Pollack, Box 422, New London—Tel: New London 2-6760

District of Columbia

George P. Adair, 1833 M St., N. W., Washington 6—Tel: EX 1230
George B. Bairey, 1757 K. St., N. W., Washington 6—Tel: NA 0196
Wm. E. Benns, Jr., 3738 Kanawha St., Washington—Tel: Ordway 8071
Carl H. Butman, 892 National Press Bldg., Washington —Tel: NA 7846
Carnine & Bitter, 2332 Ontario Rd., N. W., Washington 9—Tel: Hudson 7513
Chambers & Garrison, 1519 Connecticut Ave., Washington 6,—Tel: MI 2261
Commercial Radio Equipment Co., 1319 F St., N. W., Washington 4—Tel: DI 1319
Craven, Lohnes & Culver, 1242 Munsey Bldg., Washington 4—Tel: District 8215
John Creutz, 319 Bond Bldg., Washington 5—Tel: RE 2151
George C. Davis, 501-514 Munsey Bldg., Washington 4 —Tel: Sterling 0111
Wm. L. Foss, Inc., 927 15th St., N. W., Washington—Tel: Republic 3883
Gautney, Ray & Price, Warner Bldg., Washington 4—Tel: NA 7757
Glenn D. Gillett & Associates, National Press Bldg., Washington 4—Tel: NA 3373
Jansky & Bailey, National Press Bldg., Washington 4—Tel: Adams 2414
Kear & Kennedy, 1703 K St., N. W., Washington 6—Tel: Sterling 7932
John J. Keel, Warner Bldg., Washington 4—Tel: NA 6513
Mason & Dixon, 1616 16 St., S. S., Washington 20—Tel: Ludlow 4-1012
Russell P. May, 1422 F. St. N. W., Washington 4—Tel: Republic 3984
Dixie B. McKey & Associates, 1820 Jefferson Pl., Washington 6—Tel: Republic 7236
McIntosh & Inglis, 710 14th St. N. W., Washington 5 —Tel: Metropolitan 4477
McNary & Wrathall, National Press Bldg., Washington 4—Tel: District 1205
Albert F. Murray, 4707 Windom Place N. W., Washington 16—Tel: ORdway 4841
E. C. Page, 600 Bond Bldg., Washington 5—Tel: EX 5670
A. D. Ring & Co., Munsey Bldg., Washington 4—Tel: Republic 2347
Silliman & Barclay, 1011 New Hampshire Ave. N. W., Washington 7,—Tel: RE 6646
L. C. Smeby, 82 13th St. N. W., Washington 3—Tel: EX 8073
Weldon & Carr, 1605 Conn. Ave. N. W., Washington 9 —Tel: Michigan 4151
Raymond M. Wilmotte Inc., 1469 Church St. N. W., Washington 5—Tel:—DEcatur 1231
Herbert L. Wilson, 1025 Connecticut Ave. N. W., Washington—Tel: NA-7161

Georgia

W. J. Hotey, 1146 Briarcliff Pl. N. E., Atlanta—Tel: Atwood 3328

Illinois

Andrew Corp., 363 E. 75 St., Chicago 19—Tel: TRiangle 4-4400
Doolittle Radio Inc., 7421 S. Loomis Blvd., Chicago 36 —Tel: Radcliffe 3-4100
The Francis Co., 343 S. Dearborn St., Chicago 4—Tel: Harrison 7-7747
Eugene Mittelmann, 540 W. Washington Blvd., Chicago 6—Tel: State 2-8021
Hahn & Coe, 1515 Halsted St., Chicago Heights—Tel: 4787
Edward W. Jacker, Church Rd., Elmhurst—Tel: Elmhurst 3610
Hy Mark Products Co., 734 N. Austin Blvd., Oak Park—Estebrook 8-7047
Ellery L. Plotts, P. O. Box 165, Park Ridge—Tel: Talcott 3-7933
A. James Ebel, 212 S. Jefferson St., Peoria 2—Tel: 6-0711
Clarence R. Jacobs, P. O. Box 69, Princeton—Tel: Princeton 4200
Walter F. Kean, 1 Riverside Rd., Riverside—Tel: Riverside 7-2153

Indiana

Harold B. Rothrock, Citizens National Bank Bldg., Bedford—Tel: 4270
Martin R. Williams, 1131 N. Delaware St., Indianapolis 2

Iowa

Lloyd R. Amoo, 3709 Carpenter, Des Moines—Tel: 7-9272

Louisiana

L. J. N. du Treil & Associates, 204 Homedale Ave., New Orleans 19—Tel: AUdubon 0917
Broadcast Engineering Service, P. O. Box 1387, Shreveport—Tel: 2-8711

Maine

C. L. Warren & Co., Easy St., Canaan

Maryland

Worthington C. Lent, 5209 Roosevelt St., Bethesda 14
Henry H. Lyon, 4004 Jefferson St., Hyattsville—Tel: WArfield 7137
Albert Preisman, 616 St. Andrews Lane, Silver Spring—Tel: SLigo 6307

Massachusetts

Andrew Alford, 299 Atlantic Ave., Boston 10
Pickard & Burns, 240 Highland Ave., Needham—Tel: Needham 3-3033
J. Gordon Keyworth, 42 Main St., Wililamstown—Tel: 869-J

Mississippi

Ellington Radio, Inc, 816 S. Gallatin St., Jackson—Tel: 3-1327

Missouri

John B. Heffelfinger, 815 E. 83 St., Kansas City 5—Tel: Hiland 7010
Gred O. Grimwood & Co., 2033 Railway Exchange Bldg., St. Louis—Tel: Ch 4977
Lee E. Baker, 826-28 Landers Bldg., Springfield 1—Tel: 2-1951

New Jersey

C. J. Franks Laboratories, Inc., P. O. Box 59, Boonton —Tel: Boonton 8-2423
Robert F. Holtz, Box 177, Great Notch—Tel: Little Falls 4-1433R
Harold Galanty, 287 Conkoin Ave., Hillside 5—Tel: WAverly 6-0091
Robert Finlay, 104 Brookside Ave., Ridgwood—Tel: RI 6-8645
Paul Godley Co., P. O. Box J, Upper Montclair—Tel: 3-3000
Ralph W. Bumstead, 624 Maple St., Westfield—Tel: WE 2-0628 M

New York

Empire Devices, Inc., 38-25 Bell Blvd., Bayside—Tel: Bayside 9-1145
Hanson-Gorrill-Brian, Inc., 1 Continental Hill, Glen Cove—Tel: Glen Cove 4-1922
Wheeler Laboratories, 122 Cutter Mill Rd., Great Neck, Tel: Great Neck 2-7806
M. G. Crosby, 126 Old Country Rd., Mineola—Garden City 7-0284
The Austin Co., 19 Rector St., New York 6—Tel: Whitehall 4-6386
H. Russell Brownell, 188 W. Fourth St., New York 14 —Tel: CHelsea 2-4208
Elctronic Systems Corp., 508 Broadway, New York 12—Tel: WAlker 5-2419
Elk Electronic Laboratories, 333 W. 52 St., New York 19—Tel: PLaza 7-0520
Dr. Alfred N. Goldsmith, 597 Fifth Ave., New York 17 —Tel: PLaza 3-4150
Paul Hetenyi, 41 E. 42 St., New York 17—Tel: MU 7-1643
John V. L. Hogan, 155 Perry St., New York 14—Tel: CHelsea 2-7855
Heinz E. Kallmann, 417 Riverside Dr., New York 25—
Lawton Products Co., 624 Madison Ave., New York 22 —Tel: PLaza 3-0884
Radio Engineering Co., 8 State St., New York 4—Tel: Whitehall 4-5266
Ben Adler, 720 Milton Rd., Rye—Tel: Rye 7-1413
Andrew W. Vincent, 300 W. High Terrace, Rochester 11 —GEnesee 2648

Ohio

Carl E. Smith, 4900 Euclid Ave., Cleveland 3
R. C. Higgy, 2032 Indianola Ave., Columbus 1—Tel: UNiversity 9229
A. R. Bitter, 4125 Monroe St., Toledo 13—Tel: KIngswood 7631

Oregon

Harold C. Singleton, 2073 S. W. Park Ave. #127, Portland 1—Tel: BEacon 1201

Texas

Guy C. Hutcheson, 1100 W. Abram St., Arlington—Tel: AR 4-8721
Silliam & Barclay, 2915 Red River St., Austin—Tel: PH 2-5055
A. Earl Cullum Jr., Highland Park Village, Dallas 5—Tel: Justin 8-6108
W. M. Witty, 6923 Snider Plaza Dallas 5—Tel: Lakeside 7118

Washington

J. B. Hatfield, 936 35 Ave., Seattle 22

Wisconsin

Nathan Williams, 20 Algoma Blvd., Oshkosh—Tel: Blackhawk 22
Jack Collins Associates, 808 N. Third St., Milwaukee 3—Tel: Broadway 2-5163
D. W. Gellerup, 5437 N. Santa Monica Blvd., Milwaukee 11—Tel: Woodruff 2-5172

Destructive Effects Seen in FCC Color-TV Proposal

(*Continued from page 26*)

decided, they then used portions of the hearing record that supported their choice, discarding qualified opinions to the contrary. For instance, long-delay phosphors are supposed to overcome CBS flicker; horizontal dot interlace, not broadcast yet by CBS, would bolster the lacking CBS resolution; the complicated, not-yet-perfected RCA tri-color tube would remove the CBS limitation on picture size and mechanical rotating discs. The report does not mention that the employment of these needed CBS improvements would alter seriously its conclusions in these respects: delay phosphors would increase color fringing and blurring of rapid motion; the sync channel for the horizontal dot interlace would increase susceptibility to cw interference and the use of the RCA tri-color tube would remove the listed advantages of cheapness, simplicity and availability. To an unbiased engineer the report seems biased in favor of CBS.

2. A number of TV broadcasters do not want to transmit CBS color signals. Their reasons are included in the paragraph above.

3. One engineer with over 20 years experience in TV said he seriously doubted if the CBS system would ever survive as the national standard for color TV because technically it was not the best system available and in his experience an inferior system was bound to be displaced by a better one in a relative short time.

TV Set-Makers Comment

Some of the smaller TV manufacturers state that they have confidence in FCC, that the report requires further study, but in any event they are going to protect their customers.

The large manufacturers testified it would take time and plenty of customer's money to put dual, BRACKET standards into their TV sets. In order to get the FCC to hold the door open for new and improved systems they thought of appealing to the President of the United States and/or to the "grass roots".

One set designer estimated that the cost to the public will be $280 to 500 million to equip sets now in use with CBS adaptors which allow reception of CBS signals in Monochrome. This expenditure would be unnecessary if FCC had picked a compatible system. And after the sets are equipped with adaptors, then $490 to $1000 million would be the cost of adding rotating-disc converters to get pictures in color.

Radio & TV Associations

Acoustical Society of America, 57 E. 55 St., New York, N. Y., Wallace Waterfall, Sec'y

American Institute of Electrical Engineers, 33 W. 39 St., New York, N. Y., H. H. Henline, Sec'y

American Society of Mechanical Engineers, 29 W. 39 St., New York, N. Y., C. E. Davies, Sec'y

American Standards Association, 70 E. 45 St., New York, N. Y., Admiral G. S. Hussey, Sec'y

American Television Society, 17 E. 45 St., New York 17, N. Y., R. R. Kraft, Sec'y

Armed Forces Communication Assn., 1624 Eye St. N. W., Washington 6, D. C., G. P. Dixon, Sec'y

Associated Police Communication Officers, Sec'y: W. H. Durham, 4236 Creed Ave., Los Angeles 43, Calif.

Association of Federal Communications Consulting Engineers, Munsey Bldg., Washington 4, D. C., J. C. McNary, Sec'y

Audio Engineering Society, Box F, Oceanside N. Y., N. C. Pickering, Sec'y

Electronic Manufacturers Assn., 1450 Broadway, New York 18, N. Y., Allen Bernstein, Sec'y

Institute of Radio Engineers, 1 E. 79th St., New York 21, N. Y., Haraden Pratt, Sec'y

Instrument Society of America, 921 Ridge Ave., Pittsburgh 12, Pa., Richard Rimbach, Sec'y

Joint Technical Advisory Committee, 1 E. 79 St., New York 21, N. Y., L. G. Dumming, Sec'y

National Association of Broadcasters, 1771 N. St., N. W. Washington, D. C., C. E. Arney, Jr., Sec'y

National Electrical Mfrs. Ass'n., 155 E. 44 St., New York 17, N. Y., W. G. Donald, Mg. Dir.

Radio Club of America, 11 W. 42 St., New York 17, N. Y., R. R. Batcher, Sec'y

Radio Manufacturers Assn., 1317 F. St., N. W., Washington 4, D. C., Bond Geddes, Sec'y

Society of Motion Picture & Television Engineers, 342 Madison Ave., N. Y., Boyce Nemec, Sec'y

Television Broadcasters Assn., 500 Fifth Ave., New York 18, N. Y., Will Baltin, Sec'y

Favorable Interpretation of FCC Color-TV Proposal

(*Continued from page 27*)

peared on this tube face side by side and were combined by means of a projection lens into one picture about 12 ins. by 16 ins. on a standard projection screen. The tube was made by the Rauland Company of Chicago. By using **long persistence** phosphor on the green section flicker was completely eliminated, even though the picture was observed to be brilliant in a lighted room. The cost of a tube of this type is not known, but it would probably be made for a reasonable figure in quantity production.

Probably the greatest stumbling block to the general acceptance of sequential color is the compatability question. But if the recent FCC proposal is carefully studied it will be seen that the proposal to build bracket standards into TV receivers is not a great hardship, and **it does not necessarily mean that sequential color will be adopted at this time.** All it proposes is that future receivers be capable of **wider** vertical and horizontal scanning adjustment. If this is done the door is left open for any other system which may not coincide with the present monocrome standards, but which is not arbitrarily a sequential system. Proponents of other systems will also be able to demonstrate their ideas and offer them for adoption as the color system under these conditions.

Make Sets Flexible Now.

In any case it should be realized that making black and white standards and color standards the same, in terms of scanning rates, is only the first—and long overdue—step in paving the way for color. It is much better to start making receivers sufficiently flexible **now** than to wait another year or two until the seven million in use have doubled or tripled in number. The first broadcasters in any market will undoubtedly suffer a loss of viewers initially, but after servicemen have had a field day adapting receivers, more viewers than ever will be attracted by the novelty of color.

Taken all in all it seems that the FCC's proposal is the only possible move at this time unless color is again to be shelved and denied to the people of America. It may well be that in the lifetime of many viewers today successful simultaneous color will not be achieved in spite of promises made by its promoters. Therefore a system which does work satisfactorily **now** should be made available at once without further procrastination. This is what the FCC's proposal means.

MICROWAVE ANTENNA ORIENTATION

(*Continued from page 39*)

wiring running from the terminal board to the horizontal motor.

It is desirable that the transmitter engineer know the exact vertical and horizontal position of the parabola when panning. This information eliminates the possibility of tuning to a strong out-of-phase or reflected signal and helps prevent possible damage to the parabola and rotator assembly in case one of the directivity limit switches should fail to open.

Direction indicators, which consist of two surplus Signal Corps selsyn units (Bendix type I-82-A) provide a constant indication of the receiving parabola in degrees. The horizontal and vertical selsyn driver units are mounted on gear boxes (see Fig. 4B, 4C) which also contain limit switches for automatic control of the panning angle. Each selsyn is equipped with a toothed gear (item 28 in Fig. 4B) which is chain-driven from a similar gear attached to the horizontal and vertical driving motor shafts (see items 5 and 16 in Fig. 4A.). Again, the size of the gears is not important. The only requirement is that the gear ratio be 1:1 in order to give a true reading on the selsyns. The size of the limit switch gears is not critical; neither is the ratio. The small toothed gear is attached to the selsyn drive shaft and rotates the larger gear. A small drop of solder (or brazed spot) on the larger gear acts as a trip lever in operating the micro-type limit switches at the desired point of rotation. (These switches, normally closed, prevent operation of either drive motor past the preset degree of rotation.) A second spot or protrusion may be added if a different panning degree is desired. (The gear box assembly could be simplified if desired by omitting the limit switch gears entirely and substituting a cam instead of the smaller gear. Adjustable trips could be installed on the cam to control tripping action over any desired angle.)

The tops and bottoms of the gear box frames are made of 10″ x 10″ x ⅛″ aluminum sheet. The frame posts are ¼″ x ¼″ x 5″, drilled and tapped for 10/32″ screws. The bushings are insert types, obtained, as were all the gears and bushings, at a local machine supply company.

Since the rotator proper is exposed to the elements, both driving motors and selsyns are equipped with weather-proof cover boxes (items 5, 8 and 21 in Fig. 4A). These covers are caulked to prevent entrance of water into the gear and terminal assemblies.

The control panel for the rotator is mounted above the relay receiver control unit in one of the transmitter equipment racks. This panel contains the horizontal and vertical selsyn indicators, switches S1, S2, S3 and S4, indicator lamp P1, Transformer T1, a terminal block for the rotator connecting cable, and a fuse F1.

Control Panel Operation

Master Switch S4 controls a-c to the entire rotator system. The positions of selector switches S2 and S3 determine the direction and degree of panning. In the "up" position, S2 sets up the *vertical* driving motor for operation. The parabola can then be panned "up", if switch S3 is in the up position, or "down" if S3 is in the down position, by operating the "run" switch S1. (This is a momentary-push switch to minimize the danger of excessive or unintentional rotation.)

With S2 in the "down" position, the *horizontal* driving motor is set up. Panning is then accomplished in a clockwise direction is S3 is in its up position, or counter-clockwise if S3 is in the down position.

Due to the particular location and structure of the rotator at WKRC-TV, care is taken to avoid panning vertically to a position lower than 40 degrees. An angle lower than this might damage the parabola. This actually imposes no limitations, since all remote pickups within the area require a higher vertical angle.

The interconnecting cable is a vinylite basket-weave armor type containing fourteen #16 conductors. Approximately 750 feet of this cable was required at WKRC-TV to run from the control point to the 300-foot level of the tower. This cable is terminated at the rotator base in an 18-connector Cannon male plug. The female receptacle to this plug (not shown in the diagrams) is mounted face down on the rotator base plate to prevent entrance of water and foreign matter. (The base plate is shown in Fig. 2.) The cable connector cannot be seen in this illustration, but is located directly behind the horizontal driving motor (at right rear of base). Transformer T2 appears in the left rear, while the cable terminal board is directly in front of it. In the center of the photo are the operating relays, while the horizontal selsyn gear box is seen at the right.

Ordinarily, continued operation of the rotator would produce considerable wear on the connecting cable, with the possibility of early failure in one of the conductors. This has been eliminated by using a 20-ft. length of flexible neoprene-covered cable from the microwave receiver to the rotator terminal board. This cable is coiled around the rotator several times to allow a maximum of flexibility in movement with a minimum of strain.

The authors gratefully acknowledge the assistance of Raymond O. Shannon, assistant TV engineering supervisor, WKRC-TV.

14 CITIES ADDED TO TV NETWORK

(*Continued from page 33*)

35 repeater stations spaced at about 25 mile intervals across the 838-mile route. The individual towers vary in height from 60 to 200 ft. depending on the terrain and for the most part are of poured concrete construction. 10 ft. square directional antennas are mounted on top of the structures and wave guides are used as the medium for transmitting the energy between the antennas and the radio transmitters which are located on the upper floor of the building. The lower floors of these structures contain main and stand-by power equipment and other facilities.

Radio transmitters operate in spectrum space of 500 MC and each communication channel occupies approximately 40 MC. Each transmitter has a power output of approximately ½ watt. The type 416A close-spaced triode (BTL-1553)[2] has been employed extensively throughout the repeater and terminal equipment serving in such various functions as amplifier, modulator, oscillator and frequency multiplier.

The microwave relay system between Chicago and Omaha, opened September 30, extends along a 458-mile route. Extension of this system to the west coast will be by way of Denver, Colo. and construction of this section was begun last April. Radio equipment is now being installed. Tests for relay paths between Denver and the Pacific coast are now completed and construction of relay stations across the Rockies,

the Sierra Nevadas, and the coastal ranges is in the preliminary stages. The west coast system between Los Angeles and San Francisco now in operation consists of eight repeater stations installed at a cost of 2.6 million dollars.

1. Coaxial Cable Joins East & Mid-West TV Networks, R. Hertzberg, Tele-Tech, Feb. 1949, pages 18, 19, 20, 55.
2. New Triode for 4000 MC Operation, J. A. Morton and R. M. Ryder, Tele-Tech, April 1949, pages 32, 33, 62, 64.

TABLE I

Section	Channels Available	Type Facility
New York-Philadelphia	5 - south	Coaxial
	2 - north	
New York-Chicago	2 - west	Relay
	2 - east	
Pittsburgh-Johnstown	1 - east	Relay
New York-Washington	1 - north	Relay
	1 - south	
Philadelphia-Chicago	3 - west	Coaxial
	1 - east	
Philadelphia-Washington	4 - south	Coaxial
	1 - north	
Philadelphia-Wilmington	1 - south	Relay
Baltimore-Washington	1 - north	Relay
	1 - south	
Washington-Richmond	1 - south	Coaxial
	2 - south	Coaxial
Richmond-Norfolk	1 - east	Relay
Richmond-Charlotte	2 - south	Coaxial
Charlotte-Birmingham	1 - south	Coaxial
New York-Boston	2 - east	Relay
Boston-Providence	1 - south	Relay
New York-Albany	2 - north	Coaxial
	1 - south	
Albany-Syracuse	2 - west	Relay
Cleveland-Erie	2 - east	Coaxial
Erie-Buffalo	1 - east	Coaxial
Buffalo-Rochester	1 - east	Relay
Toledo-Detroit	3 - north	Relay
Toledo-Dayton	3 - south	Coaxial
	1 - north	
Dayton-Columbus	3 - east	Relay
Dayton-Cincinnati	3 - south	Relay
Dayton-Indianapolis	2 - west	Relay
Indianapolis-Louisville	1 - south	Coaxial
Chicago-St. Louis	1 - north	Coaxial
	1 - south	
St. Louis-Memphis	1 - south	Coaxial
Chicago-Milwaukee	2 - north	Relay
Chicago-Des Moines	2 - west	Relay
Des Moines-Minneapolis	2 - north	Coaxial
Des Moines-Omaha	2 - west	Relay
Des Moines-Ames	1 - north	Relay
Omaha-Kansas City	1 - south	Coaxial
Los Angeles-San Francisco	2 - north	Relay

Industrial Color-TV by CBS, Remington Rand

Color television for industrial, business, hospital, governmental and military use will be a reality in a few months through an unusual cooperative agreement concluded recently between Remington Rand Inc., the world's largest manufacturer of office machines, business and industrial equipment, and the Columbia Broadcasting System, developer of the CBS system of color television.

Under the agreement CBS will provide the designs of the equipment, Remington Rand will manufacture and sell, CBS will perform the testing functions, and Remington Rand will then take over distribution and installation. Existing organizations of both companies will be utilized for the project, and for the time being no expansion will be required.

Acme Electric Expands

Construction of a new 25,000 sq. ft. building at Allegany, N. Y. has been initiated by the Acme Electric Corp., Cuba, N. Y. Acme manufactures transformers and transformer components.

Multivibrator Design

(*Continued from page 31*)

θ_1 = negative ratio of plate voltage to grid voltage for cut-off of (1).

θ_2 = same as above for (2).

The calculations and graphic constructions to be made are now listed in order. Derivations of the formulas are given in the appendix.

Given E_B, E_O, T:

1. Choose tube types for (1) and (2). It is not necessary that the triodes be identical, although they are usually so chosen for convenience.

2. Calculate θ_1 and θ_2 from the E_P-I_P curves for the chosen tubes. It is sufficient to calculate these ratios using $E_P = E_B$ and E_C equal to the grid bias at $I_P = 0$.

3. Choose $I_1 R_K > (E_B/\theta_2)$

4. On the E_P-I_P curves for (1), read I_1 at $E_P = E_B - E_O - I_1 R_K$ and $E_C = 0$. I_1 should not exceed the maximum current rating for the tube, and $I_1(E_B - E_O - I_1 R_K)$ should not exceed the allowable plate dissipation. If either quantity is too large, E_B should be decreased.

5. Calculate $R_1 = (E_O/I_1)$

6. Calculate $R_K = (I_1 R_K/I_1)$

7. Choose $S > 1$. Values from 2 to 5 are usually satisfactory.

8. On the E_P-I_P curves for (2), plot

$$E_2 = \left(1 - \frac{S}{\theta_1}\right) E_B - I_1 R_k + \frac{S R_k}{\theta_1} I_2$$

for various values of I_2 (see Fig. 2).

9. Using the intersections of the E_2 line with the I_P curves, plot E_C versus I_2 on a separate graph (see Fig. 3).

10. On the same graph, plot $-I_2 R_K$ versus I_2.

11. Read I_2 at the intersection on Fig. 3, and locate this value on Fig. 2. Read E_2.

12. Calculate $R_2 = (E_B - E_2)/I_2 - R_K$

13. Choose $R >> R_2$, and at least 10^6 ohms.

14. Calculate:

$$C = \frac{T}{R \ln \left[\frac{E_B + I_2 R_2 - I_1 R_k}{\left(1 + \frac{1}{\theta_1}\right)(E_B - I_2 R_k)}\right]}$$

where ln indicates the logarithm to the base *e*.

15. Calculate:

$$E_T > \left(1 + \frac{1}{\theta_2}\right) I_1 R_k - \frac{E_B}{\theta_2}$$

This completes the design.

APPENDIX

Supplementary symbols:

E_G = grid potential of (1) during conduction.

E_G' = minimum grid potential of (1) during cutoff.

$e_G(t)$ = instantaneous grid potential of (1) during pulse cycle.

t = elapsed time, starting at time of triggering.

Initially, in order to ensure cutoff of (2), $I_1 R_K > E_B/\theta_2$

If $R >> R_2$; $E_G' = E_G - I_2R_2$

But if R is greater than about 10^5, the grid-cathode potential of (1) is nearly zero. Therefore:

$$E_G = I_1R_K$$

and $$E_G' = I_1R_K - I_2R_2 \quad \text{.....(a)}$$

For (1) to be cut off,

$$I_2R_K - E_G' > (E_B - I_2R_K)/\theta_1$$

Use a ratio S; then

$$I_2R_K - E_G' = (S/\theta_1)(E_B - I_2R_K) \quad \text{.....(b)}$$

Substitute (a) for E_G' in (b), and

$$I_2(R_K+R_2) = (S/\theta_1)(E_B - I_2R_K) + I_1R_K \quad \text{.....(c)}$$

Now $$E_2 = E_B - I_2(R_K+R_2) \quad \text{....(d)}$$

Substitute (c) for $I_2(R_K+R_2)$ in (d), and

$$E_2 = \left(1-\frac{S}{\theta_1}\right) E_B - I_1 R_K + \frac{SR_K}{\theta_1} I_2$$

This is the equation of the line plotted in Fig. 2.

To determine the pulse duration, notice that:

$$e_G(t) = E_B - (E_B - I_1 R_k + I_2 R_2)\, e^{\frac{-t}{RC}}$$

At $t = T$,

$$I_2 R_k - e_G(T) = \frac{E_B - I_2 R_k}{\theta_1}$$

Substitute (e) for $e_G(t)$ in (f), and

$$e^{\frac{-T}{RC}} = \frac{\left(1+\frac{1}{\theta_1}\right)(E_B - I_2 R_k)}{E_B + I_2 R_2 - I_1 R_k}$$

from which

$$C = \frac{T}{R \ln \left[\frac{E_B + I_2 R_2 - I_1 R_k}{\left(1+\frac{1}{\theta_1}\right)(E_B - I_2 R_k)}\right]}$$

REFERENCES

1. **Principles of Radar,** M.I.T. Radar School Staff, McGraw-Hill, 1946, pp. 2-53 to 2-58.
2. **Waveforms,** B. Chance, McGraw-Hill, 1949, pp. 166-171.

Philco Introduces Microwave Housing

To protect microwave antennas from the elements, tampering and vandalism, a new type of shelter for microwave repeater stations has been designed by Philco engineers.

Parabolic microwave anterna dishes are mounted within this shelter above the microwave repeater equipment and just under the ceiling, aimed upwards at passive reflectors mounted on the tower. Passive reflectors are used to deflect the radiated beam in the desired direction, obviating the need for long waveguide runs and permitting indoor installation of the antenna dishes.

A pressed fiberglas window is installed in the sloping roof of the shelter directly above each antenna dish.

MASTER SWITCHER

(*Continued from page* 30)

USE at the upper panel and audio IN USE plus video PRESET at the lower panel or vice versa. This is not good practice, and the operators have been urged to keep the audio-video PRESET and IN USE function in synchronization.

In the PRESET condition, the tally lights are lit through the program selector push-buttons. In the IN USE condition, the tally lights are lit through a tally circuit on the program relays, which will not function unless the corresponding relay picks up.

Whenever the VIDEO PLUS AUDIO tally lights are on, the audio program switching is automatically controlled by the video program selector. Under these conditions, the controls which have been provided for audio switching are disabled. However, the audio tally lights still light to indicate that the corresponding audio program relay has been picked up.

A simple impedance matching device has been employed in the audio program circuit input to the master control switchers. The audio program sources have been set to transmit at 150 ohms impedance. Each of these sources is terminated at each of the four channel inputs in 600 ohms, for an effective impedance of 150 ohms. A 600 ohm outgoing channel is switched to the program source in place of the 600 ohm termination when the program is selected. This maintains the desired impedance match and eliminates annoying switching disturbances in the audio output.

Video is handled in the usual manner in the switcher. The high impedance cathode follower output is coupled to a bridging distribution amplifier with a short length of low capacity RG-62U cable. The output of this distribution amplifier is fed to a stabilizing amplifier which feeds the outgoing line. The stabilizing amplifier monitoring output provides a signal at the channel monitor and elsewhere as required. Remote controls at the channel switcher make possible continuous adjustment of the output stabilizing amplifier.

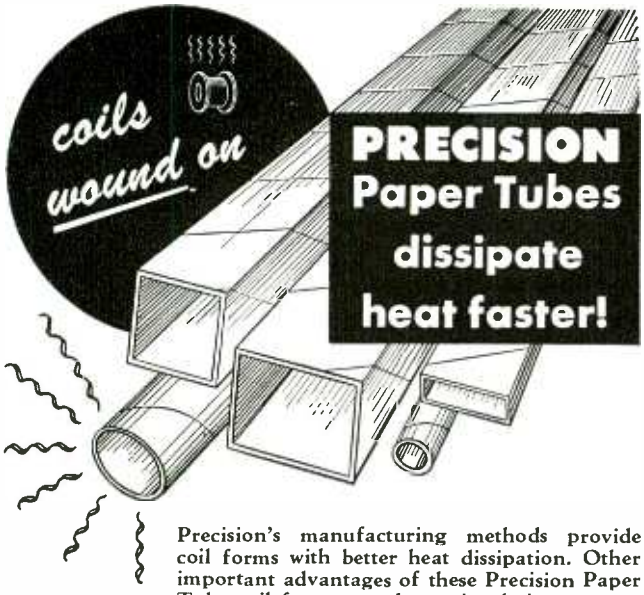
Complete monitoring facilities for both audio and video programs are provided in the left section of the MC channel. The loudspeaker is mounted overhead in a suitable enclosure. Audio program level and monitor controls are located beneath the video master monitor.

The two preview channels are used solely for video. A standard push-button selector is employed to operate the TS-20A relays. The distribution amplifier output is fed directly to a master monitor where it is terminated. A feature of the preview position is the input stabilizing amplifier remote control panel located nearby. Each of the video inputs to the MC switcher is the output of a stabilizing amplifier. The stabilizing amplifier remote controls make it possible to match the inputs to the MC switcher by adjustment at the preview position.

This project was conceived and developed by the WOR-TV Engineering Department in cooperation with RCA.

Ferrite Core Production Speed-Up Seen

Pointing the way toward a break-up of one of the biggest bottlenecks in television receiver production. Lyle G. Hall president of the Stackpole Carbon Co., St. Marys, Penna. has announced the signing of a comprehensive working agreement designed to bring Allen-Bradley Co., Milwaukee, Wis. into the manufacture of Ferrite components molded from powders under license by the Phillips' Laboratories, Inc.



Precision's manufacturing methods provide coil forms with better heat dissipation. Other important advantages of these Precision Paper Tube coil forms are: better insulation, greater moisture resistance, greater strength with less weight. Precision Paper Tubes are made of finest dielectric Kraft, Fish Paper, Cellulose Acetate, or combinations. Round, square, oval rectangular—any shape, length, ID or OD—exactly to your specifications. Let us make up a sample for you.

Write today for new mandrel list of over 1,000 sizes.

PRECISION PAPER TUBE CO.

2057 W. Charleston St., Chicago 47, Ill.
PLANT #2: 79 Chapel St., Hartford, Conn.
Also Mfrs. of Precision Coil Bobbins

The
GUARDIAN
Series 220 A.C.
RELAY

Series 220 operates as an A.C. Relay capable of breaking currents up to 20 amps. at 230 v., 60 c., A.C., non-inductive load. Contacts are same alloy used in Guardian Solenoid Contactors, specially compounded to withstand high loads. Dual contacts reduce arcing to a minimum. Standard hermetically sealed unit weighs 6.2 ounces. Highly insulated. Compact. Low priced.

GUARDIAN ELECTRIC
1607-L W. WALNUT STREET CHICAGO 12, ILLINOIS
A COMPLETE LINE OF RELAYS SERVING AMERICAN INDUSTRY

FREE BOOKLET

shows how 15 products are improved with G-E Glow Lamps!

SEE specific suggestions for improving the usefulness and sales appeal of home appliances, wiring devices, industrial equipment with G-E Neon Indicator Glow Lamps. Glow Lamps give off practically no heat, require a minimum of current, withstand severe vibration and shock, generally last for the life of the product.

WRITE NOW *for this free, informative booklet to Lamp Department, Div. 166-TT10, General Electric Company, Nela Park, Cleveland 12, Ohio.*

GE LAMPS

You can put your confidence in—

GENERAL ELECTRIC

BULLETINS

Mobile Equipment

Uni-channel and Sensicon models of mobile and base station equipment are described in new literature being distributed by Motorola Inc., Chicago 51, Ill. Units cover the 25-50 MC and 152-174 MC bands in 30-watt and 60-watt outputs.

Connector Dust Caps

Cannon Electric Co., 3209 Humbaldt St., Los Angeles 31, Calif., has developed a complete line of new plastic protective dust caps designed to provide a covering for Type AN Connectors and other industrial fittings. The caps are available in three basic types to fit cupling end and conduit of AN3100, AN3101, AN3102, AN3106, AN3107 and AN3108 connectors, sizes from 8S to 48.

Vibrator Converters

Cornell-Dubilier's new Catalog No. 410 on its line of Powercon vibrator converters is a combination catalog and manual that also will serve as a handy reference and guide. Twenty-two models in five different types are covered — dc and ac converters, phone-motor and record player converters, battery charges and eliminators, dc to dc converters, dc and ac (mobile and fixed station) dual-operation converters. Each model is illustrated and described in detail.—Address inquiries toff **Cornell-Dubilier Electric Corporation, South Plainfield, N. J.**

Microwave Communications

A brochure describing Philco Microwave Communications Systems and Philco pulse amplitude modulated (P.A.M.) multiplex terminals is now available for distribution. Copies may be obtained by writing—**Philco Corp., Industrial Div., Philadelphia 34, Pa.**

Measurements Notes

Measurements Corp. of Boonton, N. J., manufacturers of electronic test equipment have announced the publication of the second issue of "Measurement Notes." This four page brochure describes the measurement of the impulse noise susceptibility of receivers.

Shock Machines

A new 7-page illustrated bulletin describes the design features of the Barry 150 VD medium impact shock machine and the characteristics of the deceleration-time pulse to which equipment undergoing test can be subjected. The Type 150 VD permits tests for complete compliance with Specifications AN-E-19. This unit is a product of the **Barry Corp., 179-4 Sidney St., Cambridge, Mass.**

Variable Transformers

The Superior Electric Co., Bristol, Conn., has published a new bulletin (No. P550) on its line of Powerstat variable transformers. Motor Drives, oil-cooled models, explosion-proof models, line correctors and Voltbox ac supplies are included.

Mobile Radio for Arkansas Game Commission

Equipment for the largest two-way mobile radio communication system to be established by any fish and game commission in the United States will be supplied by the RCA Engineering Products Department to the Arkansas State Fish and Game Commission.

Under terms of a contract recently awarded to RCA, six 250-watt Fleetfone main station equipments, twelve 30-50 megacycle station receivers, one hundred and twenty-five 60-watt mobile Fleetfone units, two complete microwave radio relay stations, and remote control units and test equipment will be supplied to the fish and game authorities.

PERSONNEL

John T. Wilner, engineering director of Stations WBAL and WBAL-TV, Baltimore, Md., has been elected vice-president in charge of engineering of Hearst Radio, Inc. Wilner, former engineer-in-charge of CBS television development, is the inventor and designer of numerous video circuit refinements, including an electronic horizontal wipe.

Dr. Peter Goldmark, head of CBS Research Division has been elected a vice president of the Columbia Broadcasting System. The announcement was made a few days after the FCC's tacit approval of the CBS field sequential color TV system.

Roy W. Augustine has been appointed engineer on a special new-product development program for the Muter Company, Chicago, which is the parent corporation for both the Rola Company and the Jensen Mfg. Company. Mr. Augustine is a radio pioneer who founded both the Joy-Kelsey Company, early radio-set makers, and the Oxford Company, speaker manufacturers. Prior to World War II, he headed engineering and sales for the Utah Company, resigning to aid in the war conversion of the Kellogg Switchboard Company.

Ferrite—Core Yoke

(*Continued from page* 44)

The yoke cap meets the requirements of the Underwriters' Laboratories "Standard for Power-Operated Radio Receiving Appliances", November 5, 1942, to render a live part inaccessible. The cap covers the yoke termina's with insulating fiber 1/16 in. thick, wax impregnated for moisture resistance. The cap snaps into position over two protruding lugs on the case. It may be removed for changing damping resistors or capacitors by inserting a broad-bladed screwdriver between the cap and case at one of the notches.

The mounting bracket used on the first post-war yoke was a four-piece assembly adapted for mounting on the uneven surface resulting from random winding the iron-wire core. The new yoke, built with an even-surfaced ferrite core, permits combining the bridge and band into one part with a speednut for rapid and secure mechanical assembly. The material used for the band is tempered steel. During assembly, the band is opened wide over the core and then tightened about the complete yoke with minimum deformation of the mounting bridge. Present practice in television receiver production is to ship

receivers with the kinescopes in operating position. The use of this bracket for the yoke assembly facilitates this practice in that a secure mounting is provided for the yoke.

During the development of the first RCA deflecting yokes, samples were made having a molded spool inside the case in order to replace the paper washers and paper insulation to improve the insulation characteristics. Costs of this assembly, however, were prohibitive for a commercial component. The present low-cost design was then developed which combines the spool and the terminal assembly, and eliminates the case. Improved insulation between the core and coils plus a terminal section for lead assembly is provided.

Functional requirements of the case include:

(1) the case must be locked to the coil structure,
(2) the case must be locked to the core,
(3) the terminal mounting holes should be made without requiring retractable pins in the mold,
(4) protruding lugs should be provided to assemble the cap over the terminals.

To lock the case to the coil structure, two narrow ridges are molded in the inside of the spool which engage the openings between the vertical coils. These ridges are very narrow so that the coils almost butt together. To lock the core to the case, a ridge is left on the outside diameter of the case which engages a slot in the core. The terminal holes near the edge of the case are designed so that a straight draw can be made when the case is molded, thus reducing the cost of the mold and, of course, the cost of the finished product. The cap is locked on by the two triangular lugs on the outside surface of the yoke case near the terminal end. These engage with two square holes in the cap.

The characteristics of the material used for the core, (general-purpose phenolic), are well known and meet all mechanical and electrical requirements of this application. This material was chosen over lower-cost injection-molded thermoplastics because of its mechanical stability at elevated temperatures, freedom from distortion, and mechanical strength.

The coils are wound to approximately final shape by means of special tension devices and arbors. After winding, the coils are dipped in cement, dried, heated and molded

FERRITE–CORE YOKE

(*Continued from preceding page*)

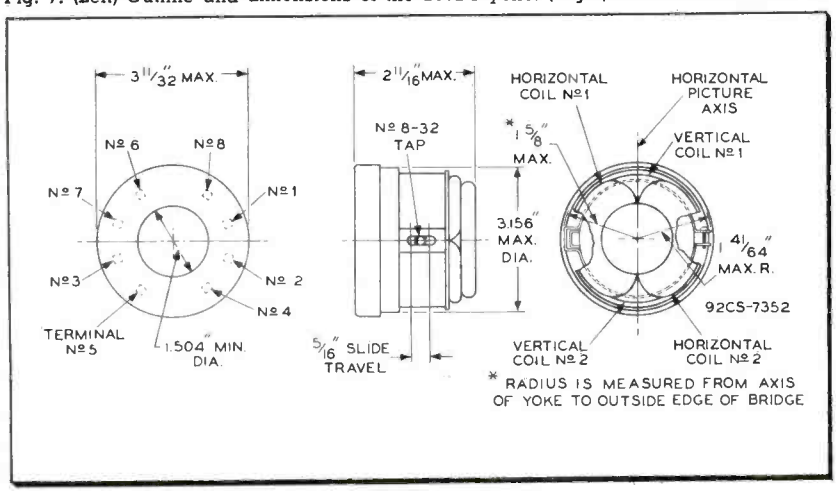
to their final shape.

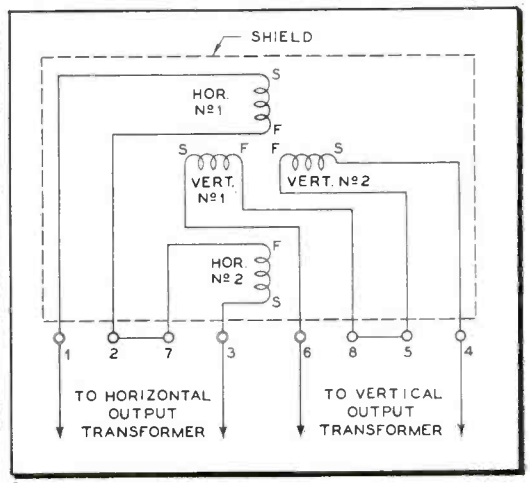
The coil configuration permits mechanized assembly for low-cost and precise mechanical alignment by means of the coil assembly fixture shown in Fig. 5.

The coil assembly, core, and mounting bracket are combined into a complete yoke in the final assembly fixture shown in Fig. 6. The lead exit hole in the case is indexed, and both case halves, when assembled, will be correctly oriented with respect to the coil assembly. The cores will be oriented on the case because of the key in the outer surface of the case and the keyway in the inside surface of the ferrite core. The fixture will locate the mounting bridge in the proper position with respect to the coils.

The yoke coils are tested for continuity and shorted turns after molding; the completed yoke is tested for interconnection of the coils, continuity of the coils, cross talk, voltage breakdown, and induced voltage. Horizontal coils are tested with an induced voltage of 4500 peak volts, and the vertical coils are tested with an induced voltage of 900 peak volts. These tests detect faulty or damaged insulation on the wire, incorrect number of turns on the yoke coils, lead dress of conductor extensions or of interconnecting jumpers, and incorrect coil alignment.

Fig. 7: (Left) Outline and dimensions of the 206D1 yoke. (Right) Schematic diagram of yoke showing horizontal and vertical coil connections





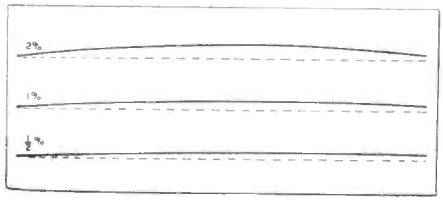


Fig. 8: Curves for barrel or pincushion

The final yoke test is a performance test made in a television receiver which is adjusted for proper operation with a calibrated standard yoke.

The final physical dimensions and electrical characteristics were the result of many considerations, but the foremost objective was to develop a low-cost yoke with improved deflection sensitivity which could be used to scan the 70°-angle 16GP4 kinescope and provide a high-quality picture. The dimensional outline and schematic of the 206D1 is shown in Fig. 7.

The yoke is designed to give a rectangular raster on the kinescope with a variation tolerance from rectangularity amounting to ±2% in barrel, pincushion, parallelogram, and trapezoid. Curves shown in Fig. 8 were developed to be used in conjunction with a "bar" pattern on the kinescope to make the pincushion measurement easier and more accurate.

Vertical and horizontal deflection may vary +5% or −3% from an approved standard. The maximum rated peak-to-peak voltage across the horizontal coils of the 206D1 is 2500 volts for a maximum duration of 7 μseconds; the maximum rated peak-to-peak voltage across the vertical coils is 800 volts for a maximum duration of 100 μseconds. For direct-drive deflection circuits, a similar yoke with additional insulation has been designed which will permit a maximum voltage across the horizontal coils of 3000 volts for a maximum duration of 7 μseconds.

The rated maximum peak-to-peak sawtooth current in the horizontal coils of the 206D1 is 1 amp. for a scanning speed of 15750 cps; and the rated maximum peak-to-peak sawtooth current in the vertical coils is 320 ma for a scanning speed of 60 cps. With yokes which require inductance values other than those of the 206D1, these maximum values of sawtooth current will be different.

In addition to the foregoing tests, the ferrite-core yoke operated satisfactorily when it was tested in a television receiver after 150 hours in a chamber having a relative hu-

Ferrite—Core Yoke

(Continued from preceding page)

midity of 95% and a temperature of 120°F.

When a kinescope with a relatively flat face is scanned through a wide deflection angle, and the beam is adjusted to focus in the center area, the beam will have passed focus and spread slightly before reaching the screen edges. This deflection defocusing is usually negligible but can be corrected.

A more important cause of poor resolution, however, is distortion caused by asymmetric magnetic fields affecting the beam during its path from cathode to screen. These fields may include the fields of the ion-trap magnet, focusing coil, and deflecting yoke. The amount of distortion caused by several deflecting yokes was evaluated, using a kinescope with electrostatic focus and a straight gun (no ion-trap). Under these test conditions, the yoke performance was not affected by asymmetry of the focusing coil and ion-trap fields. Yokes made with straight and tapered-turn sections, and different core configurations which provided both barrelled and pincushioned patterns (less than 2%) were tested. There was little difference in focus over the total area with either type yoke on a 16GP4 operated with 14 KV on the anode.

To obtain best overall focus and to minimize distortion, the beam should enter the center of the yoke deflecting field. The detrimental effect on corner focus is readily apparent when the ion-trap magnet or focusing coil is misadjusted.

Yokes made with the coil configuration of the original 10BP4 yoke require painstaking alignment of ion-trap magnet and focusing coil when used for 70° deflection. Adjustment of the new 206D1 yoke is less critical, and this feature is of added value because of the general practice of tilting the focus coil for centering the raster.

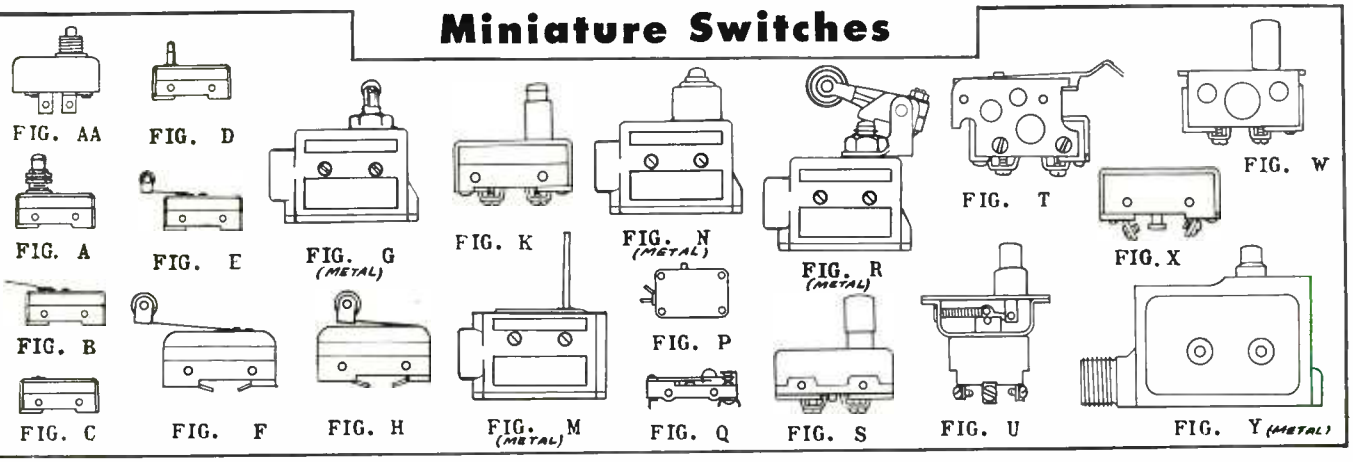
The authors wish to acknowledge the help of the following members of the RCA Tube Department: Mr. Otto Schade who first built a yoke with distributed coil windings of this type to demonstrate the improved focus obtainable with a minimum of adjustment of the ion-trap magnet and focusing coil; Mr. L. E. Swedlund who co-operated in making the final yoke-length adjustment to prevent difficulty with the beam striking the neck of production 16GP4 kinescopes; and, Mr. C. Polk who provided data on ferrites.

ADVERTISERS OCTOBER 1950

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

SAVE on Miniature and Toggle Switches at WELLS

Miniature Switches



STOCK NUMBER	MANUFACTURER	MFR. TYPE NO.	CONTACTS	ILLUSTRATION	PRICE EACH
305-10	Microswitch	WP3M5	N.C.	FIG. AA	$0.40
305-160	Microswitch	WP-5M3	N.C.	FIG. AA	.40
307-210	Microswitch	YP3A	N.O.	FIG. AA	.50
303-67	Microswitch	YZ7RA6	N.O.	FIG. A	.71
PH-100	Acro	R0182T	N.O.	FIG. A	.71
301-46	MU-Switch	MLB-321	SPDT	FIB. B	.85
301-93	Microswitch	YZ-2YLTC1	SPDT	FIG. B	1.01
301-30	MU-Switch	R02M	SPDT	FIG. B	.95
301-78	MU-Switch	Green Dot	SPDT	FIG. B	.75
303-79	Microswitch	BZ-RL32	SPDT	FIG. B	.75
303-85	MU-Switch	MLB329	SPDT	FIG. B	.67
305-154	Acro	XD4-5L	SPDT	FIG. B	.78
311-130	Acro	— —	SPDT	FIG. B	.70
PH-101	Microswitch	BRL18	SPDT	FIG. B	.78
PH-102	Microswitch	YZRL812	N.O.	FIG. B	.65
PH-104	Microswitch	YZ3RLTC2	N.O.	FIG. B	.64
PH-105	Microswitch	YZR31	N.O.	FIG. C	.53
PH-106	Microswitch	R-R36	N.C.	FIG. C	.50
PH-107	Microswitch	BR-26	N.C.	FIG. C	.53
PH-108	Microswitch	WZ-2RT	N.C.	FIG. C	.50
305-161	Microswitch	YZ3R3	N.O.	FIG. C	.71
311-115	Microswitch	WZR31	N.C.	FIG. C	.71
311-123	Microswitch	WZ-7R	N.C.	FIG. C	.60
311-126	Acro	HRRC7.1A	N.C.	FIG. C	.50
311-125	Acro	HRR07.1A	N.O.	FIG. C	.53
311-121	Microswitch	WZ7RTC	N.C.	FIG. C	.50
311-128B	Microswitch	YZ	N.O.	FIG. C	.53
370-6	Microswitch	X757	N.C.	FIG. C	.45
PH-119	Microswitch	WZR-8X	N.C.	FIG. C	.45
PH-109	Microswitch	RRS13	N.C.	FIG. D	.45
PH-110	Microswitch	BRS36	SPDT	FIG. D	.53
PH-111	Microswitch	GRS	N.O.	FIG. D	$0.49
311-116	Microswitch	SW-186	N.C.	FIG. D	.63
303-49	Microswitch	YZ2YST	SPDT	FIG. D	.68
309-93	Microswitch	BRS36	SPDT	FIG. D	.68
307-17	MU-Switch	QRS	SPDT	FIG. D	.75
PH-112	MU-Switch	MBW	SPDT	FIG. E	.72
311-25	MU-Switch	CUN24155	N.C.	FIG. E	.85
370-10	Acro	R02M12T	N.O.	FIG. E	.70
303-32	Microswitch	YZ-3RW2T	N.O.	FIG. F	.65
306-10	Microswitch	BZE-2RQ9TM1	SPDT	FIG. G	2.48
PH-120	Microswitch	YZ7RQ9T6	N.O.	FIG. G	.75
309-101	Microswitch	BZ-2FW221	SPDT	FIG. H	.95
PH-113	Microswitch	RZBQT	SPDT	FIG. K	.58
L306-1010	Acro	R07-8586	N.O.	FIG. K	.55
370-18	Acro	HR071P2TSF1	N.O.	FIG. K	.60
370-19	Microswitch	YZRQ41	N.O.	FIG. K	.65
370-8	Microswitch	RN-11-H03	SPDT	FIG. M	1.50
309-157	MU-Switch	— —	N.C.	FIG. N	1.15
370-15	MU-Switch	AHB203	SPDT	FIG. N	1.25
370-7	Microswitch	WZE-7RQTN	N.C.	FIG. N	1.35
305-11	Acro	2M031A	N.O.	FIG. P	.37
305-50	Microswitch	Open Type	SPDT	FIG. Q	.35
303-84	Acro	HR07-4PST	N.O.	FIG. S	.50
303-83	Microswitch	YZ-RQ4	N.O.	FIG. S	.50
PH-114	Microswitch	WZR-31	N.C.	FIG. T	.65
PH-115	Cutler Hammer	8905K564	DPDT	FIG. U	.65
PH-116	Microswitch	WZRQ41	N.O.	FIG. W	.60
PH-118	Microswitch	BZRQ41	SPDT	FIG. W	.60
311-128A	Microswitch	YZ-RTX1	N.O.	FIG. X	.90
PH-117	MU-Switch	Z	N.C.	FIG. Y	1.35

Toggle and Push Switches

STOCK NUMBER	FIG.	CONTACT ARRANGEMENT	MANUFACTURER & NUMBER	PRICE EACH
PH-500	A	SPDT	B1B	$0.35
PH-501	A	SPDT	AN3022-3B	$.35
PH-503	A	SPDT CENTER OFF MOM EACH SIDE	B11	.32
PH-505A	A	SPDT MOMENTARY	B21	.30
PH-505	A	SPST	AN-3022-2B	.30
PH-506	A	SPDT CENTER OFF	AN-3022-1	.35
PH-507	A	SPDT CENTER OFF MOM EACH SIDE	AN-3022-7B	.32
PH-508	A	SPST MOMENTARY	AN-3022-8	.28
PH-513	A	SPDT CENTER OFF	CH AN-3022-1B	.38
PH-514	A	SPST	CH B-5 A	.35
PH-516	A	SPST	B5	.35
LT-104	A	SPDT 1 SIDE MOMENTARY	CH 8905K568	.35
309-168	A	SPST	168553	.30
370-1	A	SPST MOMENTARY	CH AN-3022-8B	.25
370-4	A	SPDT CENTER OFF	CH B-9A	.35
370-14	A	SPDT CENTER OFF 1 SIDE MOM.	CH B-7A	.30
370-25	A	SPST MOMENTARY	CH B-6B	.25
305-171	A	SPDT CENTER OFF MOM 1 SIDE	8209K5	.32
309-169	B	SPST MOMENTARY	CH B-19	.35
PH-509	C	DPST	AN-3023-2B	.45
PH-510	C	DPDT MOMENTARY	CH 8715K2	.50
PH-511	C	DPDT MOMENTARY	CH 8715K3	.50
PH-512	C	DPST CENTER OFF	CH 8720K1	.55
PH-515	C	DPDT CENTER OFF	C-9A-8700K2	.55
PH-517	C	DPDT	C-5A-8701K2	.55
303-65	C	DPST	CH AN-3023-2	.45
305-174	C	DPDT CENTER OFF MOM 1 SIDE	AN-3023-5	$0.51
305-177	C	DPDT CENTER OFF MOM EACH SIDE	C-3	.50
305-176	C	DPDT CENTER OFF MOM EACH SIDE	AN-3023-7	.50
305-173	C	DPDT	8710K3	.55
305-175	C	DPDT CENTER OFF MOM EACH SIDE	3712K3	.50
305-179	C	DPDT CENTER OFF MOM EACH SIDE	8732-K2	.50
309-163	C	DPDT CENTER OFF MOMENTARY	CH C-11	.55
309-162	C	DPST	CH C-1	.45
309-164	C	DPST MOMENTARY	CH 8711K3	.40
370-31	C	DPDT	CH C-1B	.55
305-87	D	1 SIDE DPST MOM 1 SIDE SPST	AH & H CH	.95 .22
LT-100	F	SPST	AH & H w/LEADS	.20
LT-101	F	SPST MOMENTARY	CH 8905K12	.75
301-51	G	4PDT MOMENTARY	OPEN FRAME	.25
305-140	H	DT NO MAKE EACH SIDE	CH 8781K3	1.95
309-161	K	SPST	AH & H OPEN FRAME	.75
305-76	L	DPST	AH & H SPECIAL FOR HANDY	.40
301-12	M	DPST	AH & H TALKIE	.25
LT-107	N	DPST		

Distributors: Our standard distributor arrangement applies on these items.

Many More Types in Stock. Send Us Your Requirements.

JUST OUT: CATALOG H500 **Manufacturers, Distributors and Amateurs write for the brand new Wells Electronic Catalog H500. Full of tremendous values in highest quality components.**

WELLS SALES, INC.

Order directly from this ad or through your local parts jobber—

320 N. LA SALLE ST. DEPT. T, CHICAGO 10, ILL.

PRODUCED FOR YOUR REQUIREMENTS
- by the top specialists in the ceramic field

Hi-Q

CERAMIC PLATE CAPACITORS

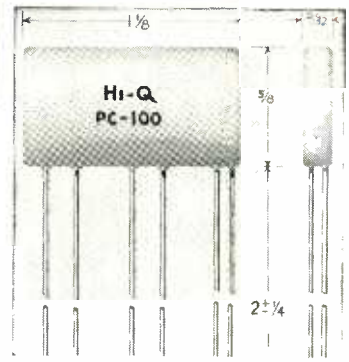
Essentially similar, except in shape, to **Hi-Q** Disk Capacitors except that in the multiple units they do NOT have to have a common ground as is the case with disks. These **Hi-Q** Plates can be produced in an unlimited range of capacities, the number on a plate being limited only by the K of the material and the physical size of the unit. They offer the greatest available capacity per unit volume of any type condenser on the market.

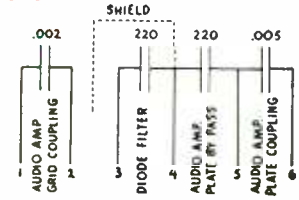
Guaranteed minimum values of capacity up to 33,000 mmf per sq. in. are available. This is based on the use of Body 41 ceramic having 3000 as a dielectric constant "K" and .020 in. thickness and the formula:

$$C \text{ (mmf)} = \frac{.224 \text{ K A (Sq. in.)}}{D \text{ in.}}$$

If temperature compensating ceramics are used, the capacity will be considerably lower. Typical circuits are shown here, but almost any combination can be produced for your specific needs. Consult our engineers for complete details. Write for new **Hi-Q** datalog.

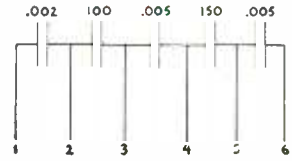
PC-100





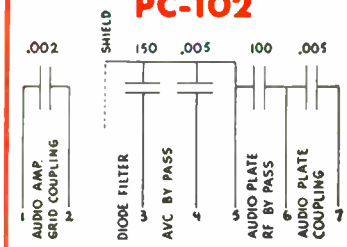
1-2	.002	$+\frac{75}{-25}$ %	mf
3-4	220	$+\frac{50}{-50}$ %	mmf
4-5	220	$+\frac{50}{-50}$ %	mmf
5-6	.005	$+\frac{75}{-25}$ %	mf

PC-101



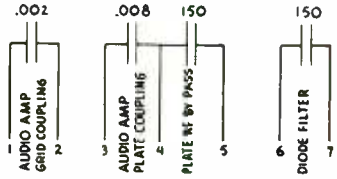
1-2	.002	$+\frac{75}{-25}$ %	mf
2-3	100	$+\frac{50}{-50}$ %	mmf
3-4	.005	$+\frac{75}{-25}$ %	mf
4-5	150	$+\frac{50}{-50}$ %	mmf
5-6	.005	$+\frac{75}{-25}$ %	mf

PC-102



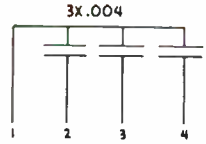
1-2	.002	$+\frac{75}{-25}$ %	mf
3-5	150	$+\frac{100}{-0}$ %	mmf
4-5	.005	$+\frac{100}{-0}$ %	mf
5-6	100	$+\frac{75}{-25}$ %	mmf
6-7	.005	$+\frac{75}{-25}$ %	mf

PC-103



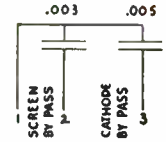
1-2	.002	$+\frac{75}{-25}$ %	mf
3-4	.008	Min %	mf
4-5	150	$+\frac{50}{-50}$ %	mmf
6-7	150	$+\frac{50}{-50}$ %	mmf

PC-104

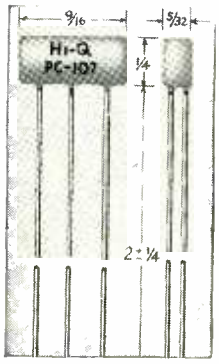


3X .004 Min mf

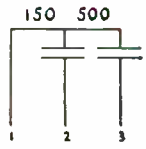
PC-105



1-2	.003	$+\frac{75}{-25}$ %	mf
1-3	.005	$+\frac{75}{-25}$ %	mf



PC-107



1-2	150	$+\frac{75}{-25}$ %	mmf
1-3	500	$+\frac{75}{-25}$ %	mmf

Hi-Q COMPONENTS

Capacitors
Trimmers • Choke Coils
Wire Wound Resistors

BETTER 4 WAYS

- ✓ PRECISION
- ✓ UNIFORMITY
- ✓ DEPENDABILITY
- ✓ MINIATURIZATION

JOBBERS—ADDRESS: 740 Belleville Ave., New Bedford, Mass.

Hi-Q

Electrical Reactance Corp.

OLEAN, N. Y.

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

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

12 REASONS WHY...

it pays equipment manufacturers to deal with RCA

1. RCA Application Engineering Service—welve field engineering specialts devote their time *exclusively* the design problems of equipent manufacturers. They re ady to pitch in and help you any time.

2. RCA Application Engineering Laboratories—RCA maintains application laboratories at Harrison, Lancaster, and Chicago. The services of these laboratories are at the disposal of all RCA tube and component customers

3. RCA Circuit Investigations – RCA carries on independent research in circuit design for the exclusive benefit of its tube and component customers. Engineering reports are provided as a free service.

4. RCA Tube and Component Development—RCA works years ahead in tube and component design—anticipates future requirements. That's why you get the types of tubes and components you want *when* you want them.

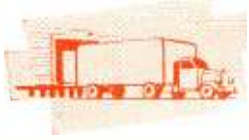
5. RCA Engineering Literature—RCA technical ulletins and data, covering the pecifications and operating conditions of RCA tubes and compoents, are the most authoritative nd comprehensive in the field.

6. RCA Manufacturing Facilities – RCA tubes and components are manufactured in modern plants equipped largely with RCA-designed, precision machinery—your assurance of uniform, dependable quality tubes and components

7. RCA Quality Control—Quality controls begin with the raw material and are followed through in every successive step of manufacture and assembly That's why RCA tubes and components are consistently reliable.

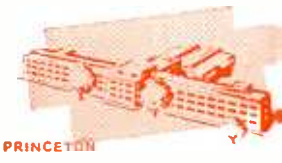
8. RCA Sales and Customers' Service – A staff of seasoned sales representatives are within convenient reach. They're available *when* you want them. In addition, a staff at the Home Office devotes its time *exclusively* to expediting your orders.

9. RCA District Offices—RCA maintains three conveniently located district offices in Harrison, Chicago, and Los Angeles to serve equipment manufacturers. You can get prompt service from the office nearest you.



10. RCA Distribution–RCA maintains bulk tube and component stocks in three warehouses strategically located in Jersey City, Chicago, and Los Angeles for quick service.

11. RCA Pricing–Mass-production techniques and the RCA "Preferred Type Plan" have consistently operated to reduce manufacturing costs—which mean lower prices to you.



12. RCA Engineering Leadership—The vast resources of experience and ability that account for RCA's engineering leadership in tubes and components, are of direct benefit to RCA customers . . . a final reason why it pays to deal with RCA.

Sales and Product Directory

. **General sales information** or requests for application engineering assistnce on receiving and television picture ubes, communications and industrial ubes, power tube fittings, electronic omponents, and test and measuring equipment:

Equipment Sales Field Representatives at the RCA Sales Office nearest you:

City and State	Street Address	Telephone No.
Harrison, N. J.	415 S. 5th St.	Harrison 6-8000
Chicago 11, Ill.	589 E. Illinois St.	Whitehall 4-2900
Los Angeles 13, Calif.	420 S. San Pedro St.	Madison 9-3671

2. Inquiries relative to technical bulletins: Commercial Engineering, RCA, 415 South 5th Street, Harrison, N. J.

3. Orders and inquiries on orders: Tubes: RCA warehouse serving you:

Jersey City Warehouse, RCA
34 Exchange Place
Jersey City 2, N. J.
Phone: Bergen 4-2100

Chicago Warehouse, RCA
589 E. Illinois St.
Chicago 11, Ill.
Phone: Whitehall 4-2900

Los Angeles Warehouse, RCA, 420 S. San Pedro St.
Los Angeles 13, Calif. Phone: Madison 9-3671

RADIO CORPORATION of AMERICA

ELECTRON TUBES AND COMPONENTS — **HARRISON, N. J.**