TELE-TECH

& Electronic Industries

Industry Statistics & Previews for 1955

SHARE THIS COPY!
Please Route to

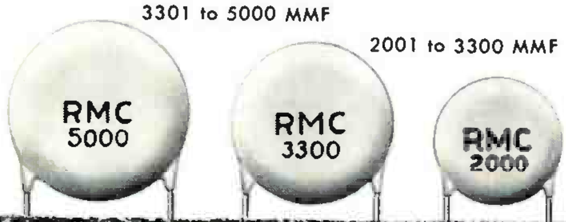
January • 1955
In 2 Sections • Section 1

Caldwell-Clements Inc.

3301 to 5000 MMF

2001 to 3300 MMF

1501 to 2000 MMF



extended temperature range

Close TOLERANCE

Type JL RMC DISCAPS®

Type JL DISCAPS have a very small capacity variation over an extended temperature range. The maximum capacity change between —60°C and +110°C is only ±7.5% of capacity value at 25°C. With a standard working voltage of 1000 V. D. C., they are manufactured in capacities between 220 MMF and 5000 MMF.

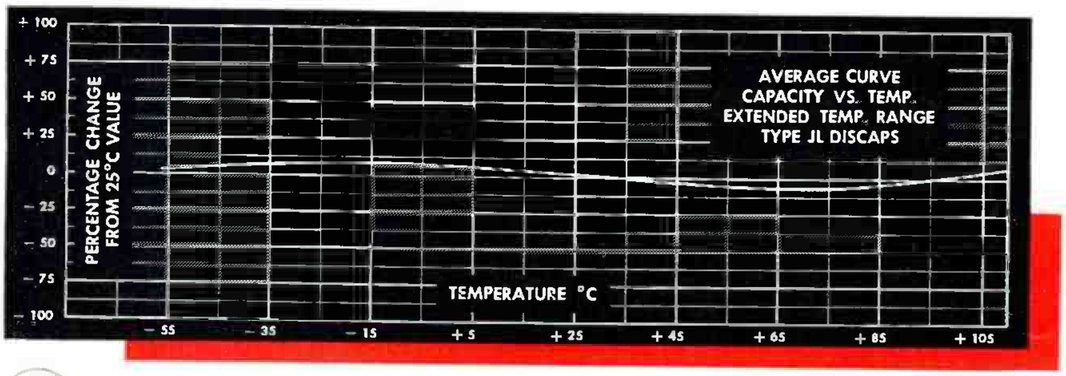
Offering the advantages of longer life, dependability, and lower initial cost, their smaller size and greater mechanical strength provide additional economies in assembly line operations.

Specify Type JL DISCAPS as the cost-saving replacement for paper or general purpose mica capacitors.

220 to 330 MMF

801 to 1500 MMF

331 to 800 MMF



POWER FACTOR: 1% max. @ 1 K C (initial)
POWER FACTOR: 2.5% max. @ 1 K C, after humidity
WORKING VOLTAGE: 1000 V.D.C.
TEST VOLTAGE (FLASH): 2000 V.D.C.
LEADS: No. 22 tinned copper (.026 dia.)
INSULATION: Durez phenolic—vacuum waxed
INITIAL LEAKAGE RESISTANCE: Guaranteed higher than 7500 megohms
AFTER HUMIDITY LEAKAGE RESISTANCE: Guaranteed higher than 1000 megohms
CAPACITY TOLERANCE: ± 10% ± 20% at 25° C

DISCAP
CERAMIC
CAPACITORS

RMC

RADIO MATERIALS CORPORATION

GENERAL OFFICE: 3325 N. California Ave., Chicago 18, Ill.

FACTORIES AT CHICAGO, ILL. AND ATTICA, IND.

Two RMC Plants Devoted Exclusively to Ceramic Capacitors

www.americanradiohistory.com

In Two Sections • Section Two • January • 1955

TELE-TECH
& Electronic Industries

CALDWELL-CLEMENTS, INC. ★ 480 LEXINGTON AVENUE, NEW YORK 17, N.Y. ★ PLaza 9-7880

LOUDSPEAKERS BY University

a complete line for every commercial sound and public address need

REFLEX TRUMPETS
for directional sound projection

Pioneered by University, the most efficient modern method of sound distribution.

- Economical—More sound output for less amplifier power.
- Ruggedly constructed—weatherproof . . . install it and forget it.
- Five trumpet sizes to cover varied response and coverage requirements.

MODEL	GH	LH	PH	SMH	4A4**
LOW FREQUENCY CUTOFF	85 cps.	120 cps.	150 cps.	200 cps.	200 cps.
SOUND DISTRIBUTION	65°	75°	85°	95°	80 degs.
AIR COLUMN LENGTH	6½ ft.	4½ ft.	3½ ft.	2½ ft.	2½ ft.
BELL DIAMETER	30⅞"	25⅝"	20¼"	16¼"	16⅞"
*HORN LENGTH	27⅞"	19"	15¾"	12"	20½"
*SHIPPING WEIGHT	25 lbs.	20 lbs.	11 lbs.	9 lbs.	30 lbs.

**Less Driver Unit*
***This model takes 4 drivers—produces 100 watts.*

RADIAL REFLEX PROJECTORS
for uniform dispersion in all directions

- Reduces the total number of loudspeakers required to cover a given area.
- More efficient—driver-driven radial speakers provide as much as 500% greater output than cone speaker radials.
- Versatile—ideal for spacious areas necessitating suspension installation, such as hangars, church towers, warehouses, etc. Suitable for voice and music.

MODEL	RLH	RPH	RSH
LOW FREQUENCY CUTOFF	120 cps.	140 cps.	180 cps.
SOUND DISTRIBUTION	360°	360°	360°
AIR COLUMN LENGTH	5 ft.	4 ft.	3 ft.
BELL DIAMETER	28⅛"	25⅛"	18⅞"
OVERALL HEIGHT	18½"	14"	11"
SHIPPING WEIGHT	27 lbs.	21 lbs.	18 lbs.

Less Driver Unit

FOR BI-DIRECTIONAL COVERAGE

Model 2W25

- Covers two opposite areas with a single driver unit (driver supplied).
- Reduces installation and equipment costs.
- Versatile bracket arrangement provides 4 different mounting positions.
- Built for continuous heavy duty service.

University

FOR WIDE ANGLE HORIZONTAL DISPERSION
The New COBREFLEX-2

Meets every requirement for:

- Paging and Talk-Back installations
- Fixed or Mobile systems
- Heavy Industry applications
- 2 or 3 way hi-fi systems

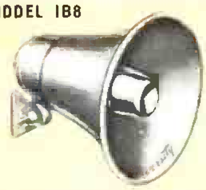
Heavy-duty design provides wide angle dispersion of sound. Use with any University driver. 1-pc. dye-casting.

CMIL CIB

Provide moderate power with maximum intelligibility and wide angle dispersion pattern. Built-in hermetically sealed driver. In 4, 8, and 45 ohms. CIB 12 w, CMIL 3 watts.

PAGING AND TALK-BACK SPEAKERS
for maximum penetration through areas with high noise density.

MODEL IB8



High efficiency provides maximum coverage with minimum power. Features high power capacity . . . high sensitivity . . . rising frequency characteristics.*

MODEL MIL

For installations requiring concentrated power to cover small areas. High conversion efficiency conserves amplifier power, ideal for low level systems.*

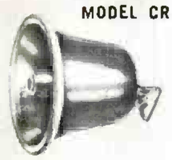
MODEL MIS

Designed for flange or flush mounting in cabinets, walls, ceilings, bulkheads, etc. Ideal for replacement of cone speakers to increase output.*

MODEL IBR

Small radial speakers, complete with built-in driver unit. Affords 360° horizontal dispersion resulting in wide coverage with a minimum of speakers.

MODEL CR



Reflex speaker conservatively rated at 20 watts continuous duty, and featuring built-in driver unit. Excellent tonal balance for music.

**Available in 4, 8, and 45 ohms.*

www.americanradiohistory.com

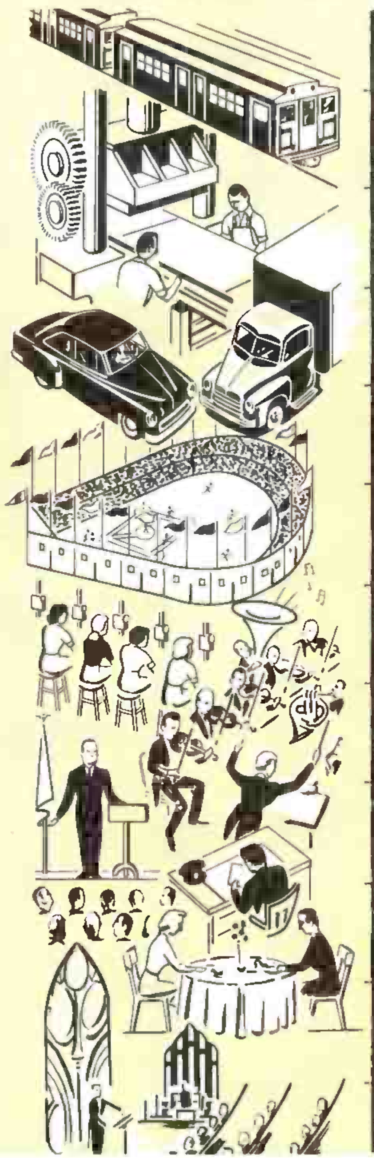
SOUND SYSTEM APPLICATION GUIDE

TELE-TECH *& Electronic Industries*

TELE-TECH *& Electronic Industries*

This guide is a brief basic reference to help audio system planners select the proper components for a number of popular applications. Of course, individual manufacturer's equipment and specific locations may vary somewhat from the conditions described here. Nevertheless, these fundamental specifications are useful in all normal circumstances, and eliminate the hit-or-miss method of audio selection by providing positive criteria for choosing the correct component type and rating.

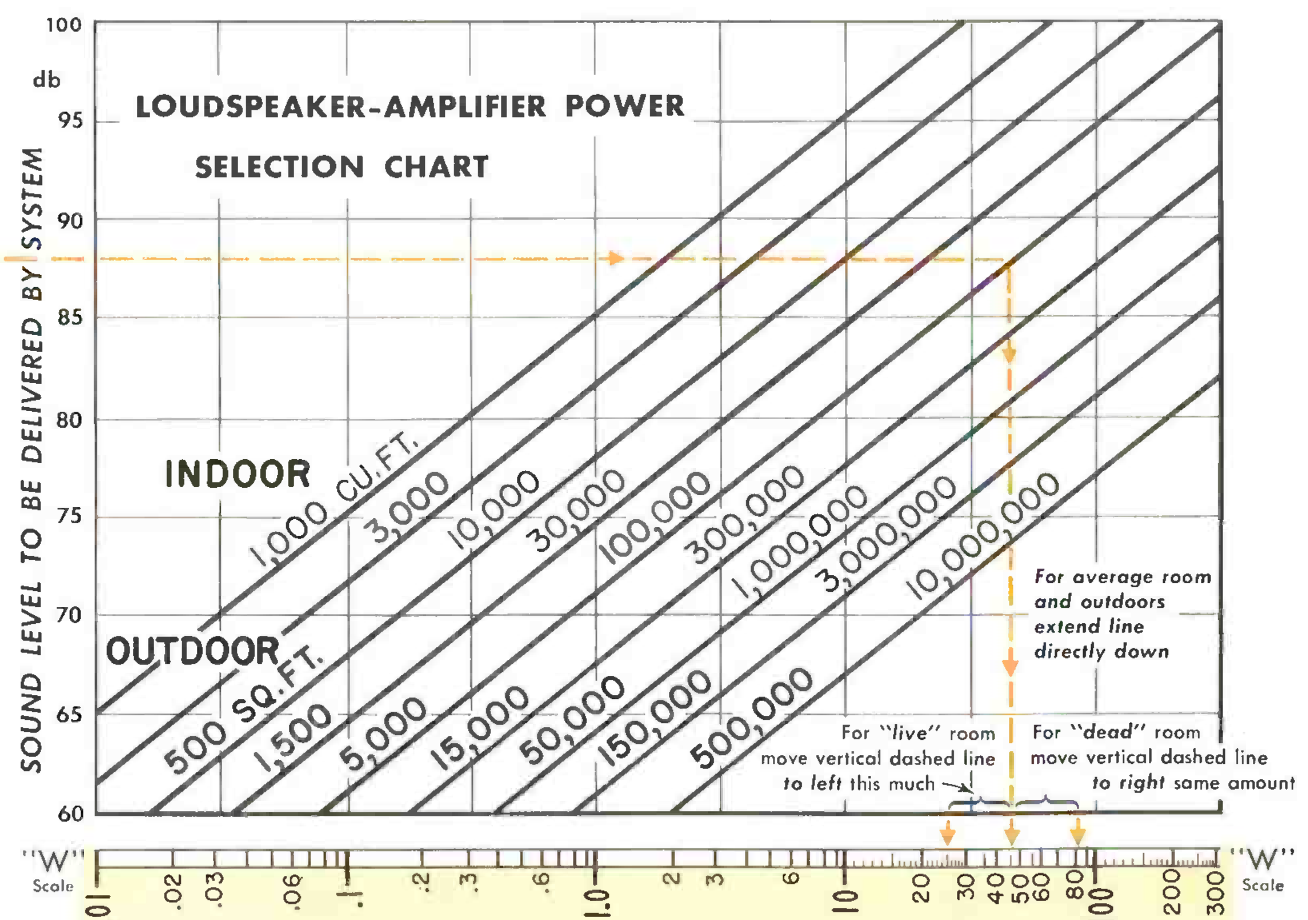
BACKGROUND NOISE LEVEL



TYPICAL APPLICATIONS

db	Typical Applications
100	Boiler Factory Subway Platform Speedboat Race
90	Factory, Heavy Industrial Street Traffic, Very Heavy Baseball Stadium
80	Print Shop Ballroom Factory Assembly Line Railroad Waiting Room Orchestral Music
70	Drive-in Theatre Shipping Room Office, Busy Ordinary Conversation Department Store Auditorium
60	Restaurant Hotel Lobby Residential Street Hospital
50	Church

HOW TO USE CHART: Select background noise level or typical application at left. Next scale to right shows sound level to be delivered by system, normally 10 db above background. Follow line across to right until it reaches diagonal representing indoor volume or outdoor area of proposed installation. From this point drop line vertically to lower "W" scale. "W" scale shows amplifier power required for average room or outdoors when large horn and high efficiency drivers are used. Two types of correction factors are given for conditions where a "dead" room or lower efficiency speakers require more power, or where a "live" room demands less amplifier power.

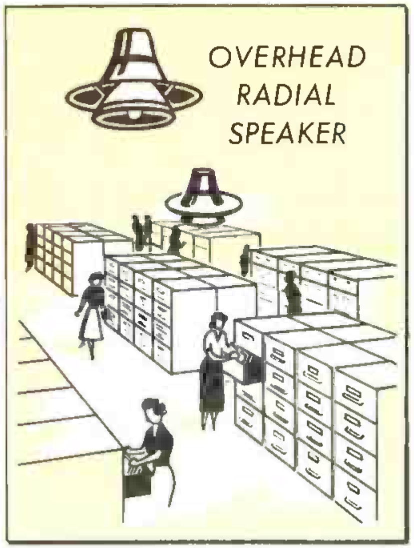


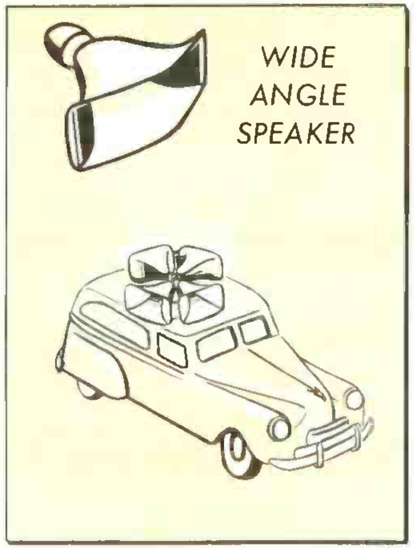
Required Amplifier Power (approx) (watts) = W, for large horns and high efficiency drivers

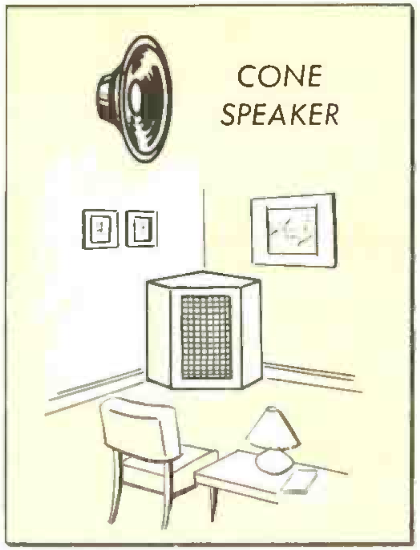
= Wx3, for small paging type projectors

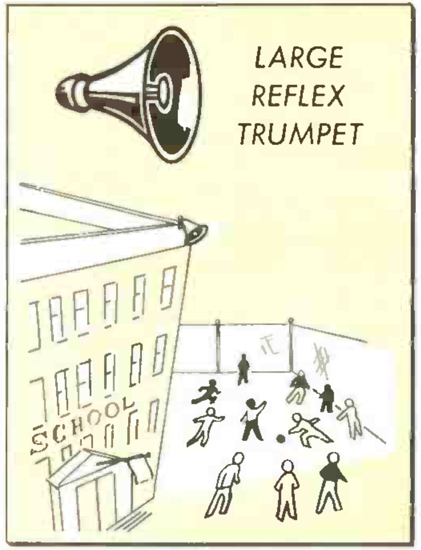
www.americanradiohistory.com

TYPICAL LOUDSPEAKER APPLICATIONS

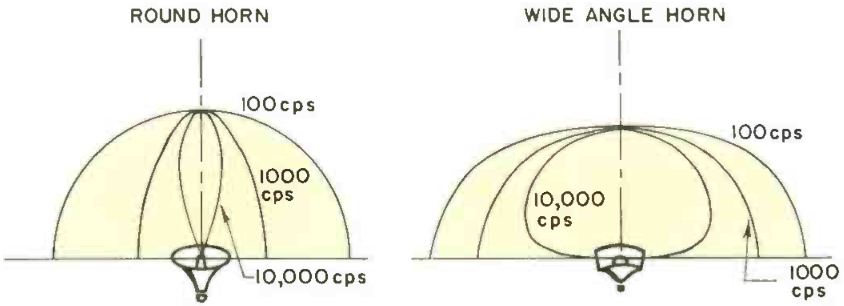




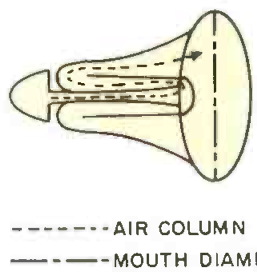




FREQUENCY DISPERSION CHARACTERISTICS OF HORNS

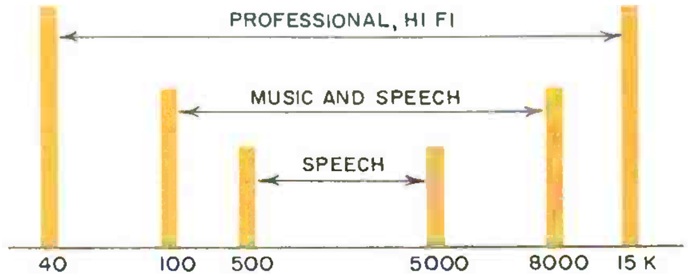


LOW FREQUENCY CHARACTERISTICS OF HORNS

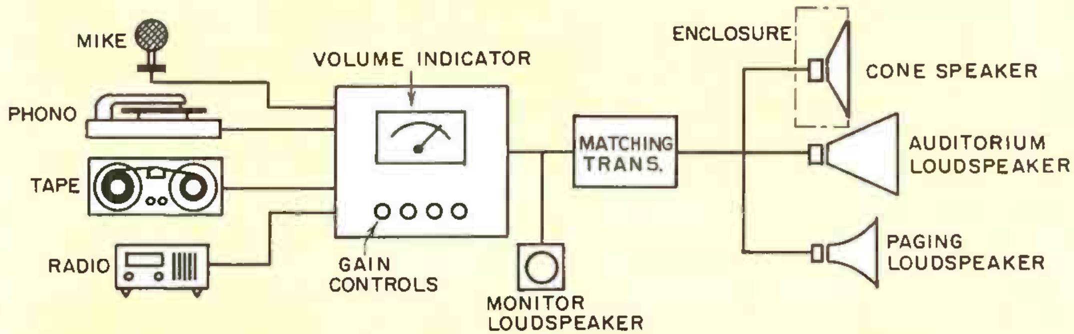


AIR COLUMN LENGTH	MOUTH DIAM	LOW FREQ CUT-OFF
2½'	16"	200
3½'	20"	150
4½'	26"	120
6½'	31"	85 cps

FREQUENCY REQUIREMENTS OF SOUND SYSTEMS



SOUND SYSTEMS COMPONENTS



AUDIO LINE SIZE TABLE

WIRE SIZE (B&S)	LOAD IMPEDANCE 4 OHMS	8 OHMS	16 OHMS
14	125'	250'	450'
16	75'	150'	300'
18	50'	100'	200'
20	25'	50'	100'

MAXIMUM LENGTH OF LINE FOR 15% POWER LOSS — LOW IMPEDANCE LINES

WIRE SIZE (B&S)	LOAD IMPEDANCE 100 OHMS	250 OHMS	500 OHMS
14	1000'	2500'	5000'
16	750'	1500'	3000'
18	400'	1000'	2000'
20	250'	750'	1500'

MAXIMUM LENGTH OF LINE FOR 5% POWER LOSS — HIGH IMPEDANCE LINES

Copyright January 1955 by CALDWELL-CLEMENTS, INC., 480 Lexington Avenue, New York 17, N.Y.

www.americanradiohistory.com

CONE SPEAKERS

for Hi-fi commercial installations — *eliminate distortion and improve quality of low level background music applications*

Model 6200 Extended Range Speaker

Full bodied response to beyond 10,000 cycles makes it ideal for radio, TV and phono applications. Excellent basic unit. Eight ohms impedance, 25 watts power capacity.

Diffusicone—8" and—12" Coaxial Speakers

Exclusive patented "Diffusicone" design with 1000-cycle mechanical crossover results in full fidelity anywhere in the room . . . full undistorted response without loss of highs at listening points progressively off speaker axis. Eight ohms impedance, 25 watts power capacity.

Model 6201 Dual Range System

Acknowledged as the industry's finest value in a high quality 12" loudspeaker. Complete with coaxial tweeter driver and wide angle horn, it is one of the few true dual range systems. Built-in L/C network and balance control. Eight ohms impedance, 25 watts power capacity.

University Loudspeakers are

APPLICATION ENGINEERED

to provide optimum performance with maximum economy.

EXPLOSION PROOF SPEAKERS

designed for hazardous duty

MODEL 7101-7102

Only complete loudspeakers approved by Underwriters' Laboratories for use in locations where flammable liquids, gases, dust and other combustibles are present. Permits use in industries previously denied the advantages of sound, paging, and intercom.

WIDE RANGE WEATHERPROOF COAXIAL SYSTEMS

MODEL BLC

designed to simplify indoor and outdoor "high quality" sound installations.

Two versions of a fine speaker system . . . both offering the finest reproduction found in P.A. The WLC Theatre System has successfully proven itself in deluxe stadium and outdoor theatre installations. The BLC, a smaller, more compact version, is excellent for general application in public address work. Both units feature separate drivers for the woofer and tweeter sections.

MODEL	BLC	WLC
Power Cap.	25 w	30 w
Imped.	8 ohms	8 ohms
Resp.	70-15,000 cps	50-15,000 cps
Disp.	120°	90°
Diam.	22½"	33½"
Depth	9"	20"

RELIABLE RUGGED DRIVER UNITS

with these exclusive built-in features

- W-shaped Alnico 5 magnet results in maximum efficiency by reducing reluctance losses and surface leakage.
- Built-in transformers provide installation flexibility to meet any impedance and constant voltage system requirement.
- Bi-sectional mechanism with foolproof automatic "rim-centered" diaphragm voice coil assembly assures immunity to shock and vibration.
- Full selection to meet all power, frequency response, impedance and mechanical requirements.





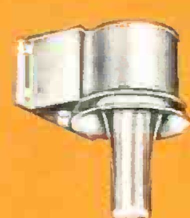
MODEL	PA-30	SA-30	SA-HF	MA-25	T-30
Continuous Power	30 watts	30 watts	25 watts	25 watts	20 watts
Frequency Response	80-10,000 cps.	90-10,000 cps.	90-10,000 cps.	90-6000 cps.	250-15,000 cps
Voice Coil Impedance	16 ohms	16 ohms	16 ohms	16 ohms	8 ohms
Transformer Impedances	165/250/500/1000/2000 ohms	45/165/250/500/1000/2000 ohms	—	—	—
Constant vol. sys. pwr.	30-20-10-5-2½ watts	30-20-10-5-2½ watts	—	—	—
Diameter, Overall	6¾"	5"	4½"	4⅛"	3½"
Length, Overall	6¾"	6¾"	5"	3¾"	3⅞"
Shipping Weight	6 lbs.	5 lbs.	4 lbs.	3½ lbs.	3½ lbs.

SUBMERGENCE PROOF SPEAKERS

immune to salt spray, gases, live steam, fungi, and all harmful dirt and dusts.

Designed to U. S. Navy submergence specs . . . provide reliable uninterrupted service with negligible maintenance under the most gruelling conditions. Numerous commercial and industrial applications: docks, bridges, boiler rooms, mines, railroads, etc.






MODEL	MM-2TC	MM-2F	MSR	MM-2
Continuous Power	15 watts	15 watts	15 watts	15 watts
Impedance	16 ohms	16 ohms	16 ohms	16 ohms
Dispersion	120°	150°	360°	150°
Frequency	300-6000 cycles	300-6000 cycles	250-6000 cycles	300-6000 cycles
Dimensions	10" high 4⅛" depth 6¼" wide	7¼" O.D. 3¾" depth 6⅝" mtg. hole dia.	10¾" high 8¼" depth 7¾" wide	6" O.D. 4¾" depth
Shipping Weight	9 lbs.	5 lbs.	11 lbs.	5 lbs.

Write Desk 49 for latest copy of University Technilog.

University

University Loudspeakers INC.

80 South Kensico Ave.
White Plains, New York

www.americanradiohistory.com

TELE-TECH
& Electronic Industries

JANUARY, 1955

FRONT COVER: ELECTRONIC INDUSTRIES STATISTICS—This month's cover showing a background of interesting industry totals was especially chosen so that this issue will be readily identifiable for reference purposes during the forthcoming year. Facts and figures round-up are an annual feature as well as a monthly feature of Tele-Tech & Electronic Industries. In this issue summotions are presented on pages 3 and 78-79.

SECTION ONE:

SECTION TWO: Sound System Application Guide

DEPARTMENTS

TELE-TECH & ELECTRONIC INDUSTRIES*, Vol. 14, No. 1. Published monthly by Caldwell-Clements, Inc. M. Clements, President; M. H. Newton, Assistant to President; John J. Borghi, Vice President and Secretary; M. B. Clements, Treasurer. Acceptance under section 34.64 Postal Laws and Regulations authorized at Bristol, Conn., June 9, 1954. Additional acceptance at New York, N. Y. 75¢ a copy. Subscription Rates: United States and U. S. Possessions: 1 year, $5.00; 2 years $8.00; 3 years $10.00. Canada: 1 year $7.00; 2 years $11.00; 3 years $14.00. All other countries: 1 year $10.00; 2 years $16.00. Please give title, position and company connections when subscribing. Copyright by Caldwell-Clements, Inc., 1954. Printed in U.S.A.

CALDWELL-CLEMENTS, Inc.

* Reg. U. S. Pat. Off.

Publication Office, Bristol, Conn.

Editorial/Business Offices 480 Lexington Ave., New York 17, N. Y., Tel. Plaza 9-7880

www.americanradiohistory.com

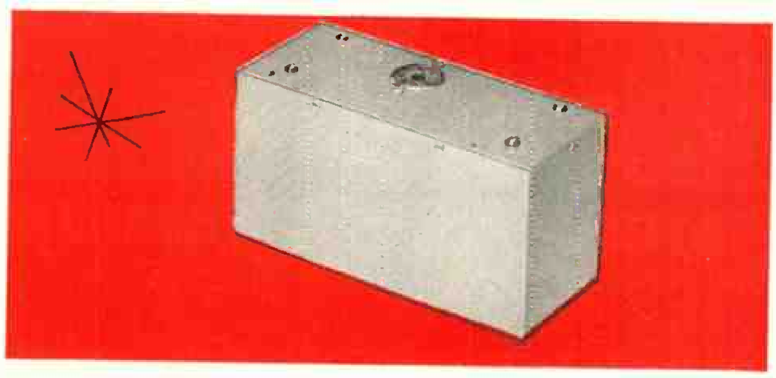
Another Burnell exclusive!

3 BIG REASONS

to check BURNELL first!

ROTOROIDS® A continuously variable, stepless toroidal inductor which can provide a 4:1 range of maximum to minimum inductance in 180° rotation of a shaft. Write for new brochure which gives complete technical data.

TOROIDS Combining the advantages of toroidal type winding with the molybdenum permalloy dust core and other specially selected materials, these toroids provide higher Q than any other structure. They also provide greater stability of inductance vs. temperature and level in a smaller space. Their self-shielding properties permit compact assemblies of coils with a minimum of deleterious effects. Supplied to an inductance accuracy of 1%. Available in standard, miniature and sub-miniature sizes. Also in a wide variety of finishes, including ***for the first time toroids molded in a new special material.***



TELEMETERING FILTERS
Band pass filters available for every channel ranging from 400 to 70,000 cycles for band width between 15 - 40%. Low pass filters available for operation in either unbalanced or balanced line, and range in cut off frequency from 6 up to 10,500 cycles. Also, miniaturized filters that do not sacrifice attenuation characteristics, save up to 80% space.

3 EXTRA REASONS TO CHECK BURNELL FIRST!

- * Proven Top Quality
- * Competitive Prices
- * Prompt Deliveries

Write Department G for Catalog 102A

TELETYPE: YONKERS, N. Y. 3633

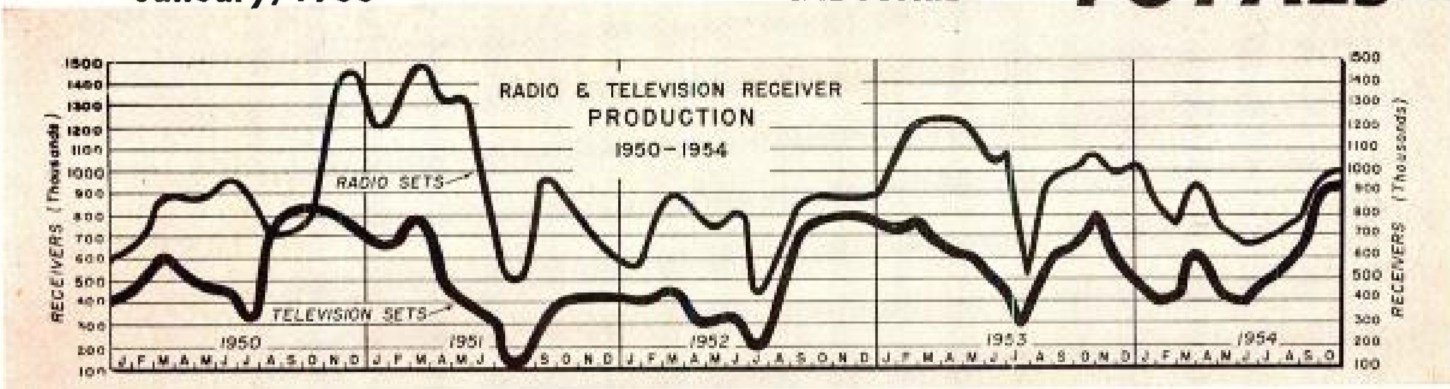
BURNELL & CO., INC.
Yonkers 2, New York

PACIFIC DIVISION: 720 Mission Street, South Pasadena, California

FIRST IN TOROIDS AND RELATED NETWORKS

www.americanradiohistory.com

TOTALS



GOVERNMENT ELECTRONIC CONTRACT AWARDS

This list classifies and gives the value of electronic equipment selected from contracts awarded by government procurement agencies in October-November 1954.

Acoustic Cable Reels, non-mag.	122,516
Actuators	169,128
Amplifiers	539,548
Antennas	657,963
Auto Pilot Syst.	3,001,682
Batteries	33,510
Batteries, dry	1,565,773
Batteries, replenishment	250,928
Batteries, storage	45,097
Beam Guid. Cont. Syst.	146,055
Cable Assys	250,000
Cable, electric	44,512
Carcinatrons	82,339
Chargers, battery	96,780
Chassis, amplifier	652,131
Circuit Breakers	36,248
Communic. Equip., radio	60,363
Comparator Groups	60,192
Components, radio set	120,618
Computers	40,885
Controls, computer	109,541
Controls, radio set	65,633
Converter-Amplifiers	89,846
Data Recording Systems	42,867
Detonating Fuses	4,816,106
Dynamotors	86,698
Earphone Cushions	49,265
Electrodes, welding	68,771
Elements, submarine battery	2,966,764
Exciters	41,300
Film, radiographic	1,737,585
Generators	40,606
Generators, control panel	124,809
Generator Sets, electric	82,342
Generators, signal	251,693
Generators, tachometer	27,131
Gyroscopes, miniature	31,672
Handsets, telephone	76,600
Headset Assys	114,812
Indicators, azimuth-range	456,949
Indicators, pressure	47,049
Indicators, tachometer	245,169
Jack Box Assys, telephone	146,268
Jamming Equipment	100,667
Keyers and Controls	32,447
Kits	803,688
Meters, acft TV	29,536
Microphone Assys	119,563
Motor Generators	1,079,539
Motor & Gear Drive Operators	96,015
Mounts, Torque	684,575
Panels, generator control	29,578
Parts, controller assy	73,154
Potentiometers	34,572
Power Supplies, "Teletype"	97,165
Power Units	35,153
Radio Beacon	63,789
Radiosonde Adapter Syst.	29,814
Receivers, radio	59,245
Receivers, "Rawin"	936,333
Receivers, transistorized	26,835
Receiver-Transmitters, selector control	2,424,660
Receiving Sets, omni-range	149,872
Receptacles, connector	28,093
Recorder-Reproducers	75,873
Rectifiers	140,580
Rectifiers, pic. projectors	183,440
Rectifiers, power unit	202,792
Relays	123,145
Repair and Overhaul, radar	1,070,000
Repair Parts, gyrocompass	74,406
Rheostats	18,072
Screen, X-Ray protective	35,609
Servo Motors	70,000
Sets, radar	14,991,298
Sets, radio	2,727,353
Side Winder Missiles	150,000
Sonar Domes, rubber	298,017
Spare Parts, keyer	271,164
Spare Parts, radar trainer	450,000
Spare Parts, signal gen.	32,292
Sub Assys, switch drive	32,900
Sub Assys, transformer	30,200
Switchboards	489,460
Switching Units	39,669
Targets	19,441
Test Sets, multi-purpose	88,327
Test Units	35,516
Topographic Stereoplotters	35,448
Training Sets, "Radiac"	40,426
Transformers, silicon	326,580
Transmitters	77,780
Transmitters, synch. cont.	61,031
Transistors, infra-red photo	245,148
Tubes, Electron	5,285,039
Video Recording System	28,850

Shown below are charts showing attendance breakdown figures for WESCON 1954 held in Los Angeles last August. Total registration exceeded 22,000. This year's convention will be held at the Civic Auditorium in San Francisco, Aug. 24-26. An even larger registration is expected

1954 WESCON · SHOW REGISTRATION

Pan Pacific Auditorium, Los Angeles

INDUSTRY

OCCUPATION		Manufacturer: Electronic 1	Manufacturer: Other 2	Mfgs. Rep. 3	Trade: Whsle. 4	Trade: Retail 5	Trade: Publisher 6	Govt. 7	Broadcasting: AM-FM-TV 8	Broadcasting: Recording 9	Allied Business 10	TOTALS
MANAGEMENT	Owner 11	537	144	94	160	230	8	0	20	14	50	1266
	Exec. 12	888	258	46	136	47	9	58	34	12	·211	1699
PRODUCTION	Eng. 13	1256	251	31	7	24	0	70	28	12	31	1710
	Other 14	1135	320	27	21	48	0	80	9	10	63	1713
ENGINEERING	Research Design 15	4509	1191	21	25	34	6	779	36	12	297	6910
	Operat. 16	383	145	14	21	57	4	158	151	23	131	1087
	Purchasing Agt. 17	355	66	13	59	10	2	43	5	0	15	568
	Sales or Adv. 18	377	165	256	308	106	33	3	4	5	92	1349
EDUCATION	Stud. 19	108	38	0	0	0	2	78	0	0	55	347
	Teach. 20	25	9	0	0	0	0	29	0	0	58	130
TOTALS		9573	2587	502	737	556	64	1298	287	88	1012	16704

Show registration ......16,704 Unclassified ....175 Exhibitors 3,502
TOTAL SHOW REGISTRATION 20,381

1954 WESCON - CONVENTION REGISTRATION

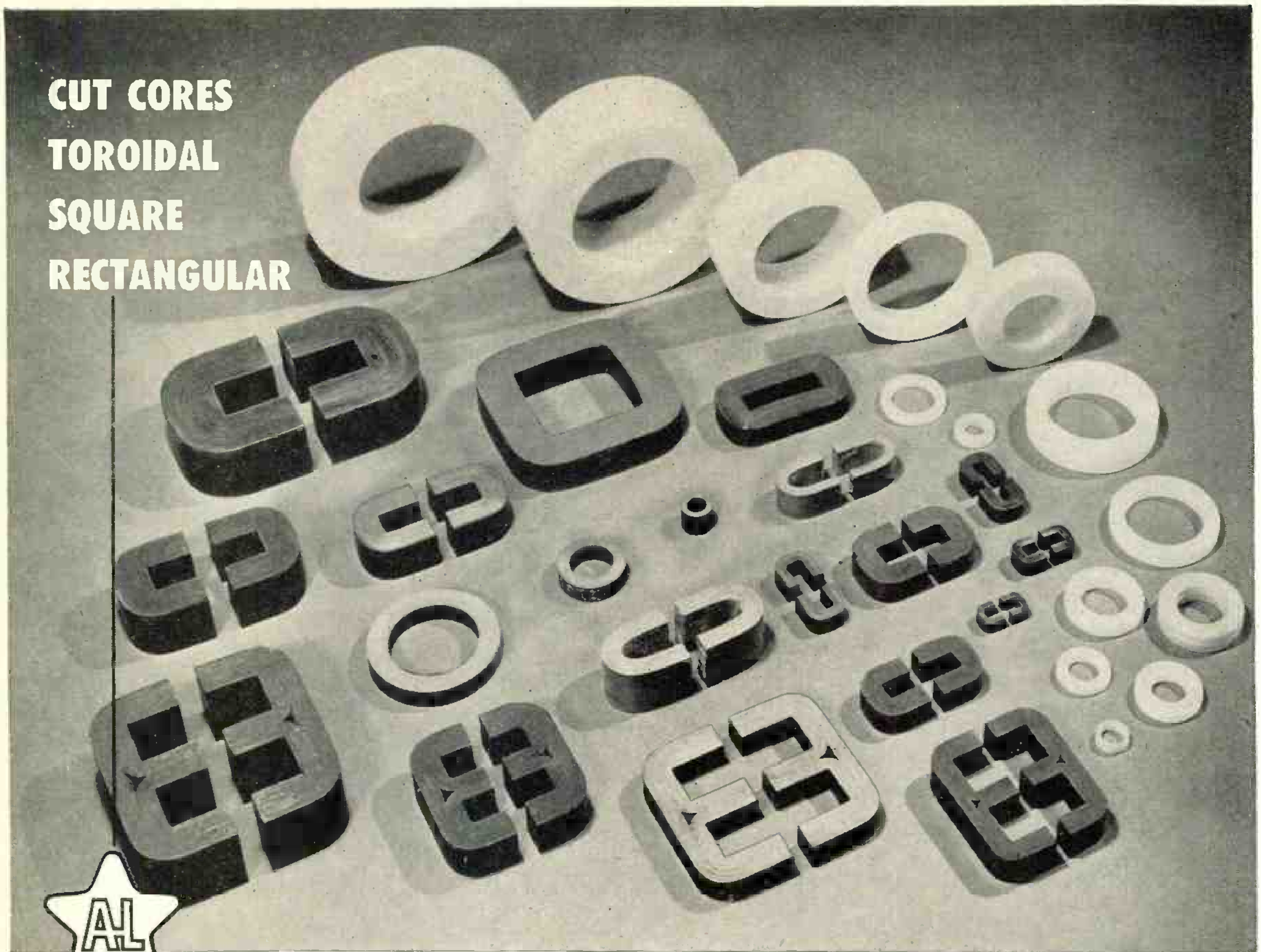
Ambassador Hotel, Los Angeles

INDUSTRY

OCCUPATION		Manufacturer: Electronic 1	Manufacturer: Other 2	Mfgs. Rep. 3	Trade: Whsle. 4	Trade: Retail 5	Trade: Publisher 6	Govt. 7	Broadcasting: AM-FM-TV 8	Broadcasting: Recording 9	Allied Business 10	TOTALS
MANAGEMENT	Owner 11	18	1	10	7	2	0	0	1	1	5	45
	Exec. 12	153	14	5	7	1	0	10	4	2	14	210
PRODUCTION	Eng. 13	66	8	0	0	0	0	8	0	0	3	85
	Other 14	11	4	0	0	1	0	2	0	1	0	19
ENGINEERING	Research Design 15	1407	204	3		0	2	278	5	2	61	1962
	Operat. 16	31	6	2	1	0	0	17	11	0	8	76
	Purchasing Agt. 17	2	0	0	1	0	1	0	0	0	0	4
	Sales or Adv. 18	40	1	9	4	0	1	0	0	0	6	61
EDUCATION	Stud. 19	10	0	0	0	1	0	3	1	0	7	22
	Teach. 20	3	0	0	0	0	0	9	1	0	12	25
TOTALS		1741	238	29	20	5	4	327	23	6	116	2509

IRE Members .... 1,147 Non Members 862
IRE Students .... 114 Speakers 277
Exhibitors .... 109 Unclassified 46
TOTAL CONVENTION REGISTRATION 2,555

www.americanradiohistory.com



Anything You May Need in
TAPE-WOUND CORES

RANGE OF MATERIALS

Depending upon the specific properties required by the application, Arnold Tape-Wound Cores are available made of DELTAMAX . . . 4-79 MO-PERMALLOY . . . SUPERMALLOY . . . MUMETAL . . . 4750 ELECTRICAL METAL . . . and SILECTRON.

RANGE OF SIZES

Practically any size Tape-Wound Core can be supplied, from a fraction of a gram to several hundred pounds in weight. Toroidal cores are made in twenty-seven standard sizes with protective nylon cases. Special sizes of toroidal cores—and all cut cores, square or rectangular cores—are manufactured to meet your individual requirements.

RANGE OF TYPES

In most of the magnetic materials named, Arnold Tape-Wound Cores are produced in the following standard tape thicknesses: .012″, .004″, .002″, .001″, .0005″, or .00025″, as required.

For complete details, write for Bulletins TC-101A and SC-107.

Applications

Let us help with your core problems for Pulse and Power Transformers, 3-Phase Transformers, Magnetic Amplifiers, Current Transformers, Wide-Band Transformers, Non-Linear Retard Coils, Reactors, etc.

ADDRESS DEPT. T-51

W&D 5465

THE ARNOLD ENGINEERING COMPANY

SUBSIDIARY OF ALLEGHENY LUDLUM STEEL CORPORATION

General Office & Plant: Marengo, Illinois

DISTRICT SALES OFFICES . . . New York: 350 Fifth Ave.
Los Angeles: 3450 Wilshire Blvd. Boston: 200 Berkeley St.

www.americanradiohistory.com

SIMPLER MICROWAVE MEASUREMENTS TO SAVE ENGINEERING MANHOURS

MEASURES MICROWAVE POWER WITH ONLY ONE PROBE ...NO BURNOUTS

POWER METER MODEL P-2
DC TO 11,000 MC

Over the entire frequency range DC to 11,000 MC, Polarad's new Micro Power Meter utilizes only one power probe, supplied as an integral part of the instrument. This unique power probe will sustain severe overloads without burnout since it does not contain hot wire barreters or other delicate components.

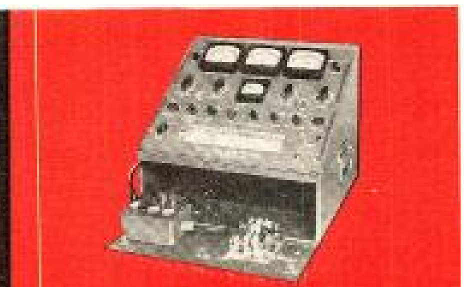
This new rugged and stable instrument reduces microwave power readings to the simplicity of everyday low frequency measurements. It is a true rms milliwatt indicating meter accurately measuring CW and pulse power, in milliwatts and dbm. Insensitive to line voltage changes.

Because of its wide band coverage, the Polarad Model P-2 is outstanding as a general lab and field instrument, available for power measurements at all commonly used frequencies. P-2 can be completely calibrated from its own self-contained DC source.

Features and Specifications:

- Single power probe for all frequencies.
- 150% overload without burnout.
- Direct reading.
- Broadband Coverage .... DC to 11,000 mc continuous in single mount.
- Multi-Power Range .... 0-1 mw, 0-10 mw, 0-100 mw. 0 dbm, + 10 dbm, + 20 dbm.
- Impedance .... 50 ohms coaxial.
- VSWR .... Less than 1.4:1 from 0 to 5000 mc. Less than 2:1 from 5000 to 11,000 mc.
- Accuracy .... ± 1.0 db.
- Connector .... Type N plug.
- Input Power Required .... 115v ± 10%, 60 cps.
- Dimensions .... 10" x 8" x 8".
- Weight .... 14 lbs.

TESTS ALL KLYSTRON TUBES



MODEL K-100
KLYSTRON TUBE TESTER

Now, for the first time, you can test all commercially available klystron tubes, built-in cavity types as well as those requiring external cavities, just as easily as you make tests on vacuum tubes.

Polarad's new Model K-100 Klystron Tube Tester provides complete metering facilities and control adjustments with a tube data chart to determine settings. Safety features protect personnel at all times when testing tubes requiring high voltages.

Features:

- Performs the following basic tests:
  - **a.** Filament continuity.
  - **b.** Short circuit tests between all elements.
  - **c.** Static d-c tests—measurement of rated d-c currents and voltages.
  - **d.** Life test—relation of cathode current versus reduced filament voltages.
  - **e.** Dynamic test—provision is made for external modulation so that klystrone tubes may be dynamically tested with external r-f measuring equipment.
- Special adapter mount for all commercial types of klystrons.
- Safety features protect personnel during tests.
- Protective devices prevent misadjustment and save tubes from accidental burnout.
- Built-in heavy duty blower provides forced air cooling of the klystron tubes.
- Tester designed to be adapted for future tubes.
- Built-in Universal Power Supply may be used for klystron testing purposes outside the instrument.

AVAILABLE ON
EQUIPMENT LEASE PLAN

POLARAD
PROVEN RELIABILITY

ELECTRONICS CORPORATION
43-20 34th ST., LONG ISLAND CITY 1, N. Y.

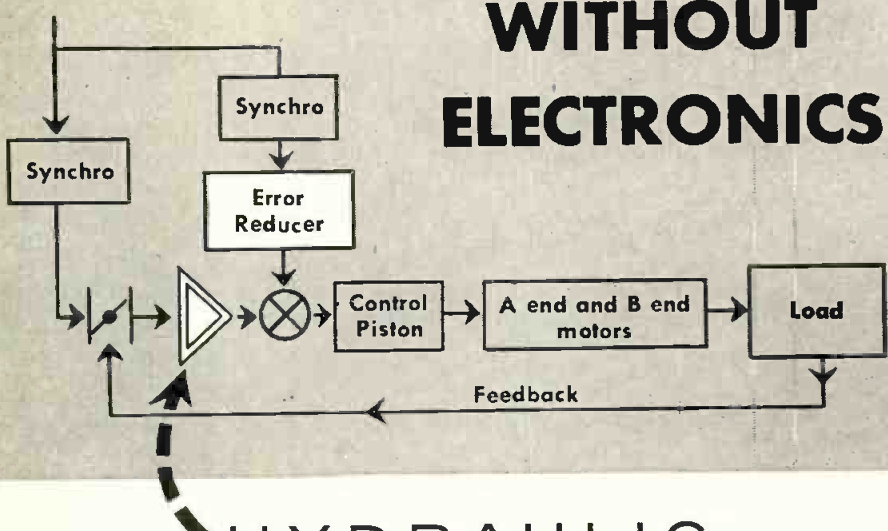
REPRESENTATIVES • Albuquerque • Atlanta • Baltimore • Boston • Chicago • Cleveland • Fort Worth • Kansas City • Los Angeles • New York
Philadelphia • San Francisco • Seattle • St. Paul • Syracuse • Washington, D. C. • Canada, Arnprior—Export: Rocke International Corporation

For product information, use inquiry card on last page.

www.americanradiohistory.com

SINCE 1915 LEADERS IN AUTOMATIC CONTROL

FROM SYNCHROS TO 150 HP WITHOUT ELECTRONICS



HYDRAULIC AMPLIFICATION

Ford engineers have developed a highly accurate synchronizing gun drive that is amplified from a small synchro motor to 150 horsepower purely by hydraulic amplification. With the addition of the Ford-perfected Error Reducer, the drive controls the power to train and elevate the guns, thus achieving continuous aiming of the guns with extremely high accuracy. Full use is being made of this experience with hydraulic servo gun drives in Ford's current work on reactor controls.

This hydraulic amplifying system is typical of the unusual amplifying systems developed by Ford Instrument Company over the past forty years. Other examples are the electronic amplifier circuits in mission control computers for the Navy Bureau of Aeronautics, magnetic amplifier circuits for power drives, and transistor amplifiers for missile guidance systems.

If you have a problem in control engineering, Ford Instrument Company's forty years of experience in high precision design and production will help you find the answer. 39

FORD INSTRUMENT COMPANY
DIVISION OF THE SPERRY CORPORATION
31-10 Thomson Avenue, Long Island City 1, N.Y.

ENGINEERS of unusual abilities can find a future at FORD INSTRUMENT COMPANY. Write for information.

TELE-TECH
& Electronic Industries

M. CLEMENTS, *Publisher*
DR. O. H. CALDWELL, *Editorial Consultant*
BERNARD F. OSBAHR, *Editor*
ALBERT J. FORMAN, *Associate Editor*
DR. A. F. MURRAY, *Contributing Editor*
JOHN H. BATTISON, *Contributing Editor*
B. V. SPINETTA, *Directory Editor*
MARTHA USDIN, *Assistant Editor*
CARL THOMAS, *Assistant Editor*
R. C. DAVIES, *Washington News Editor*
CHARLES F. DREYER, *Art Director*
GAIL CARLSON, *Editorial Secretary*
STANLEY GERSTIN, *Contributing Editor*

BUSINESS DEPARTMENT

M. H. NEWTON, *Business Manager*
HOWARD A. REED, *General Sales Manager*
PAUL J. CARNESE, *Sales Promotion Manager*
JOSEPH DRUCKER, *District Manager*
JAMES S. COLEMAN, *Asst. Sales Manager*
N. McALLISTER, *Asst. Business Manager*
CECILIA KAVANAUGH, *Advg. Records*
A. SHILLIN, *Production Manager*
480 Lexington Ave., New York 17, N.Y.
Telephone PLaza 9-7880

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

CHRIS DUNKLE & ASSOCIATES
California Representatives
3257 W. 6th Street, Los Angeles 5, Calif.
Telephone DUnkirk 7-6149
1651 Market St., San Francisco 3, Calif.
Telephone UNderhill 3-5282

ELMER DALTON, *Circulation Manager*
JOHN J. BORGHI, *Controller*

Member BPA

CIRCULATION NOW 27,000

An increase of 5,000, effective with the January 1955 issue, provides greater penetration of plants, stations and laboratories in the primary markets of the industry—Manufacturing, Broadcasting and Armed Forces procurement.

These are the markets with greatest buying power and greatest expansion, industrially and geographically.

The circulation of TELE-TECH is increasing in two ways:

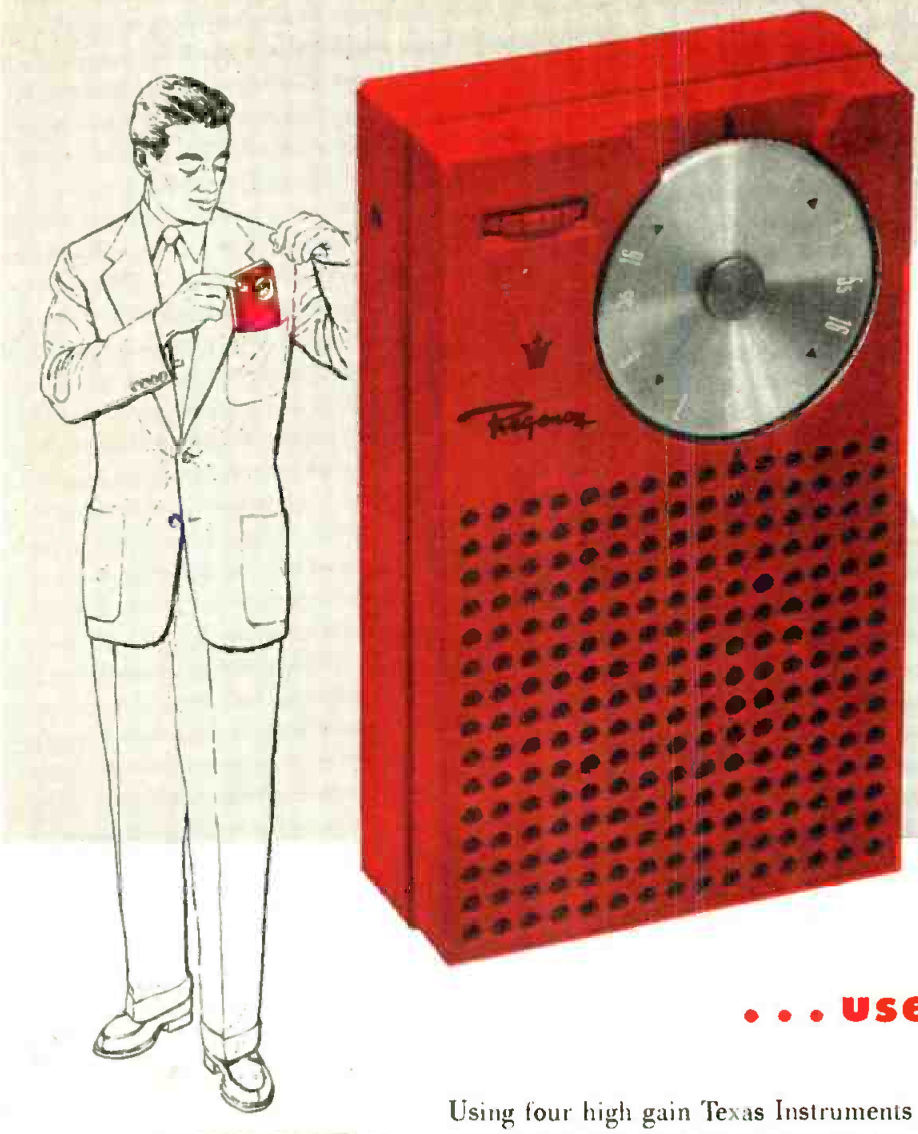
1—Growth of TELE-TECH's Unit Coverage of top-ranking engineers—the magazine's basic readership, preselected for complimentary subscriptions.

2—Making paid subscriptions available to other engineers in research, design, production, operation and maintenance.

Although effective immediately, the increased circulation cannot appear in audit statements until the first half of 1955 is audited.

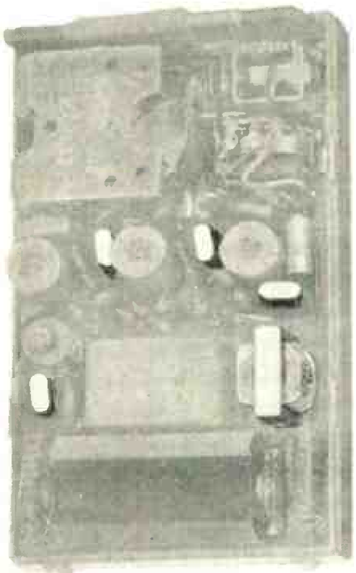
THE ELECTRONIC INDUSTRIES DIRECTORY

Published annually as an integral section of TELE-TECH in June



the First transistorized consumer product

. . . uses TI transistors!



******With four Texas Instruments grown junction n-p-n germanium low cost, high gain transistors*, the Regency radio achieves power gains of 32 decibels in each intermediate-frequency stage and 37 decibels in the audio stage. One transistor is used as a combination mixer-oscillator, two as intermediate-frequency amplifiers, and one as an audio amplifier. Output transformer also TI manufactured.

Using four high gain Texas Instruments transistors, the world's first transistorized consumer product — a high performance pocket size radio — is now available on the retail market! Priced under $50, the world's smallest commercial radio receiver (manufactured by Regency of Indianapolis) achieves better performance than many much larger conventional sets. To produce the specially designed transistors used in this superb little instrument, TI has developed advanced manufacturing techniques that assure uniformly high product quality as well as mass production quantities.

With the transistor radio already a reality, the multi-million dollar consumer market is ready and waiting for still more transistorized products. Don't delay your own product development for lack of suitable low cost, high performance transistors. In designing transistorized products, depend on transistors from Texas Instruments, a leading supplier of transistors for a variety of commercial and military applications. Producing the industry's widest range of semiconductor devices — silicon or germanium; diodes or transistors — Texas Instruments is your most *experienced* source of supply for dependable semiconductor products.

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE DALLAS 9, TEXAS

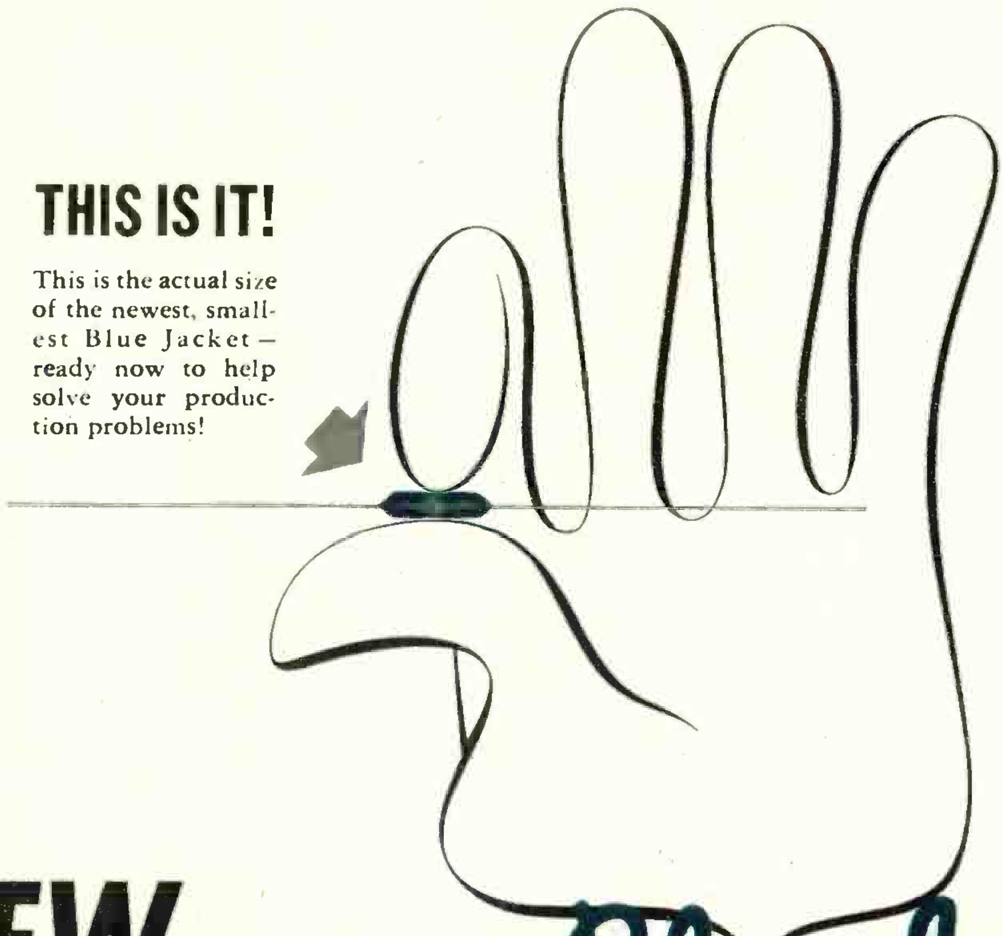
For product information, use inquiry card on last page.

www.americanradiohistory.com

★ ★

THIS IS IT!

This is the actual size of the newest, smallest Blue Jacket — ready now to help solve your production problems!



NEW... a 3-watt Blue Jacket®

miniaturized axial-lead wire-wound resistor

This power-type wire wound axial-lead Blue Jacket is hardly larger than a match head *but it performs like a giant!* It's a rugged vitreous-enamel coated job—and like the entire Blue Jacket family, it is built to withstand severest humidity performance requirements.

Blue Jackets are ideal for dip-soldered sub-assemblies . . . for point-to-point wiring . . . for terminal board mounting and processed wiring boards. They're low in cost, eliminate extra hardware, save time and labor in mounting!

Axial-lead Blue Jackets in 3, 5 and 10 watt ratings are available without delay in any quantity you require. ★ ★

SPRAGUE TYPE NO.	WATTAGE RATING	DIMENSIONS L (inches)	D	MAXIMUM RESISTANCE
151E	3	17/32	13/64	6,000 Ω
27E	5	1 1/8	5/16	30,000 Ω
28E	10	1 7/8	5/16	50,000 Ω

Standard Resistance Tolerance: ±5%

WRITE FOR ENGINEERING BULLETIN NO. 111B

SPRAGUE

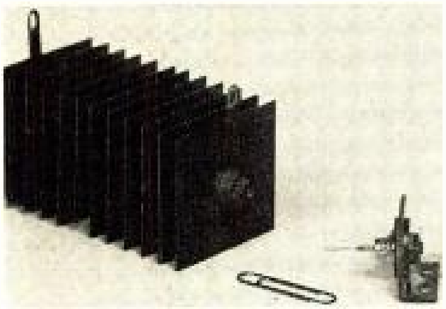
'RAGUE ELECTRIC COMPANY · 233 MARSHALL ST. · NORTH ADAMS, MASS.

www.americanradiohistory.com

As We Go To Press...

Transitron Develops Silicon Power Rectifier

A new silicon power rectifier has been developed by the Transitron Electronic Corp., Melrose, Mass., according to its president, Dr. David Bakalar. The experimental rectifier units are being manufactured under a U. S. Army Signal Corps industrial preparedness program contract.



New silicon power rectifier at right operates over —60° to 150° C. Selenium unit is at left

"The new silicon rectifier has promise of being technically superior in every important respect to existing rectifiers, including selenium, and may open up new fields of application as well," the Transitron president said. "Silicon rectifiers are capable of operating efficiently between the extremes of 150°C above and —60°C below zero, and possess large power handling ability. They can be made extremely compact, which is a significant step forward in the current trend to miniaturization. They do not exhibit a continuous aging effect as selenium rectifiers do. Because of their extremely low losses, operating efficiencies as high as 98% are possible."

Color TV Projection System Makes Bid

A new color TV system employing three monochrome crt projection tubes with color phosphors has been demonstrated by Hazeltine Corp. The optical system which enlarges the pictures and fuses the images from the three tubes on a 240 sq. in. flat screen was developed by American Optical Co. Cost of the projection arrangement without basic chassis is expected to be about $250. More details on page 71.

TV Station Celebrates 15th Year

One of the nation's pioneer TV stations, General Electric's WRGB, is currently celebrating its 15th anniversary of regular telecasting. The station dates back to when receiver screens were only four-inches wide. It began one-hour per week telecasting on Nov. 6, 1939 after 12 years of research. Earlier that year, WRGB, known at the time as experimental station W2XB, participated in the first long-distance transmission of modern high-definition TV. GE engineers, located in the Helderberg Hills outside Schenectady, received and transmitted pictures of England's King George and Queen Elizabeth as they toured the 1939 World's Fair.

Actually, the station's history goes back to 1928. GE engineer Dr. E. F. W. Alexanderson, already renowned for his radio developments, staged the first demonstration of "remote" TV at his home in Schenectady on Jan. 11. Later that year engineers took equipment to Albany, 15 miles away, and televised New York Governor Alfred E. Smith's acceptance of the Democratic Party nomination for president, thus becoming the first man in history whose picture was flashed to the public via the new medium. But the station's "public" at the time consisted of only four reception sets, one of which was in Dr. Alexanderson's home. Today the pioneer station brings TV to more than 2 million people in Eastern New York and Western New England.

MORE NEWS on page 12

TV AIDS MOTION PICTURE PRODUCTION

A technique developed jointly by TV and movie engineers promises to effect a considerable saving in time, money and film footage for the motion picture industry. DuMont Labs and RKO-Pathe collaborated on the system, which consists of a DuMont "Tel-Eye" TV camera mounted on a standard movie camera. While the movie camera is grinding out film, the TV camera flashes the scene being "shot" to a monitor TV set so that the director can see exactly what is being filmed. In the experimental model shown the TV camera, as a unit, is mounted on the camera. Plans eventually call for integrating the camera tube itself into the movie camera, with the associated circuitry to be cable-connected to the unit

www.americanradiohistory.com

For the **right** start in Color-TV...

you need this RCA Test and Measuring Equipment "Package!"

This indispensable package represents a basic "*must*" for a satisfactory color operation—network, film or live. You need it to check your station performance, maintain your broadcasting standards, assure the highest quality.

The various components of this vital "package" are pictured below. Charts at the right show how these units are used with relation to other station equipment as a means of providing complete testing facilities to meet various situations.

RCA engineers—the acknowledged pioneers in the development of compatible color television—have spent years developing this test equipment which takes the guesswork out of color broadcasting. Already, RCA color test equipment is proving itself in nearly 100 stations, assuring compliance with FCC standards of quality.

The "package" represents the minimum requirements for your station. For peak station performance each of these items should be included. In many stations the duplication of certain of the items will be desirable.

For experienced assistance in planning the installation of this equipment to meet your individual requirements, call on your RCA Broadcast Sales Representative. Or write RCA Engineering Products Division, Camden, N. J.

The 6 functions shown here represent the testing facilities required to attain and maintain the highest standards in color operation

RCA PIONEERED AND DEVELOPED COMPATIBLE COLOR TELEVISION

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DIVISION CAMDEN, N.J.

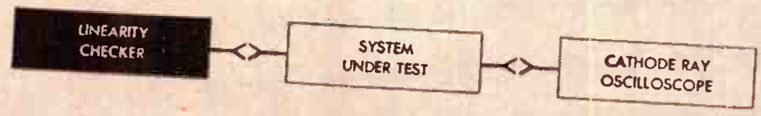
You will need all of these 5 instruments for color test and measurement...

LINEARITY CHECKER
WA-7B

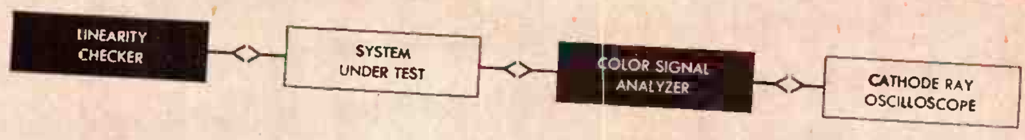
COLOR SIGNAL ANALYZER
WA-6A

www.americanradiohistory.com

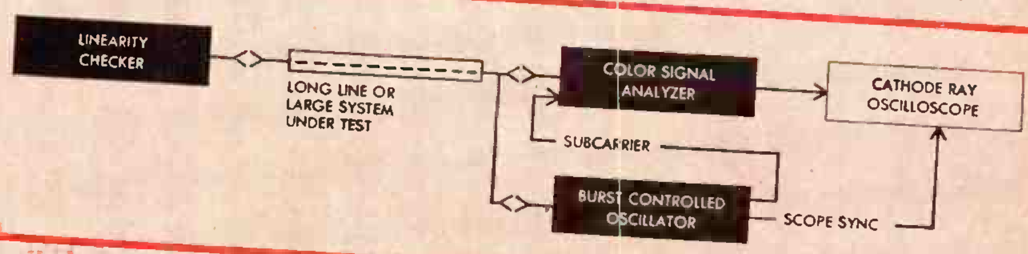
1 Linearity Checker and Oscilloscope test for differential gain.



2 Addition of Color Signal Analyzer makes it possible to check differential gain and differential phase.

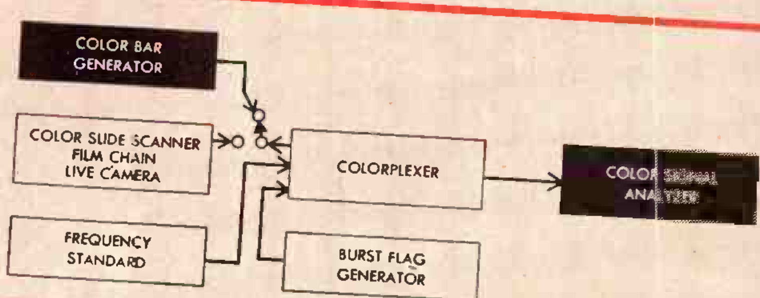


3 Burst-Controlled Oscillator must be added to check differential gain and phase at remote locations where studio sub-carrier is not available.

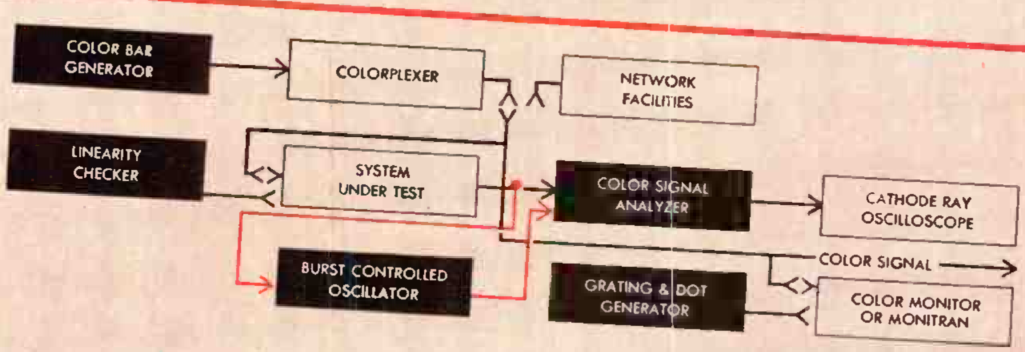


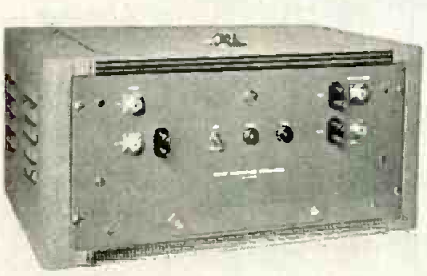
4 Grating and Dot Generator checks convergence and deflection linearity of monitors. Its signal can also be used for checking house monitoring systems.

5 The Color Bar Generator shown is used with origination equipment for supplying test signal to system. The Color Bar Generator in conjunction with the Color Signal Analyzer is used for precise alignment of the Colorplexer.



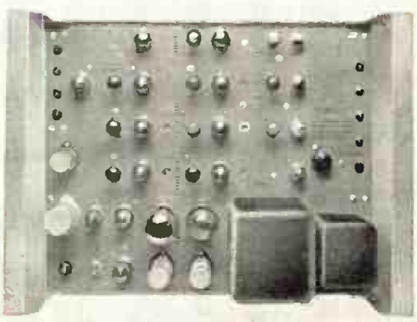
6 Integrated Test Equipment System for color broadcasting. This includes all situations depicted above.





BURST-CONTROLLED OSCILLATOR
WA-4A

GRATING AND DOT GENERATOR
WA-3B

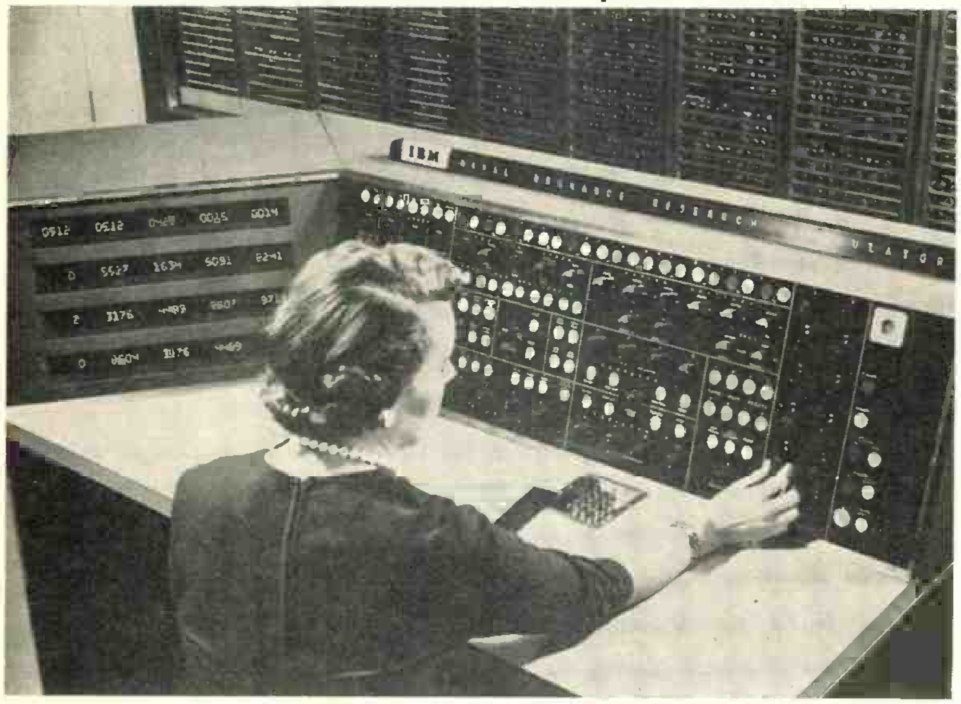


COLOR BAR GENERATOR
WA-1D

www.americanradiohistory.com

As We Go To Press . . . (Continued)

NAVAL COMPUTER FEATURES 140 ips TAPE HANDLER



NORC—the Naval Ordnance Research Calculator—was recently delivered to the Navy by IBM for installation at the Naval Proving Ground, Dahlgren, Va. Over 5 years of research and nearly 3 years of actual construction time went into the big computer, which was built at the Watson Laboratory operated by IBM at Columbia Univ. One of the more notable features of its construction is a magnetic tape handling system which feeds data to the unit at 140 ips, using 4-track, high-density recorded tape—a rate of 70,000 decimal digits/sec

NBC Replies to "Radio Abandonment" Charge

In reply to a published speculation by radio-TV columnist Ben Gross that NBC would probably be the first network to abandon radio, Brig. Gen. David Sarnoff, Chairman of the boards of RCA and NBC stated: "Our early recognition of the problem which network radio is now facing certainly does not mean abandonment of effort and resolve to cope affirmatively with it. I assure you that even if it should prove impossible to build such a new base for network radio, NBC would be the last, and not the first, to abandon the field. We are confident that radio as a medium will continue to live and we expect NBC to maintain leadership in its future."

Autopilot Uses Transistors

The first successful flight of an airplane controlled by an automatic pilot using transistors entirely instead of electron tubes has been claimed by R. P. Lansing, vice president and group executive of the Bendix Aviation Corp. Military considerations banned earlier news of the flight, which took place here last May 18, he said.

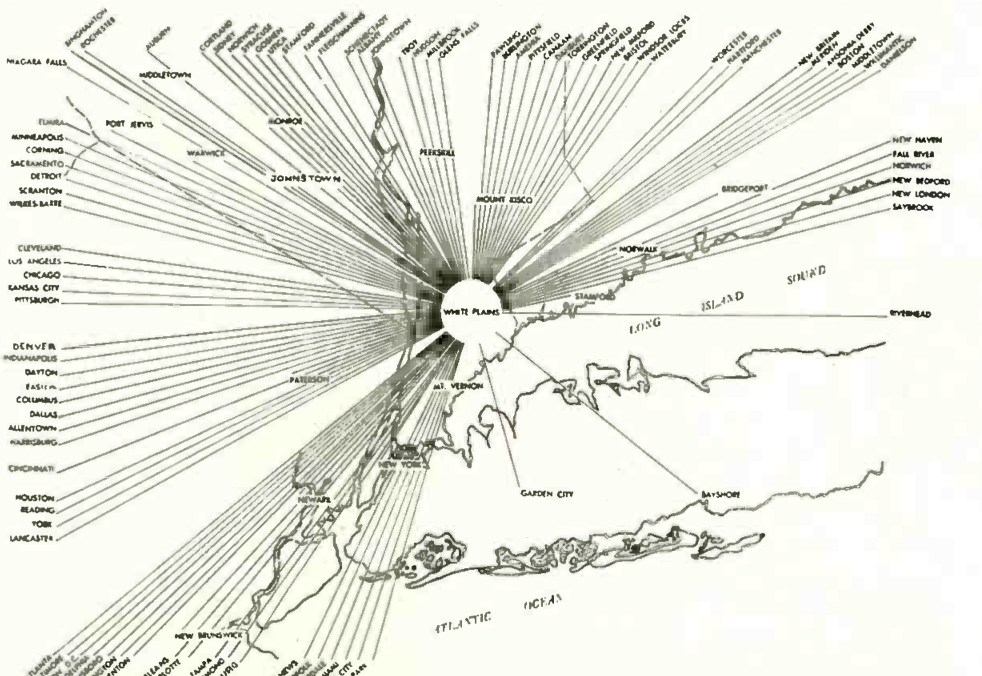
Further flight tests with the completely "transistorized" PB-20 automatic pilot system developed by the Eclipse-Pioneer division of Bendix and installed on the division's B-25 Flying Laboratory have been continuing. Lansing also revealed that another completely transistorized automatic pilot system had been delivered to Wright Air Development Center, Wright-Patterson Air Force Base, during April of this year. That one, destined for evaluation in high-performance aircraft, has been installed and is being ground tested in a Lockheed F94C, he said.

Long Distance Dialing Expanded

The Bell System, in the biggest operation of its kind, added three new long distance dialing centers to its network. They are located in White Plains, N. Y., Denver, Colo., and Charlotte, N. C. The Long Lines Dept. of AT&T said the new communications centers, along with similar facilities already in operation in 28 other cities, brought the number of cities and towns on the nation's long distance dialing network to 3,250.

The three new offices are equipped with the latest long distance switching equipment, which automatically routes telephone messages over the most direct channel available. The electronic machinery, known as the "4-A Automatic Switching System," enables the long distance operator to place a call direct to a subscriber in a distant city without the aid of other operators en route. The equipment selects the best route to the city called, operates switches at intermediate points, tries alternate routes if necessary and completes the connection—all in a few seconds. More than half of all calls handled at long distance boards are now handled in this manner.

The White Plains center, hub for long distance services for the populous northeastern section of the nation permits "through" telephone traffic to bypass New York City. The White Plains system has the capacity to handle up to 50,000 calls per day. The new office is also tied into Long Lines' nationwide radio relay network.



White Plains, N. Y., is communications crossroads for new long distance telephone center

www.americanradiohistory.com

Frankly!

WE'RE AIMING AT THE ARMED FORCES OF THE U. S. A.

...and We're ®Scoring with

- ABLE MANAGEMENT
- PROVEN ENGINEERING ABILITY
- FULLY EXPERIENCED PERSONNEL
- COMPLETE TEST and SPECIAL EQUIPMENT
- MODERN PRODUCTION FACILITIES
- GOVERNMENT CONTRACT SAVVY
- PRIME FINANCIAL RATING

® LORAL has delivered annually many millions of dollars worth of ELECTRONIC and ELECTRO-MECHANICAL MILITARY EQUIPMENT .... *on time!*

Write for Facilities Brochure T-1

LORAL *Imprint of Integrity*

ELECTRONICS CORPORATION

794 EAST 140th STREET • NEW YORK 54, N. Y.

www.americanradiohistory.com

As We Go to Press . . . .

21" Color Tube Ready

RCA has announced that its 21-in. color TV picture tube is now commercially available to TV set manufacturers. The new tube (RCA-21AXP22) has a picture area of 250 sq. in. It is offered to set manufacturers at $175. The 21-in. color tube is now in production, at the rate of 100 tubes per day, at RCA's Lancaster, Pa., plant.

In addition to big-screen pictures, reports RCA Vice President Douglas Smith, the 21-in. kinescope offers set manufacturers and owners such advantages as: Excellent color-picture brightness, contrast, and fidelity; short tube length which will facilitate the design of compact cabinets; and round, metal-shell construction which makes the RCA

Color tube with 250 sq. in. area sells for $175

tube, at 28 pounds, appreciably lighter than 19-inch all-glass types.

The deflection angle of 70°, together with the tube's short-length electron guns, permit important reductions in tube length without sacrifice of picture area. Although considerably larger in picture area than the 45° 15-in. color kinescope, the 70° 21-in. tube is shorter in length, measuring $25\frac{5}{16}$ in. compared with $26\frac{1}{8}$ in. for the 15-in. type. A special magnetic color equalizer eliminates the former magnetic shield and rim coil.

It produces pictures measuring $19\frac{9}{16}$ by $15\frac{1}{4}$ in., with rounded sides. It utilizes three electrostatic-focus electron guns spaced 120° apart, with axes tilted toward the tube axis to facilitate convergence of the three electron beams at the curved shadow mask. The tube utilizes magnetic deflection and magnetic convergence, has an ultor voltage of 25 kv.

COMING EVENTS

Jan. 8—Winter Symposium, N. Y. Section of IRE, Design Principles of Transistor Circuits, Engineering Societies Bldg., New York, N. Y.

Jan. 17-19—Conference on High Frequency Measurements, sponsored by IRE, AIEE, URSI and Nat'l Bur. of Standards, Hotel Statler and Dept. of Interior auditorium, Washington, D.C.

Jan. 20-21—Symposium on Printed Circuits, sponsored by RETMA, Univ. of Pa., auditorium, Philadelphia, Pa.

Jan. 24-27—Plant Maintenance & Engineering Conference & Show, International Amphitheatre, Chicago, Ill.

Jan. 26-28—10th Symposium on Instrumentation for the Process Industries, sponsored by School of Engineering, Chemical Engineering Dept., Agricultural & Mechanical College of Texas, College Station, Texas.

Jan. 31-Feb. 4—AIEE Winter General Meeting, Hotels Statler and Clinton, New York, N. Y.

Feb. 8-10—10th Annual Reinforced Plastics Div. Conference, sponsored by Society of Plastics Industry, Hotel Statler, Los Angeles, Calif.

Feb. 10-12—7th Annual Southwestern IRE Conference and Electronics Show, sponsored by Dallas-Fort Worth section of IRE, Baker Hotel, Dallas, Tex.

Feb. 11-13—Audio Fair-Los Angeles, sponsored by Los Angeles Section of AES, Alexandria Hotel, Los Angeles, Calif.

Feb. 17-18—Conference on Transistor Circuits, sponsored by IRE, professional Group on Circuit Theory, Science and Electronics Div. of AIEE, and Univ. of Pa., University of Pa., Philadelphia, Pa.

March 1-3—Joint Western Computer Conference and Exhibit, sponsored by IRE, AIEE, and Assn. for Computing Machinery, Statler Hotel, Los Angeles, Calif.

Mar. 14-18—ASTE Western Industrial Exposition and Annual Meeting, Shrine Auditorium and Exposition Hall, Los Angeles, Calif.

March 21-24—1955 IRE National Convention, Kingsbridge Armory, New York, N.Y.

April 6-10—World Plastics Fair and Trade Exposition, National Guard Armory, Los Angeles, Calif.

Apr. 15-16—9th Annual Spring Technical Conference, sponsored by Cincinnati Section of IRE, Engineering Soc. of Cincinnati Bldg., Cincinnati, Ohio.

Apr. 18-22—National Convention of Dept. of Audio-Visual Instruction of Nat'l. Education Assn., Hotel Biltmore, Los Angeles, Calif.

May 10-21—Global Communications Conference, sponsored by Armed Forces Communications Assn., Hotel Commodore, New York, N. Y.

May 16-20—National Materials Handling Exposition, International Amphitheatre, Chicago, Ill.

May 18-20—Nat'l Telemetering Conference and Exhibit, sponsored by IRE, AIEE, IAS, ISA, Hotel Morrison, Chicago, Ill.

May 31-June 3—3rd Basic Materials Exposition, Convention Hall, Philadelphia, Pa.

June 1-11—British Plastics Exhibition, Olympia, London, England.

June 20-23—2nd International Powder Metallurgy Congress, Reutte, Tyrol, Austria.

Aug. 24-26—Western Electronic Show & Convention, San Francisco Civic Auditorium, San Francisco, Calif.

Sept. 6-17—Production Engineering Show and Machine Tool Show, Navy Pier and International Amphitheatre, Chicago, Ill.

Sept. 12-16—10th Annual Conference and Exhibit, sponsored by ISA, Shrine Exposition Hall and Auditorium, Los Angeles, Calif.

Nov. 2-5—World Symposium on Applied Solar Energy, conducted under leadership of Stanford Research Institute, Phoenix, Arizona.

ACM: Assoc. for Computing Machines.
AES: Audio Engineering Society.
AIEE: American Institute of Electrical Engineers.
IRE: Institute of Radio Engineers.
IAS: Institute of Aeronautical Sciences.
ISA: Instrument Society of America.
NACE: National Assoc. Corrosion Engineers.
NARTB: National Assoc. of Radio and TV Broadcasters.
RETMA: Radio-Electronics-TV Manufacturers Assoc.
RTCM: Radio Technical Commission for Marine Services.
URSI: International Scientific Radio Union.

First Synthetic Mica Plant Under Construction

Reportedly the world's first synthetic mica plant, possibly the beginning of a new industry which will eventually reduce U. S. dependence on India for the highly strategic material, is under construction. The new company, Synthetic Mica Corp., is scheduled to begin production early in 1955, according to Jerome Taishoff, president of the Mycalex Corp. of America, the parent firm. Estimated annual output of the new plant will be 1,000 tons of high grade synthetic mica, about 5-10% of the nation's current requirement.

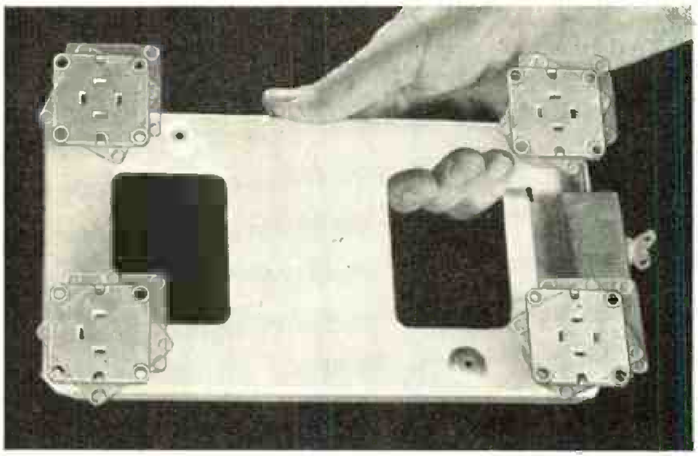
More than 90% of the high grade strategic mica used in this country today is imported from India. It is conceivable that, in time of war, this important source of the critical material might be cut off. The need for developing a local source of mica was recognized immediately after World War II when teams of U. S. technicians went to Germany to find what the Germans had learned about the synthesis of mica.

MORE NEWS on page 16

www.americanradiohistory.com

PLAIN FACTS ABOUT VIBRATION AND SHOCK MOUNTINGS

FOR AIRBORNE ELECTRONIC EQUIPMENT

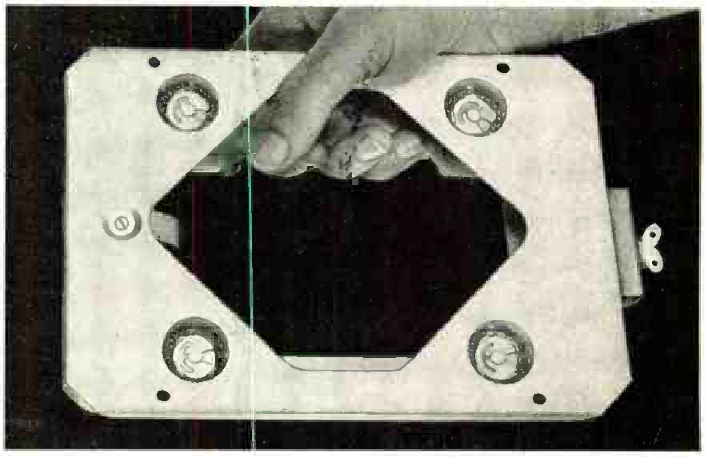


OUT-DATED UNIT MOUNT BASE

16 mounting holes and 16 bolts required.

Unit mountings may be improperly attached to the rack, and are very likely to be seriously misaligned during attachment to aircraft or missile structure.

Even minor discrepancies in spacing and attachment of unit mounts can defeat the whole purpose of the mounting base, and result in poor performance and deterioration of equipment.

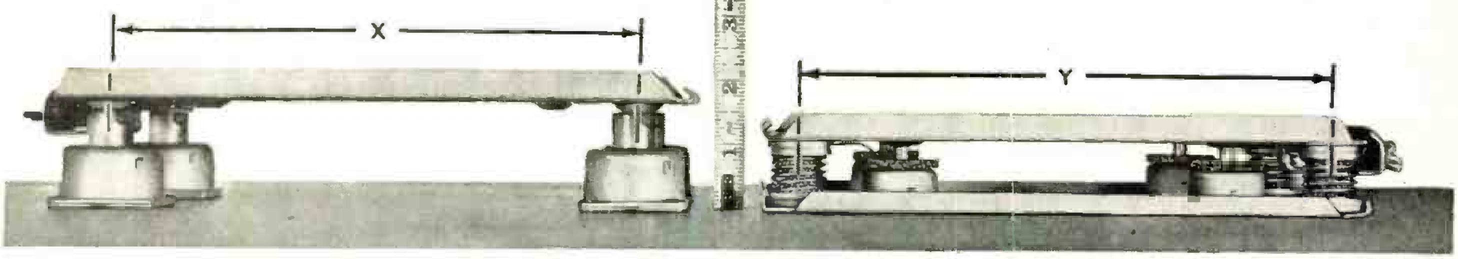


TODAY'S ENGINEERED MOUNTING SYSTEM

Only 4 mounting holes required.

Prespaced holes in a one piece base plate assure quick, accurate attachment. Relationship of all 4 holes is definitely fixed (holes spaced for interchangeability with unit mounts).

No installation errors or misalignment can occur to disturb the precise performance of the mounting system as checked and approved on acceptance tests.



Excessive height required. Unit mount bulk imposes reduced spacing (X) between support centers, resulting in impaired stability (critical in lateral direction). Greater sway space required.

Note reduction in mounting height. Important space saved. Maximum spacing (Y) of resilient elements at extreme corners provides stability. Less sway space required.

Well Designed Electronic Equipment, *If Poorly Mounted,* Too Often Operates Inefficiently and Unreliably

Failure also can result from use of inadequate mountings which are not engineered for the particular equipment and purpose. Conventional shock mounts or so called "isolators", reasonably effective when installed under ideal laboratory conditions, become dangerous trouble makers when installed by usual production line methods.

Attachment of a base plate to unit mounts to achieve spacing control is a makeshift arrangement resulting in excessive weight with no height reduction.

Failure also can result from obsolescent unit mounts employing internal rubber, organic or synthetic materials which deteriorate rapidly and are susceptible to temperature and environmental changes.

The importance of today's electronic equipment surely justifies the use of integrated mounting systems designed to meet specific problems rather than the unreliable application of assembled "catalogue" mounts.

Robinson All-Metal Engineered Mounting Systems Assure Outstanding Performance and Reliability of Equipment

The Robinson concept of vibration and shock control is the design and application of 100% all-metal mounting systems. Engineered with careful understanding of the equipment to be protected and performance expected, Robinson mounting systems come to you completely manufactured, ready to receive the electronic equipment or instrument.

The integration of these mounting systems into the electronic equipment of aircraft and missiles results in reduction of elapsed design time and basic development cost.

Robinson Mountings utilize, as main resilient elements, metal wire cushions (MET-L-FLEX), exclusive with Robinson. This construction has been thoroughly proven by years of use in nearly all military and commercial aircraft.

Some other important characteristics of Robinson Mountings: inherent high damping, non-linear spring rate, performance unaffected by grease, oil, water, dust, extreme temperatures or environmental changes.

USE OF ROBINSON ENGINEERED MOUNTING SYSTEMS results in:

A. **Reliable and uniform performance in every installation under all types of environmental conditions.**

B. **Reduced cost through "de"ruggedization of equipment — substantial reduction of size and weight is possible by simplified and compact design.**

C. **Simplified installation — only four attachment holes required—pre-spaced to save time and assure accuracy.**

For full information about this new concept of vibration and shock control, write or wire today.

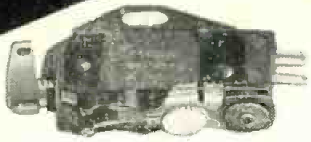
ROBINSON AVIATION INC.
TETERBORO, NEW JERSEY
Vibration Control Engineers

West Coast Engineering Office:
3006 Wilshire Boulevard, Santa Monica, California

For product information, use inquiry card on last page.

www.americanradiohistory.com

The New SHURE "TWIN-LEVER" CERAMIC PICKUP CARTRIDGE *for High Fidelity phonographs*



PC Series for 33⅓, 45, 78 r.p.m.

AN "AB" LISTENING TEST WILL PROVE THAT THIS CARTRIDGE SURPASSES ANY OTHER HIGH QUALITY COMMERCIAL CARTRIDGE FOR EQUIPMENT MANUFACTURERS!

Here is a "Balanced-Fidelity" cartridge designed for the equipment manufacturer to give you the maximum quality possible within your cost objectives.

A new frontier for the Ceramic principle has been crossed by the development of this cartridge. Designers of high fidelity phonographs and hi-fi radio or tv phono combinations, who have been "test piloting" this new "Twin-Lever" ceramic development, report an amazing superiority in tone quality that can be easily heard before the cartridge is even measured!

This "Twin-Lever" ceramic cartridge represents the ultimate in commercial high fidelity reproduction—**without compensating preamplifiers!** Smooth, wide range response from 30 to 13,500 c.p.s. Other features which help to make this new cartridge so outstanding in performance are: high compliance that virtually eliminates tracking distortion . . . extremely low effective mass provided by new specially-designed needles and new coupling . . . tailored needles on separate needle shafts, functioning independently for best 78 rpm response, too—as well as the superior microgroove performance.

The new unique design eliminates "turnover" of either the cartridge or the needles. Both needles are in the same plane, and an ingenious, lever-operated shift mechanism gently moves each needle in and out of position.

RADICAL NEW DESIGN FOR NEEDLE REPLACEMENT!

Needle replacement is now so simple it can be done blindfolded!! This is a feature that will be of special interest to the ultimate users of your original equipment. Anybody can replace the needle, without tools, in a few seconds—while the cartridge remains in the pickup arm!

MODELS PC4 and PC5

Output Level at 1,000 c.p.s.	.40 volts (33⅓, 45 rpm)
Output Level at 1,000 c.p.s.	.60 volts (78 rpm)
Frequency Response	30 to 13,500 c.p.s.
Compliance	1.30 x 10-6 cm/dyne
Tracking Force	5 gr. min.
Net Weight	7 grams
Dimensions	1¾" overall length; ⅗" wide ⅝ high

ALSO . . . .
New High Output Ceramic Cartridges NO LESS OUTSTANDING IN THEIR CONTRIBUTION TO LOW COST, FINE QUALITY REPRODUCTION ARE THE HIGH-OUTPUT CARTRIDGES, MODELS PC2 and PC3.

SHURE *The Mark of Quality*

For further information on these remarkable new cartridges, write
SALES DIVISION—SHURE BROTHERS, INC., 225 W. HURON STREET, CHICAGO 10, ILL.

As We Go To Press . . .

de Forest Visits Eiffel Tower

Dr. Lee de Forest, pioneer electronic inventor, is shown mobile microwave relay of Compagnie Generale de Telegraphie Sans Fil (CSF) atop Eiffel Tower by CSF officials. (l to r) Messrs. Ponty, Braillard, de Forest and Glickmann

AIEE Broadcast Sessions

The following technical paper program will be presented at the AIEE Midwinter General Meeting, to be held Feb. 1, 1955, at the Hotels Statler and Governor Clinton, New York City. They are sponsored by the Committee on Television and Aural Broadcasting.

Tuesday AM, Feb. 1
Antennas and Propagation

Presiding Officer—Donald B. Sinclair, General Radio Co., Cambridge, Mass.

"TV Assignment Rules and Policies," Curtis B. Plummer, Federal Communications Commission, Washington, D. C.

"UHF Wave Propagation," Robert P. Wakeman, Propagation Dept., Allen B. DuMont Laboratories, Passaic, N. J.

"Performance of Sectionalized Broadcasting Towers," Carl E. Smith, Carl E. Smith Consulting Engineers; Daniel B. Hutton, Federal Communications Commission, Washington D. C.; William G. Hutton, Goodyear Aircraft Corp., Akron, O.

"Television Receiver Signal Overload," C. Masucci, CBS-Columbia, Long Island City, N. Y.

Tuesday PM, Feb. 1, Color TV

Presiding Officer—Robert E. Shelby, National Broadcasting Co., New York, N. Y.

"Design for Production of Color Television Receivers," John P. Vandune, Television-Radio Div., Westinghouse Electric Corp., Metuchen, N. J.

"Chromacoder," Peter C. Goldmark & J. F. Bambara, CBS Laboratories Div., Columbia Broadcasting System, New York, N. Y.

"Development of the RCA 21-Inch Metal Envelope Color Kinescope," H. R. Seelen, H. C. Moodey, D. D. Van Ormer, & A. M. Morrell, Tube Div., Radio Corp. of America, Lancaster, Pa.

"Deflection and Convergence of the RCA 21-Inch Color Kinescope," M. J. Obert, Tube Div., Radio Corp. of America, Camden, N. J.

TELE TIPS begin on page 22

www.americanradiohistory.com

Burton Browne Advertising

color tv controls

CHICAGO TELEPHONE SUPPLY
Corporation

ELKHART • INDIANA

Specialists in Precision Mass Production of Variable Resistors • Founded 1896

THE ONLY COMPLETE LINE FOR ALL COLOR TV APPLICATION

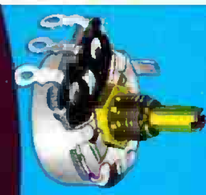
1. SIZES—"dime size" to 2 1/2" diameter.
2. WATTAGES—2/10 watt to 4 watt.
3. TYPES—carbon and wirewound with and without attached switch.
4. MOUNTINGS—conventional bushing, twist ear and snap-in bracket for printed circuits.
5. TERMINAL STYLES—for conventional soldering, prin circuits and wire wrap.
6. COMBINATIONS—an endless variety of tandems, b single and dual shaft.

A CTS control can be tailored to your specific requ ment.

FURTHER DETAILS ON OTHER SIDE

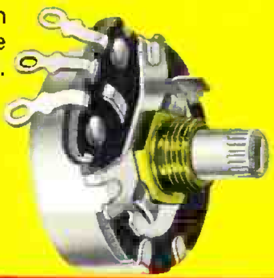
www.americanradiohistory.com

High voltage control for focus applications. Rated up to 5,000 volts DC across end terminals and 2 1/2 watts depending on total resistance. Will operate up to 15,000 volts DC above ground when mounted on insulated panel. CTS type 85.

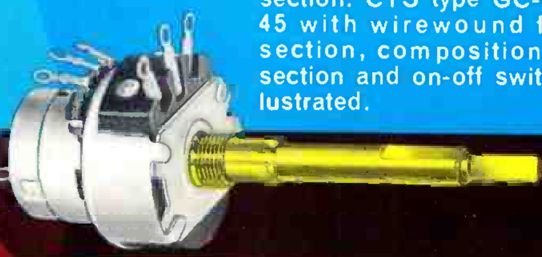


Miniature 3/4" "dime size" composition control. Conserves panel space at price comparable to larger size bushing mounted controls. CTS type 70.

1 1/8" diameter composition control for applications where ratings up to 3/4 watt required. CTS type 35.



Concentric shaft tandem control with conventional bushing mounting. Designed for front panel dual knob applications, such as contrast and volume. Available in various combinations of composition or wirewound front and rear sections with or without on-off switch attached to rear section. CTS type GC-C252-45 with wirewound front section, composition rear section and on-off switch illustrated.



nounted composition rol. Simply twist two for rigid mounting. inates bushing and inting hardware. lable with shafts for operation or for pre-applications with ated or metal shaft. type P45 with metal illustrated.

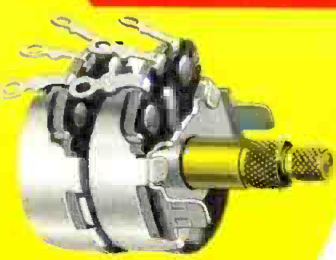
Ear mounted two watt wirewound available with or without center tap. CTS type P-254 with tap illustrated.

Four watt wirewound control available with or without center tap. CTS type 27 with tap illustrated.

Higher Wattage Carbon Controls With Exceptional Stability Available

- **ONE WATT:** Entire 45 series 15/16" diameter line available with 90 series special one watt military resistance elements.
- **TWO WATT:** Entire 35 series 1 1/8" diameter line available with 95 series special two watt military resistance elements.

mounted tandem for set applications. nbines panel space ng features of a con-ric tandem with the nomy of an ear inted unit. Available arious combinations omposition or wire-ind front and rear ions. CTS type P-C2-ith composition front rear sections illus-d.



THE ONLY COMPLETE LINE FOR ALL COLOR TV APPLICATIONS

CTS also makes a complete line of controls for military, black and white TV, radio and other commercial applications. Consultation without obligation available for all your control applications. Write for complete catalog TODAY.

CHICAGO TELEPHONE SUPPLY *Corporation*

ELKHART • INDIANA

EAST COAST OFFICE
Henry E. Sanders
130 North Broadway
Camden 2, New Jersey
Phone: Woodlawn 6-1668
TWX No. Camden NJ 380

WEST COAST OFFICE
Robert A. Stackhouse
928 S. Robertson Blvd.
Los Angeles 35, California
Phone; Crestview 4-5931
TWX No. BEV H 7666

SOUTHWESTERN U.S.A.
John A. Green Company
6815 Oriole Drive
P.O. Box 7224
Dallas 9, Texas
Phone: Dixon 9918

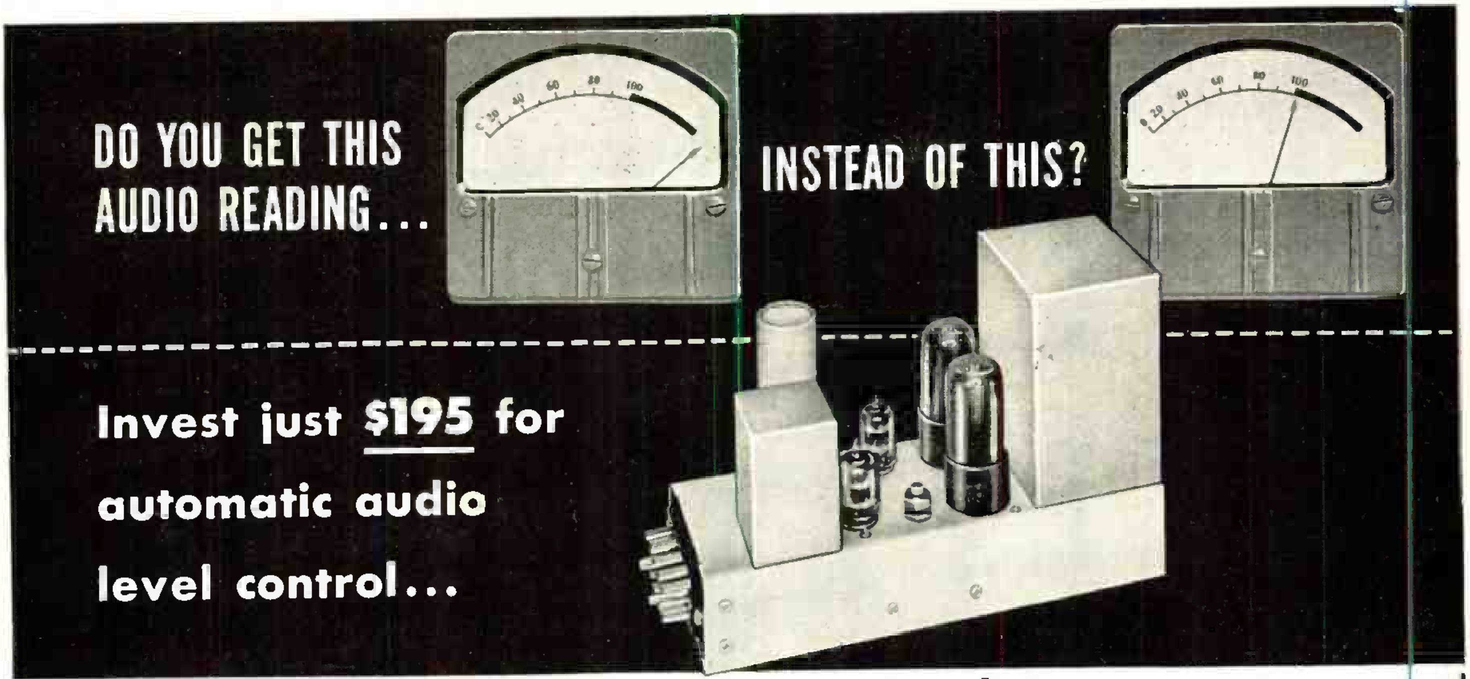
CANADIAN DIVISION
C. C. Meredith & Co., Ltd.
Streetsville, Ontario
Phone: 310

SOUTH AMERICA
Jose Luis Pontet
Buenos Aires, Argentina
Montevideo, Uruguay
Rio de Janeiro, Brazil
Sao Paulo, Brazil

OTHER EXPORT
Sylvan Ginsbury
8 West 40th Street
New York 18, New York
Phone: Pennsylvania 6-8239

Specialists in Precision Mass Production of Variable Resistors • Founded 1896

www.americanradiohistory.com



IN TV • FM • AM BROADCASTING

IN PUBLIC ADDRESS SYSTEMS

Hotel Ballrooms — Industrial Paging
Auditoriums — School Installations
Stadiums — Wired Music Applications

IN RECORDING STUDIO APPLICATIONS

Disc Recording — Tape Recording
Sound-on-Film Recording

UNI-LEVEL AMPLIFIER

HERE you have the answer to any audio engineer's prayers. The G-E "Uni-Level" Amplifier automatically compensates for level changes encountered between different audio sources. Its expansion-compression characteristics smooth out and increase average levels for all types of program material.

Yes, in any sound system that's troubled by variations in voice intensity, you can count on the BA-9-A to eliminate "blasts". You'll get higher average output. You'll save time and effort while performance is greatly improved.

Mail this coupon and complete specifications will be sent to you immediately.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Co., Broadcast Equipment,
Sec. [illegible] Electronics Park, Syracuse, N. Y.

Please send me information and detailed specs on the new G-E Uni-Level Amplifier.

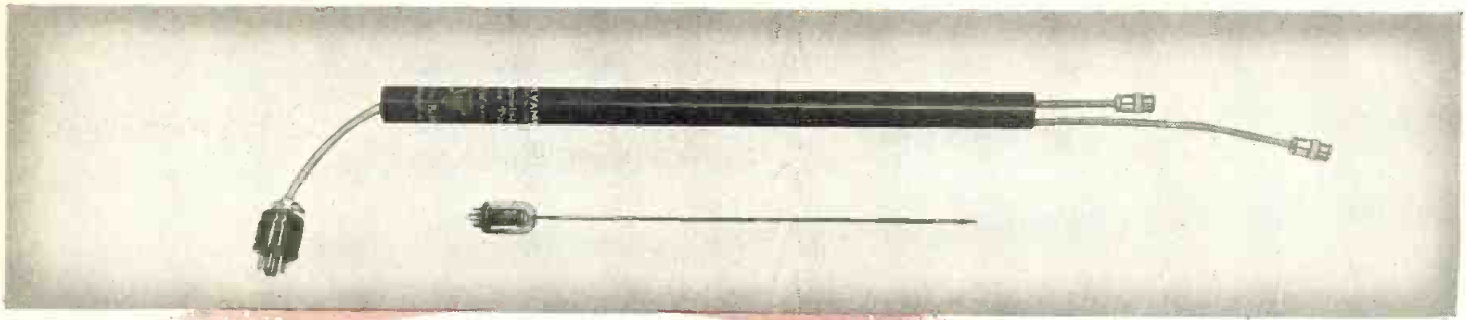
NAME ....

ADDRESS ....

CITY .... STATE ....

For product information, use inquiry card on last page.

www.americanradiohistory.com



Type 6493—Low level 2000-4000 MC amplifier. Greater than 35 db gain with 15 MW output.

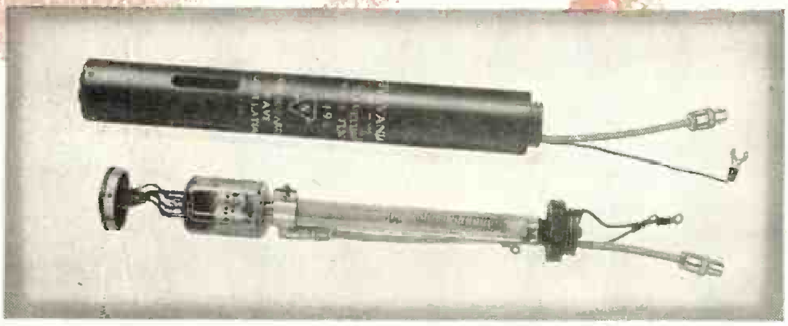
NOW Sylvania offers Traveling-Wave Tubes...

Sylvania offers designers 3 basic Traveling Wave Tube Types

6493 – low level amplifier

6496 – 10 to 1 voltage tunable oscillator

6559 – medium power amplifier



Type 6496—Tunable backward wave oscillator. 35 MW output, up to 1 watt. Complete 2000-4000 MC coverage.

Type 6559—Medium power 2000-4000 MC amplifier. 1 watt output with greater than 25 db gain.

- All with 2000-4000 MC bandwidths
- Amplifiers require no tuning
- Encapsulated for ruggedness
- Aluminum foil lightweight solenoids available
- Complete technical data available on request

WRITE FOR COMPLETE TECHNICAL DATA

SYLVANIA

Sylvania Electric Products Inc.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., St. Catherine St.
Montreal, P. Q.

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

www.americanradiohistory.com

1 to 5 ratio your quality insurance

- 21 INSPECTORS to each 100 production workers—a 1 to 5 ratio.
- ALL units thoroughly inspected on exacting custom equipment.
- UNIQUE inspection procedure for each application.

EXTREME MANUFACTURING ACCURACY

- EVERY gear cut with an AA hob and rolled against a master.
- EVERY final grind on every shaft run through a Sheffield comparator set by "jo" blocks.
- EVERY bearing bore checked with an air gauge and XX plug gauge.

A wide variety of rotating electrical components for electronic and airborne applications . . . designed and produced to your specifications. Send your requirements to OSTER design engineers. Write for "The Oster Story of Quality" today.

John Oster
MANUFACTURING CO.
AVIONIC DIVISION
RACINE, WISCONSIN

Your Rotating Equipment Specialist

Oster®

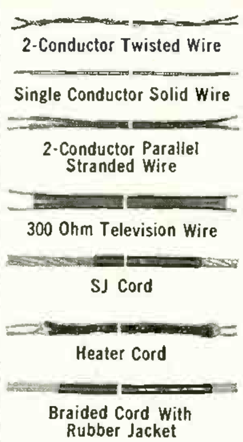
For product information, use inquiry card on last page.

Here's the fastest way to produce finished wire leads!

Allen-Bradley Co., producers of motor controls, use several Artos CS-6 automatic wire cutting and stripping machines in their Milwaukee plant.

high speed ARTOS
AUTOMATIC MODEL CS-6

MEASURES, CUTS and STRIPS wire, cord and cable at speeds up to 3000 pieces per hour



3000 STRIPPED WIRE LEADS in one hour ...each precision-cut with both ends perfectly stripped. That's the speedy pace set by the Artos CS-6 in producing wire leads up to 15 inches in length! Production rates vary in proportion to the length cut.

Highly accurate machine operation reduces work spoilage to an absolute minimum. Errors due to the human element are eliminated. There is no cutting of strands or nicking of solid wire.

PROVED PERFORMANCE

Time-consuming hand stripping jobs which once were a bottleneck in many plants are gone forever. As a result, Artos automatic wire strippers are paying their way in the mass production of television and radio sets, electrical appliances, motor controls and instruments of all kinds.

Plan now to cut wire stripping costs in your plant... with the high speed, automatic Artos CS-6.

CS-6 CAPACITY

Finished Wire Leads Per Hour: lengths to 15″, 3000; 64″-97″ lengths, 500.

Stripping Length: 1½″ max. both ends.

Cutting Length: max., 97″; min., 2″; special, ⅞″.

WRITE FOR BULLETIN ▶ Descriptive technical sheet tells how the Artos CS-6 can save you money, manpower and time.

Automatic Wire Cutting and Stripping

ARTOS ENGINEERING CO.

2753 South 28th Street • Milwaukee 46, Wisconsin

TELE-TIPS

UNDERGROUND TV is being suggested for dramatic coverage of baseball games. The camera would be buried at the pitcher's mound or home plate, with a small periscope sticking up. Home viewers could almost call their own balls and strikes by following the path of the pitched ball.

PART-TIME unskilled help have saved the radio-TV industry $2,000,000 annually, reports Workman for Work-men, Inc., national labor supply firm. These savings are supposed to be effected by having the labor supply firms assume the responsibility for on-the-job-injuries of less experienced part-time workers, thereby preventing increases in the Workman's Compensation insurance rate. A similar saving is realized with Unemployment Compensation rates, any increase being applicable to the company's entire payroll.

PATENT processing is barely crawling along, and prospects are for this pace to slacken. That's the unhappy conclusion after evaluating the annual report of the Commissioner of Patents. At last count, there were over 204,000 pending patent cases, including 131,000 applications awaiting attention by examiners. There are 622 examiners now employed in the Patent Office, which is 98 less than 1952. Since 1952 the number of applications awaiting action has increased by more than 34,000. While 750 examiners are needed to keep abreast of new work without cutting down the backlog, Congress has gone the other way by appropriating only $11,500,000 for the current fiscal year. This is $500,000 less than for the previous year. Result? It takes an average of three years and seven months to get a patent, and this critical waiting period is growing longer and longer.

VACUUM melting of metals pays off in a larger and cleaner yield whose composition can be closely controlled, say Carboloy engineers. In the case of one high-temperature material, the yield increased from 45% for air melting, to 65% for vacuum.

(Continued on page 26)

www.americanradiohistory.com

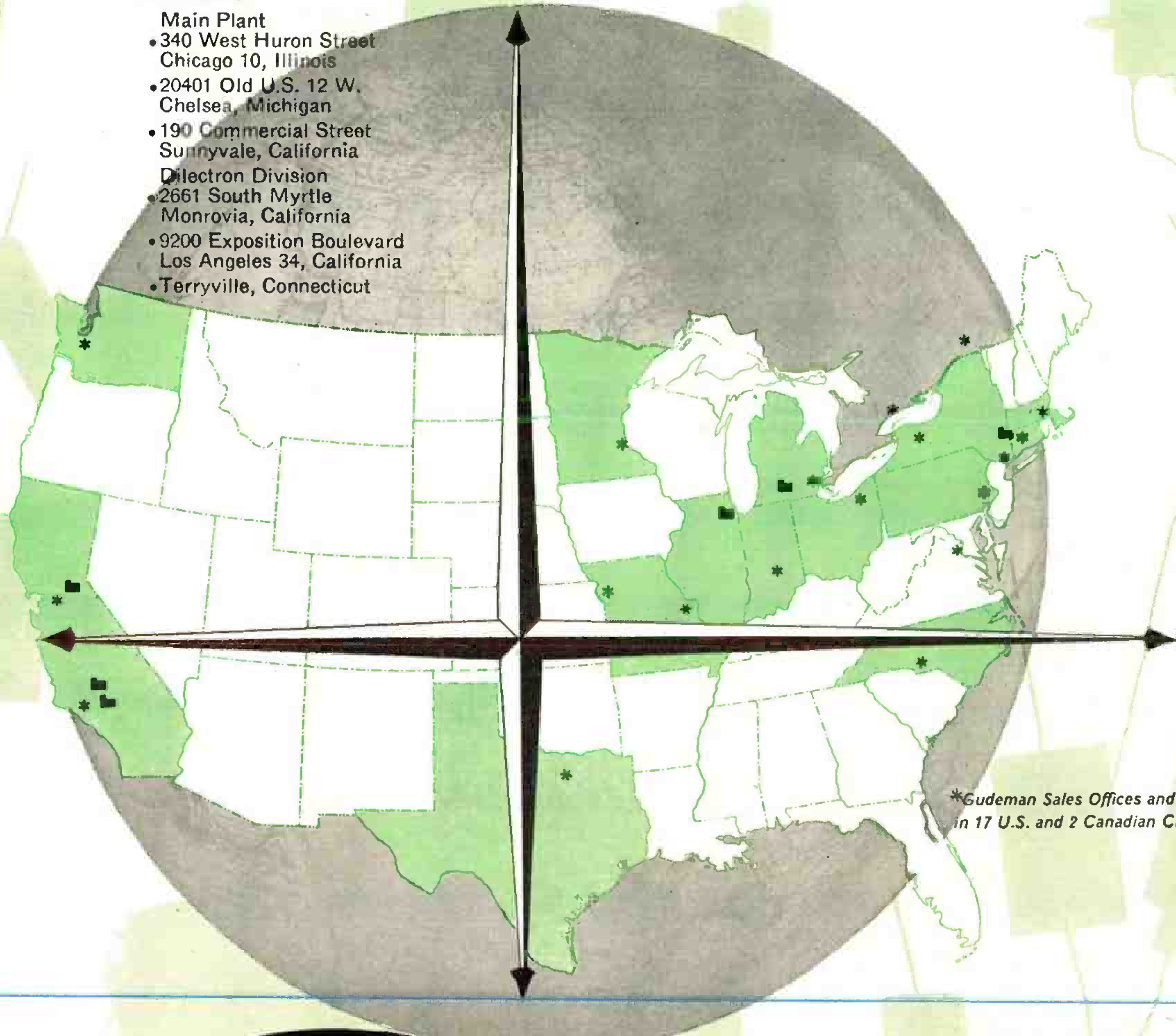
GUDEMAN COAST-TO-COAST SERVICE

Manufacturers of Capacitors, Filters, Pulse Transformers, Delay Lines and Linear Variable Differential Transformers.

6 Plants

Main Plant
- 340 West Huron Street
  Chicago 10, Illinois
- 20401 Old U.S. 12 W.
  Chelsea, Michigan
- 190 Commercial Street
  Sunnyvale, California

Dilectron Division
- 2661 South Myrtle
  Monrovia, California
- 9200 Exposition Boulevard
  Los Angeles 34, California
- Terryville, Connecticut



Gudeman Sales Offices and Representatives in 17 U.S. and 2 Canadian Cities.

Write for latest technical data on any of the following:

MIL-C-25A Capacitors
High Voltage Glass Cased Capacitors (GC Type)
Motor Starting Capacitors (Paper Dielectric-Oil Impregnated)
Paper Tubular Capacitors
Hi-Temperature-Plastic Dielectric Capacitors (XC Types-165°C)
Miniature Hi-Temp Capacitors (XH Types-125°C)
Dry Electrolytic Capacitors
Noise Suppression Filters
Delay Lines
Pulse Transformers
Ceramic Capacitors
Plastic Dielectric Capacitors (337 & 338 Types)
Linear Variable Differential Transformers
Metallized Paper Capacitors

See these products at Booth 407 I.R.E. Show

THE Gudeman

MAIN OFFICE: 340 WEST HURON STREET • CHICAGO 10, ILLINOIS
PHONE DElaware 7-7400
Manufacturers of Electronic Components

www.americanradiohistory.com

Consider the tinker:

he spread himself too thin...

One early example of the non-specialist was the Traveling Tinker. Unlike the blacksmith, the gunsmith or other engineering-minded specialists of that day, the Tinker did everything. His work was just good enough to last his pioneering customers until someone better equipped came along. Sooner or later someone always did . . . and the Tinker lost his customers. Then he drifted on. Finally progress overtook him completely and we see him no more.

We have seen similar changes in our times too. Before specialized component manufacturers came on the scene a few years ago, leading engineers had to spread themselves pretty thin . . . the designer of complex new equipment had to devise from scratch on the tiniest details. Designing a hermetic seal, say, was part and parcel of developing a sensitive relay. This is no longer so.

Like many in the electronics industry, Hermetic Seal Products Co. has specialized in a particular product and related service. Our concentrated effort has resulted in producing, for other engineers' use, hermetic seals with performance characteristics undreamed of a few years ago. This specialized attention continually brings forth new advances in our products and those of our customers.

Hermetic's specialized engineering of VAC-TITE* and matched glass seals can be applied to your particular problems, too. Why not write today for particular information and for our latest addition to the "Encyclopedia Hermetica"? . . . Sent free when requested on company letterhead.

*Vac-Tite — Hermetic's exclusive glass-to-metal, chemically-bonded compression construction. Available on headers and seals from 1-1/2 in. down to .090 in. diameter and with 1 to 53 terminals.

BETTMANN ARCHIVE

Hermetic Seal Products Company

33 South Sixth Street • Newark 7, New Jersey

SEALED IN BY HERMETIC HEADERS

FIRST & FOREMOST IN MINIATURIZATION

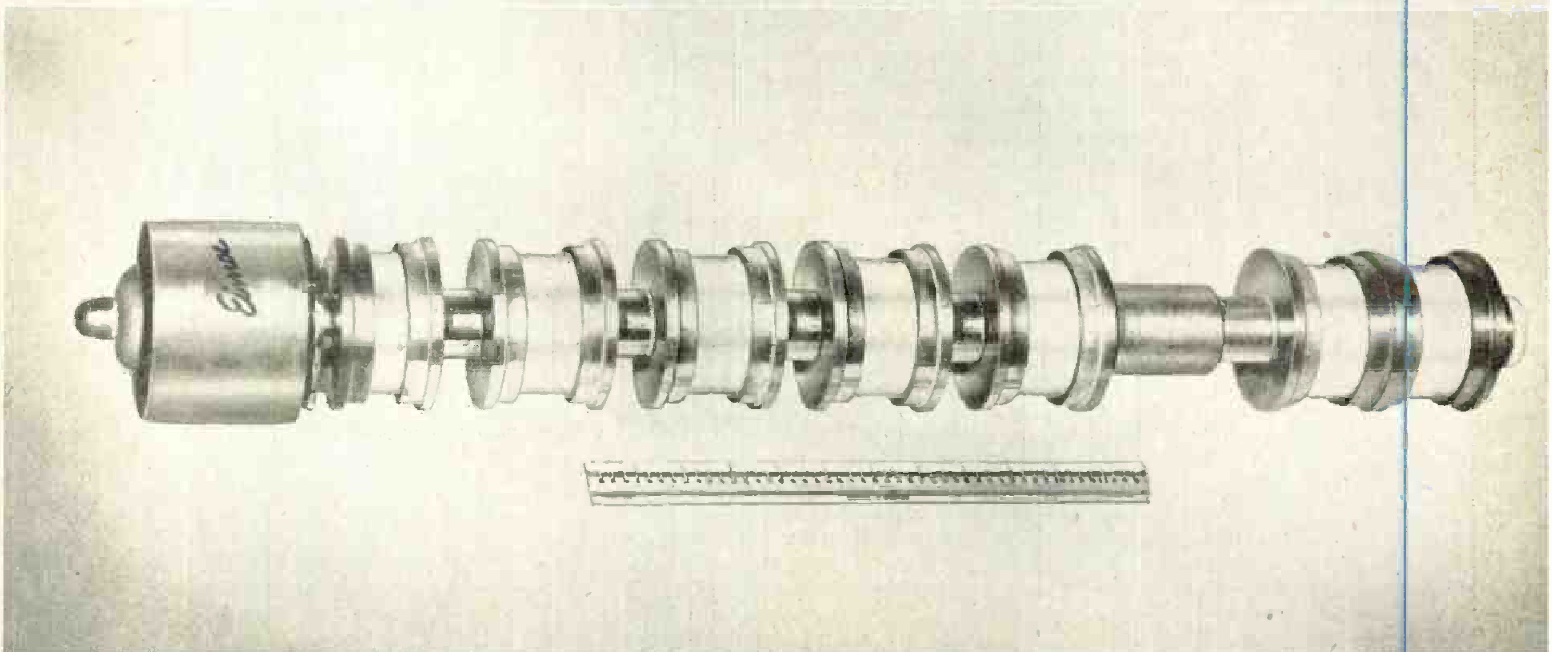
www.americanradiohistory.com

Eimac Klystron Report

X566

20kw modulating anode pulse klystron

- **High power gain of 53db**
- **UHF operation — 960-1400mc**



EIMAC X566 UHF klystrons have consistently obtained peak pulse power outputs of more than 20kw with over 40% efficiency at 960-1400mc. Many times more powerful than any other tube intended for similar operation, such as aircraft navigational aid Distance Measuring Equipment, the air-cooled X566 requires only 100 milliwatts driving power for a 20kw output — a power gain of 53db with bandwidth adequate for most pulse applications. Of special significance is the high average power capability of one kilowatt, allowing the duty cycle to be raised to 5% with a 20kw peak output, or 10% with 10kw output, and so on. Outstanding pulse capabilities of the X566 are made possible through the use of the Eimac modulating anode — an insulated anode between the cathode and drift tube section — permitting the klystron to be pulse modulated with low pulsing power. In Eimac high power amplifier k strons using ceramic and copper construction, the re nant cavities are completed outside the vacuum syste which is left free of RF tuning devices — permitti easy wide range tuning and uncomplicated input a output coupling adjustment. This simplicity of desi and rugged construction minimize replacement co as well as making the Eimac X566 suitable for m production techniques.

The X566, another Eimac high power klystron achie ment, is now available with circuit components for perimental purposes.

- *For additional information, contact our Technical Services Department.*

EITEL-McCULLOUGH, INC.

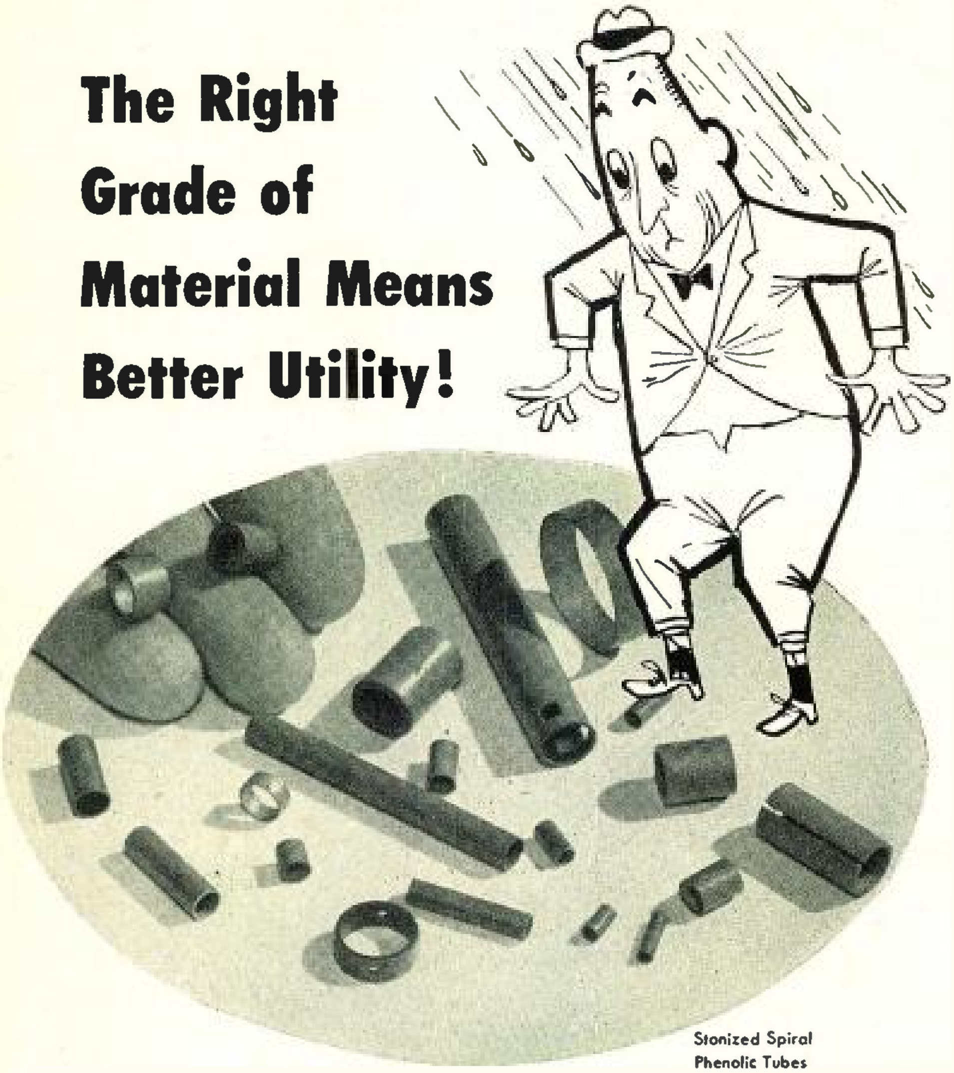
SAN BRUNO • CALIFORNIA

Eimac

THE WORLD'S LARGEST MANUFACTURER OF TRANSMITTING TUBES

www.americanradiohistory.com

The Right Grade of Material Means Better Utility!



Stonized Spiral Phenolic Tubes

All impregnated paper tubes are *not* the same even though they may look alike.

The *degree of impregnation* is most important in determining the ultimate utility of the treated paper tube.

Stone's pioneering experience in spiral wound small diameter paper tube manufacture is assurance that our phenolic impregnated tube—*"Stonized"*—will meet your most rigid specifications.

There is a special grade with low moisture absorption, corrosive and insulation resistance qualities; another of *high* mechanical strength and resiliency for bushings; others for tubing with internal threads or for embossing, forming, punching. There is a general purpose grade as well as one for stapling.

These are specific *grades* of *Stonized* tubes, but others may be tailored to your exact requirements.

Let us have one of our conveniently located representatives call on you, or write directly to us.

Stone PAPER TUBE CO.

AFFILIATED WITH

STONIZED PRODUCTS CO. INC.

900-922 Franklin Street, N.E., Washington 17, D. C.

TELE-TIPS

(Continued from page 22)

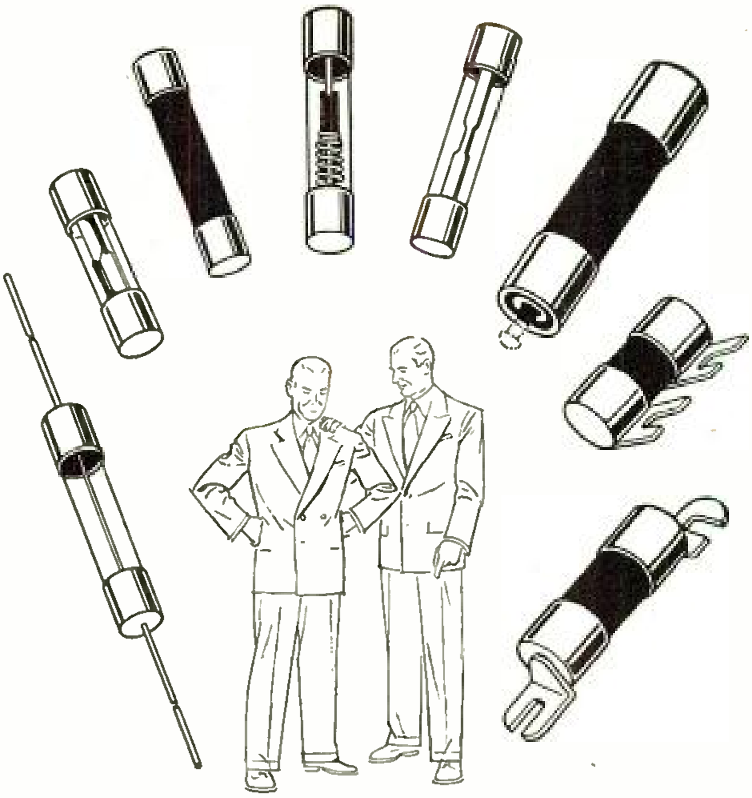
STRONG REBUTTAL to an attack on subscription TV by a committee of movie theater operators has been issued by Commander E. F. McDonald, president of Zenith. "It should be borne in mind that the single purpose of this committee of theater owners is to kill off a competitor that will, through the home box office, provide a far greater outlet for far more motion pictures.... There is not sufficient advertising revenue available in the entire United States to support TV stations in all the channels that have been allocated by FCC.... Subscription TV alone can supply the supplemental income."

MOLAR CLOSE-UPS are just one of the features of another interesting application of RCA's "TV Eye" close circuit TV. The University of Kansas City School of Dentistry uses it to teach students dental surgery. Now a whole class can observe an operation; previously only six could see directly, and none of these close enough to the patient's mouth.

"PREGNANT GOOSE" is the name being used affectionately for the new Super-Constellations which carry some six tons of electronic gear to supplement ground radar installations.

ILLEGAL activity of removing manufacturer's identifying marks from bad receiving tubes, rebranding with the name of the original or other maker, and adding an "in warranty" date code for free replacement is reported by GE. The mode of operation of the tube counterfeiters is to purchase large quantities of discarded tubes from service technicians for 1¢ or 2¢ apiece. "Good" tubes (those whose filaments would light) are washed, rebranded and sold to the public. "Bad" tubes are rebranded and returned to the manufacturer as in warranty failures. Federal and local officials are cracking down. To prevent the direct financial loss and injury to trade name prestige resulting from these activities, it has been proposed that a permanent method of branding be devised, and that strict industry-wide policing be undertaken.

www.americanradiohistory.com



BUSS

. . . one source to meet all your Fuse Needs!

CONSISTENT PIONEERING in the development of fuses that meet the most exacting standards has helped BUSS keep apace with the Electronic Industries expanding need for fuses.

The complete BUSS line of fuses includes: — dual-element (slow blowing), renewable and one-time types . . . in sizes from 1/500 ampere up . . . plus a companion line of fuse clips, blocks and holders.

It's convenient to get all your fuses from one source. Purchasing, stock handling and records are simplified.

And to make sure that the BUSS reputation for quality is maintained, every BUSS fuse normally used by the Electronic Industries is tested in a sensitive electronic device that rejects any fuse not correctly calibrated, properly constructed and right in all physical dimensions.

If you are designing a new device — or have a special problem in electrical protection — BUSS may be able to save you considerable engineering time. To help you determine the right fuse or fuse mounting for the job, BUSS places at your service the world's largest fuse research laboratory and its staff of experienced engineers.

MAKERS OF A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC AND INDUSTRIAL USE

For More Information Mail this Coupon

BUSSMANN Mfg. Co. (Div. McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me bulletin SFB containing facts on BUSS small dimension fuses and fuse holders.

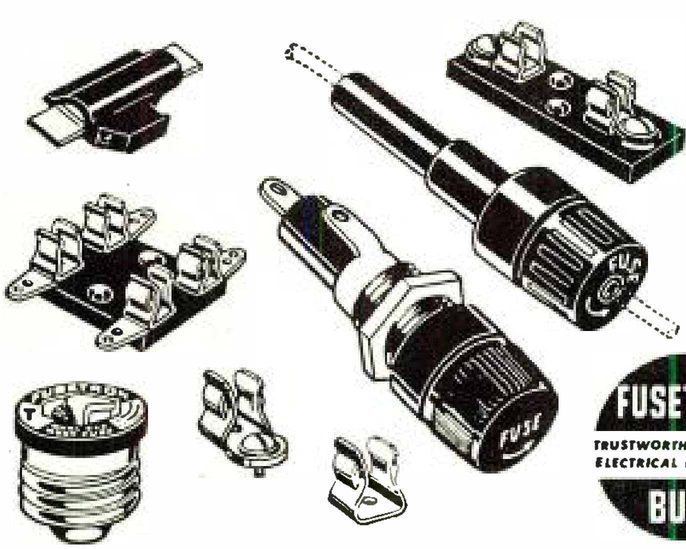
Name................................ Title................

Company................................

Address................................

City & Zone.................. State.............. TT-155

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS



www.americanradiohistory.com

www.americanradiohistory.com

SOME THINGS CAN'T BE RUSHED

IT TAKES TIME TO GO FROM RED TO GREEN

and it takes *time* to make a good recording disc...

Know-*when* is as vital as know-*how* in making a fine recording disc. This most sensitive "instrument" must be handled with special care at every point—from original preparation of materials down to the method of wrapping.

Slam-bang mass production could never achieve anything like the flawless recording discs produced by Presto. For Presto takes all the time in the world—to make Presto discs the best-performing and permanent in the world.

PRESTO GREEN · ORANGE · BROWN AND WHITE LABEL DISCS ARE USED THROUGHOUT THE WORLD—WHEREVER FINE RECORDING IS DONE

PRESTO RECORDING CORPORATION
PARAMUS, NEW JERSEY

Export Division: 25 Warren Street, New York 7, N. Y.
Canadian Division: Instantaneous Recording Service, 42 Lombard St., Toronto

TIME-CONSUMING STEP #1 IN MAKING A PRESTO RECORDING DISC

Your recording discs start with an aluminum base. The slightest flaw in the aluminum shows up in the finished disc. That's why Presto takes the time to spec and inspect every aluminum blank. It mus be milled precisely. Thickness must be 100% uniform. Circles must be die-cut 100% perfect. The approved aluminum discs go into production. Edges are burred. Platters are cleaned. And every d is polished to shimmering smoothness—the slow-but-sure way—*by hand*. Presto Recording Discs take time to make. That's why they are well worth your time—and money!

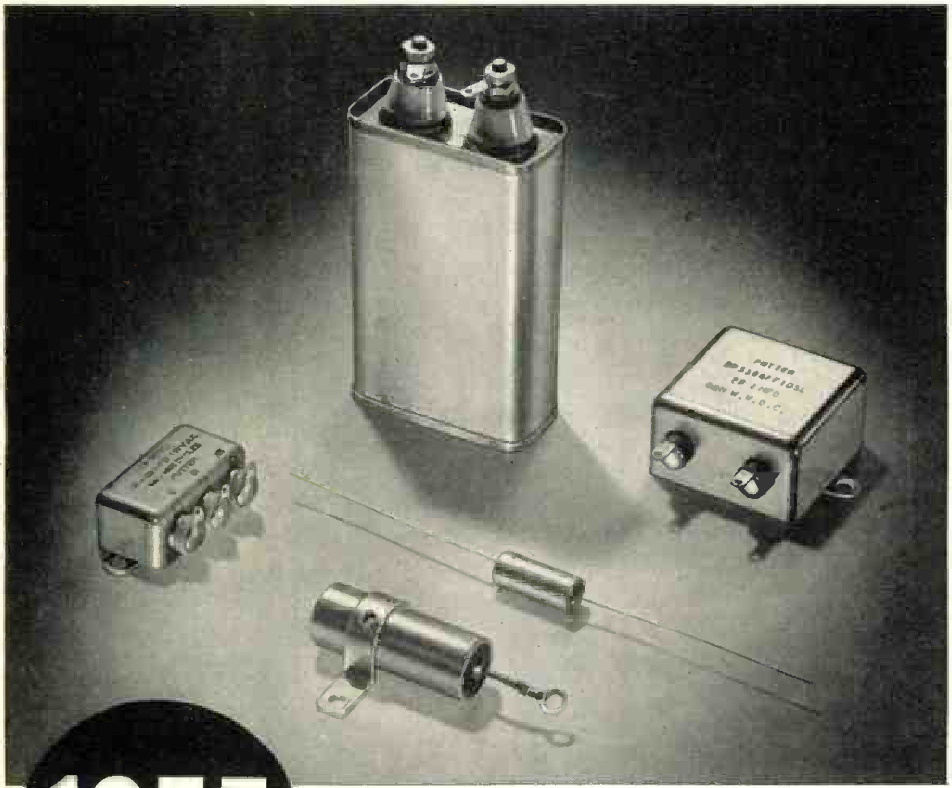
www.americanradiohistory.com

30 Years of Leadership

POTTER

Capacitors

1925



1955 ... marks the Thirtieth Year that The Potter Company has devoted its efforts to the design and construction of special capacitors to meet specific customer application ... so

If your product reputation hinges on dependable performance of quality components —

SPECIFY POTTER CAPACITORS

If you need flexible production facilities for capacitors engineered to fit your needs —

SPECIFY POTTER CAPACITORS

Write today for Free Catalog of the complete Potter Line of Capacitors and Radio Noise Filters. Address Department F.

THE potter COMPANY

SPECIALISTS IN FIXED PAPER CAPACITORS SINCE 1925

1950 SHERIDAN ROAD
NORTH CHICAGO, ILL.

BOOKS

TV Stations

By Walter J. Duschinsky. Published 1954 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 136 pages. Price $12.00.

Profusely illustrated, and well organized for easy reading and understanding, this volume offers a wealth of knowledge for TV engineers, management and station planners. Presumably to keep its scope and utility broad, extensive technical detail has been kept to a minimum. What makes this book a really valuable contribution is the fact that it integrates the many diverse facets of the TV station into one clear-cut composite text.

TV Stations is divided into two major parts, plus appendices, bibliography, glossary and index. The first part deals with the master planning prior to construction, and covers such subjects as site selection, plant facilities, space utilization, programming, personnel organization, and equipment usage. To appreciate the illustrative appeal of this handbook, consider that over several of its large size pages (8¾ x 11⅝") there are more than 60 photographs of cameras, dollies, monitors, consoles, film projectors, etc., to describe the section on equipment usage.

The second major part encompasses the practical problems and methods of station operation. To mention just a few of the topics covered, we note personnel functions, antenna structures, studio and transmitter controls, floor plan layouts, and expenditures.

Because of the time lag between completion of the manuscript and publication of the book, this volume lacks recent material on color TV. But all authors and publishers face this same time problem. The important point is that it is an excellent book as it stands.

A Dictionary of Electronic Terms

Edited by Gordon R. Partridge. Published 1954 by Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill. 72 pages. Price $.25. (Stock No. 37K756.)

No doubt all of our readers know the meaning of words like dielectric, guy wire, and feedback. However, it is not too hard to imagine how the score would run with words like ferrospinel, kenotron, Ruhmkorff coil and sabin. Well, whatever the electronic word one may be looking for, it's more than likely it will be found among the 3500 terms included in this handy reference. Also included are over 150 illustrations of components, equipment and circuits. This little 6 x 9 in. book will do a lot of things for engineers that Websters Unabridged wouldn't think of.

Transistors: Theory and Applications

By Abraham Coblenz and Harry L. Owens. Published 1955 by McGraw-Hill Book Co., 327 W. 41 St., New York 36, N. Y. Price $6.00. Covers theory, operation and application of silicon and germanium transistors. Manufacturing techniques are also included.

www.americanradiohistory.com

Now THE ULTIMATE IN MAGNETIC RECORDING TAPES . . . . . .

FERRO-SHEEN irish BRAND SHAMROCK #300

Here is a tape which some of America's largest recording studios are calling the "ultimate"! Two features raved about are the extremely flat frequency response at the high end of the spectrum and the complete absence of oxide shedding due to absolute bonding and the mirror-like surface imparted by the ***FERRO-SHEEN*** process.

You too, will find this new ***FERRO-SHEEN*** recording tape your "ultimate", whether it is for original program recording, tape masters for records and pre-recorded tapes, or for the highest fidelity in pre-recorded tape duplicates . . . in fact anywhere that highest quality professional results are a must.

HERE ARE OUTSTANDING FEATURES OF irish's FERRO-SHEEN PROCESS

EXTENDED FREQUENCY RESPONSE . . . all the highs . . . all the lows . . . limited only by the recording equipment in use.

REDUCED "DROP-OUTS" . . . nodules and agglomerates virtually eliminated.

40% to 100% REDUCTION IN HEAD WEAR . . . mirror-sheen surface operates with negligible friction and abrasion.

UNEXCELLED BONDING of oxide and base.

"JOHANNSON BLOCK EFFECT" ELIMINATED† . . . does not "polish" head surfaces.

Order a supply of this remarkable new tape today and discover new thrills in magnetically reproduced sound. At

****FERRO-SHEEN*** is irish's exclusive n
process of tape manufacture, whi
combines a new oxide and binc
treatment, a new magnetic surfa
material and a new plastic base t
gether in a new hotmelt laminati
process, resulting in the stronge
bond, the highest uniformity of oxi
particles, and the smoothest surfa
ever attained in recording ta
manufacture.

HERE ARE ADDITIONAL FEATURES OF SHAMROCK #300 TAPE.

- New irish reel . . . the strongest plastic reel on American market, heavier by actual weight . . . more plastic than any other reel. Two very large op ings permit easy access to the threading eye.
- Has 8' eye-ease green leader on both ends.
- Packed in polyethylene bag.
- Includes irish reel-tab . . . provides space for not subjects recorded and position on reel.

ORRADIO Industries, In
World's Largest Exclusive Magnetic Tape Manufactu
Opelika, Alabama
Export Division: Morhan Exporting Corp., New York, N.
In Canada: Atlas Radio Corp., Ltd., Toronto
†See short article by Talmadge Fngland

www.americanradiohistory.com

high performance for low-cost tv sets with Tung-Sol

2AF4 (Prototype—6AF4) Heater Current 0.6 A Heater Volts 2.35	**3BN6** (Prototype—6BN6) Heater Current 0.6 A Heater Volts 3.15	**5AQ5** (Prototype—6AQ5) Heater Current 0.6 A Heater Volts 4.7	**6AX7** (Prototype—12AX7) Heater Current 0.6 A Heater Volts 3.15*	**12BQ6GA** (Prototype—6BQ6GA) Heater Current 0.6 A Heater Volts 12.6
3AL5 (Prototype—6AL5) Heater Current 0.6 A Heater Volts 3.15	**3BY6** (Prototype—6BY6) Heater Current 0.6 A Heater Volts 3.15	**5BK7A** (Prototype—6BK7A) Heater Current 0.6 A Heater Volts 4.7	**6S4A** (Prototype—6S4) Heater Current 0.6 A Heater Volts 6.3	**12BQ6GT** (Prototype—6BQ6GT) Heater Current 0.6 A Heater Volts 12.6
3AU6 (Prototype—6AU6) Heater Current 0.6 A Heater Volts 3.15	**3CB6** (Prototype—6CB6) Heater Current 0.6 A Heater Volts 3.15	**5T8** (Prototype—6T8) Heater Current 0.6 A Heater Volts 4.7	**6SN7GTB** (Prototype—6SN7GTA) Heater Current 0.6 A Heater Volts 6.3	**12BY7A** (Prototype—12BY7) Heater Current 0.6 A Heater Volts 6.3*
3AV6 (Prototype—6AV6) Heater Current 0.6 A Heater Volts 3.15	**4BQ7A** (Prototype—6BQ7A) Heater Current 0.6 A Heater Volts 4.2	**5U8** (Prototype—6U8) Heater Current 0.6 A Heater Volts 4.7	**12AX4GTA** (Prototype—12AX4GT) Heater Current 0.6 A Heater Volts 12.6	**12L6GT** (Prototype—25L6GT) Heater Current 0.6 A Heater Volts 12.6
3BC5 (Prototype—6BC5) Heater Current 0.6 A Heater Volts 3.15	**4BZ7** (Prototype—6BZ7) Heater Current 0.6 A Heater Volts 4.2	**5V6GT** (Prototype—6V6GT) Heater Current 0.6 A Heater Volts 4.7	**12B4A** (Prototype—12B4) Heater Current 0.6 A Heater Volts 6.3*	**12W6GT** (Prototype—6W6GT) Heater Current 0.6 A Heater Volts 12.6
3BE6 (Prototype—6BE6 Heater Current 0.6 A Heater Volts 3.15	**5AN8** (Prototype—6AN8) Heater Current 0.6 A Heater Volts 4.7	**6AU7** (Prototype—12AU7) Heater Current 0.6 A Heater Volts 3.15*	**12BH7A** (Prototype—12BH7) Heater Current 0.6 A Heater Volts 6.3*	**19AU4** (Prototype—6AU4GT) Heater Current 0.6 A Heater Volts 18.9
				25CD6GA (Prototype—25CD6G) Heater Current 0.6 A Heater Volts 25

*Using heaters connected in parallel.
Other Series String Tube Types In Development

Series String tubes

All Tung-Sol Series String Tubes have uniform heater warm-up time to safeguard against failures from initial voltage surge.

Heater ratings are based on 600 milliamperes of current with the heater voltage adjusted for the same power as in the prototype. All other characteristics and ratings are identical to those of the prototype.

Use of these tubes provides completely satisfactory receiver characteristics during warm-up.

If you're a TV set manufacturer with an eye on the mass volume market, Tung-Sol can provide the "series string" tube types, the quality and the service you need for a successful competitive program.

COMPLETE LINE: Tung-Sol Tube types will meet the performance requirements of circuit designs currently in use, as well as any foreseeable new circuitry. Additional tube types are in development.

DEPENDABLE QUALITY: Tung-Sol quality control standards have been adjusted to the more severe service demands of "series string" operation. You can rely on Tung-Sol "Series String" Tubes to give the same dependable performance as their prototypes.

SERVICE: Competent field engineers are immediately available for consultation beginning at the design stage to help you achieve smooth, efficient production. Tube deliveries are coordinated to your manufacturing schedules and are completely reliable. Your design plans are received in strictest confidence.

For more information about Tung-Sol "Series String" TV Tubes, write to Commercial Engineering Department, Tung-Sol Electric Inc., Newark 4, New Jersey.

SALES OFFICES

Atlanta, Chicago, Columbus, Culver City (Los Angeles), Dallas, Denver, Detroit, Newark, Philadelphia, Seattle.

Tung-Sol makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

TUNG-SOL®

Radio and TV Tubes, Dial Lamps

www.americanradiohistory.com

Blaw-Knox 1029-foot tower stood firm against hurricane blasts

"During the last 30 years we've lost four towers to high winds and hurricanes," said John Peffer, assistant manager of WTAR-TV Norfolk, Virginia, "but we've never lost a Blaw-Knox Tower."

Mr. Peffer then cited their most recent experience during hurricane Hazel that hit so hard at Norfolk and the surrounding area.

In the nearby town of Driver, where WTAR's newest tower is located, the wind velocity was recorded up to 108 miles per hour. At that point the anemometer was blown down. But the 1029-foot, triangular, guyed Blaw-Knox TV Tower stood firm against the hurricane blasts.

In Norfolk, during the same blow, the indicator on the wind velocity meter frequently sat tight against the 100 mph pin (the maximum reading on that meter). But WTAR's tower in the downtown area . . . a 400-foot, four-legged, self-supporting Blaw-Knox TV Tower . . . came through in good shape.

These are just two typical examples of the sturdy strength of all Blaw-Knox Towers . . . designed and constructed to meet your specific requirements.

For further information on the many types of Blaw-Knox Antenna Towers, write for your copy of Bulletin No. 2417.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division • Tower Department
Pittsburgh 38, Pennsylvania

ANTENNA TOWERS

Guyed and self-supporting—for AM • FM
TV • radar • microwave • communications

BLAW-KNOX
EQUIPMENT DIVISION

www.americanradiohistory.com

PROVED BY USE!

In the short time the Model 1001 Regulator has been on the market, more than 300 of the instruments have been sold, mainly for meter calibration applications and for use in standards laboratories.

As a result, it can now be said — *and proved* — that the Model 1001 gives hairsplitting precision *with the rugged dependability of operation associated with voltage regulators of "ordinary" regulating accuracy!*

0.01% regulation accuracy!

1000 VA capacity!

Sorensen Model 1001

electronic AC Voltage Regulator

specifications

Input	95-130 VAC, 1Ø, 50-60∿
Output	110-120 VAC, adjustable
Load range	0-1000 VA
Regulation accuracy	±0.01% against line and ±0.01% against load guaranteed at room temperature, for a resistive load, an input variation of ±10% and over a 2-to-1 load change. For all other conditions within the specifications the 1001 has a proportionate amount of accommodation.
Distortion	3% RMS maximum
P. F. range	0.95 leading to 0.7 lagging
Time constant	0.1 second
Tube complement	6SL7GT (1), 6L6GA (1), 5Y3GT (1), 2AS15 (1)

Even greater capacity with similar accuracy will be available this fall when the Sorensen Model 2501 Regulator — ±0.01% accuracy, 2500 VA capacity — goes into production.

general catalog available

AC VOLTAGE REGULATORS — 150VA to 15000VA capacities, 115 volt and 230 volt output, 400-cycle regulators, 3-phase regulators

FREQUENCY CHANGERS — 60 cycle and 400 cycle, accuracy to ±0.01%

NOBATRONS — Regulated low-voltage, high-current DC sources

B-NOBATRONS — Regulated high-voltage, low-current B power supplies

NOBATRON-RANGERS — Wide-range variable DC sources

TUBELESS DC SUPPLIES — Magnetic amplifier supplies with various outputs and capacities

AIRBORNE FREQUENCY CHANGERS & INVERTERS MILITARIZED REGULATORS, FILTERS, TRANSFORMERS, AND RELATED EQUIPMENT.

For your copy write Sorensen & Co., Inc., 375 Fairfield Avenue, Stamford, Conn. In Europe, Sorensen A.G., Gartenstrasse 26, Zurich 2, Switzerland.

SORENSEN

375 FAIRFIELD AVENUE, STAMFORD, CONN.

LETTERS . . .

Tubes: To Select or Not Select

(The following letters comment on the article, "Tube Selection Increases Signal Capacity of TV Receivers," by Robert G. Horner, published in our Oct. 1954 issue. Without condoning the practice, the editors believe that publication of opposing views on the subject is necessary to arrive at an intelligent mutual understanding between tube manufacturers and equipment designers. Ed.)

Editors, TELE-TECH:

We read the article with great concern. We do not condone tube selection. This practice will eliminate many of the advantages gained over the years by the Electronic Tube Industry, through their joint efforts. These efforts are coordinated by RETMA and JETEC. Standardization in any Industry reduces costs and simplifies service and maintenance of the product. We realize that tube selection may result in improved performance when considering one characteristic of the product. This is due to the fact that the characteristics of electronic tubes have a natural tolerance around the average value. This fact of life is not limited to electron tubes. Every quality characteristic of any product is a variable. The ability to cope with these variables has made the American Industry what it is today.

Improved performance of TV receivers can be achieved by coordinating the design of electronic tubes with the associated circuitry. Individual performance characteristic improvements by this method may not be as fast or as spectacular as could be achieved by selection. Mr. Horner's article discusses an example. The customer is served best by considering the performance of a product from the overall viewpoint: i.e., cost, distribution, and customer service throughout the life of the product.

Several of our customers are resorting to tube selection in specific applications. It is not too widespread—but there is a trend. We are doing what we can to minimize it. Publications such as yours can help by presenting both sides of the problem.

Edgar K. Wimpy
Director of General Engineering
CBS-Hytron
Danvers, Mass.

Editors, TELE-TECH:

Tube selection has been praised and decried by many people for many years, but when all is said and done the situation always reduces to a few simple facts.

1. Better initial performance can be obtained in many instances by tube selection. The same often is true with other components.

2. Selection often may be accomplished in such a way that all tubes are

(Continued on page 38)

AlSiMag®

Widest selection of latest materials. Constant addition of new special-purpose bodies. Over 50 years accumulated experience and "know how." A highly trained staff, alert for improvements and new techniques.

low . . .

True cost is what you get for what you pay. It's risky to buy ceramics by price alone. It may mean mediocre material and outdated design. You'll profit by investigating the recent "giant steps" taken in the ceramic field.

cost . . .

AlSiMag offers the best possible ceramic for your job at a price that's right. Modern, large-scale equipment cuts production costs. Shipments are on time and to specification. AlSiMag extra services include free redesign service and use of open dies.

ceramics

Assembly lines run on deliveries, not promises. That's why we're careful to make delivery estimates that are dependable. True, ceramics are temperamental. But you'll find AlSiMag's "shipment as promised" average is high. Ask any of our customers.

• Send a blueprint and outline of operating conditions and see what American Lava can do to save you money.

53RD YEAR OF CERAMIC LEADERSHIP

AMERICAN LAVA CORPORATION

A SUBSIDIARY OF MINNESOTA MINING AND MANUFACTURING COMPANY

CHATTANOOGA 5, TENNESSEE

Branch offices in these cities (see your local telephone directory):
Cambridge, Mass • Chicago, Ill. • Cleveland, Ohio • Dallas-Houston, Texas
Indianapolis, Ind. • Los Angeles, Calif. • Newark, N. J. • Philadelphia-Pittsburgh, Pa.
St. Louis, Mo. • South San Francisco, Calif. • Syracuse, N. Y. • Tulsa, Okla.

www.americanradiohistory.com

New MALLORY VIBRATORS

set new standards for

LOW HUM LEVEL

The latest improvements in Mallory vibrators now offer designers the quietest operation ever available in a commercial vibrator. By means of a unique "floating" design, this new model thoroughly isolates the vibrator mechanism . . . minimizes transmission of mechanical hum and shake to the can or mounting base.

For the first time, mechanical noise has been reduced to a level lower than the speaker hum emitted by most automobile radio sets. The new design, furthermore, suppresses mechanical hum in *any* mounting position of the vibrator.

NO EXTRA COST. This new level of performance is available to you at the identical cost of previous Mallory vibrator models. The low-noise model now becomes the standard Mallory type, and in most instances carries the same part number. In addition, case size has been made more compact . . . affording valuable space savings in crowded circuits.

Mallory's experience is based on twenty-five years of pioneering research and development in the vibrator field, during which time we have supplied more vibrators for original equipment than all other makes combined. This experience is ready to serve you on your power supply design problems . . . to help you utilize the maximum qualities of Mallory low-noise-level vibrators. For engineering consultation, or for our Technical Bulletin, write or call us today.

Expect more . . .
Get more from
P.R. MALLORY & CO. Inc. MALLORY

IN POWER SUPPLIES BE SURE TO USE . . .

MALLORY FP Electrolytic Capacitors—The original fabricated plate capacitor, FP electrolytics have for many years been built for continuous operation at 85° C. . . . famous for long shelf and service life . . . with fast, twist-prong mounting.

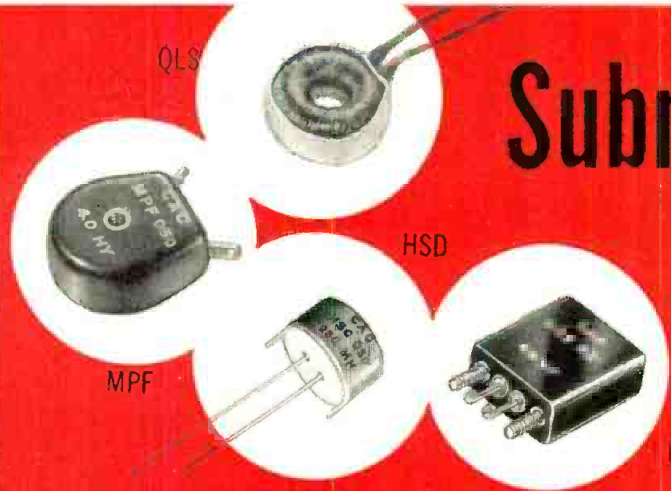
Parts distributors in all major cities stock Mallory standard components for your convenience.

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

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

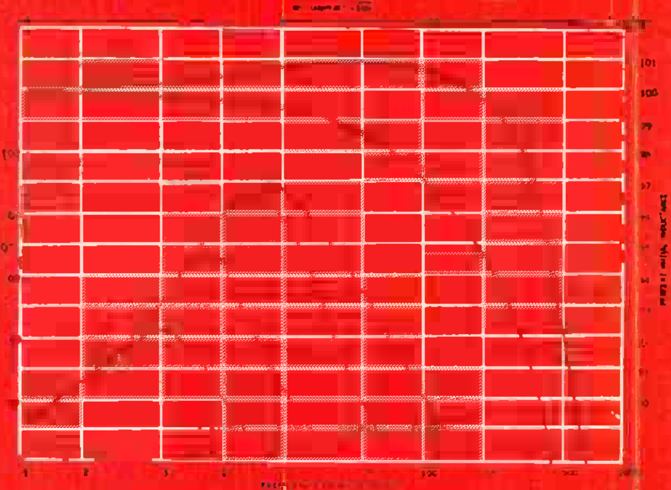
www.americanradiohistory.com



Subminiature Toroids

HIGH PRODUCTION
PROTOTYPES
ENGINEERING DEVELOPMENT
RESEARCH

C-A-C



TRANSISTOR TRANSFORMERS

Consistent with **advanced** engineering in subminiaturization, CAC offers transistor transformers in hermetically sealed cases, molded or cast-type construction—designed to meet military requirements—temperatures (—) 55° C to (+) 105° C. Enclosed magnetic field afforded by toroidal form. Frequencies and impedances to your specifications . . . utilize our **advanced** engineering and modern high speed production facilities. See your CAC representative now.

TYPICAL PULSE TRANSFORMER

IMPEDANCE RATIO	RISE TIME	WIDTH	DROOP % PEAK	—OVERSHOOT	INPUT PULSE TIME MICRO SEC	% RING
200 800	[illegible]	8.[illegible]	10.[illegible]	[illegible]	8	3
700 2800*	2.[illegible]	[illegible]	[illegible]	[illegible]	8	2.5
5000 20000	1.3	8.0	10.0	20.[illegible]	8	0

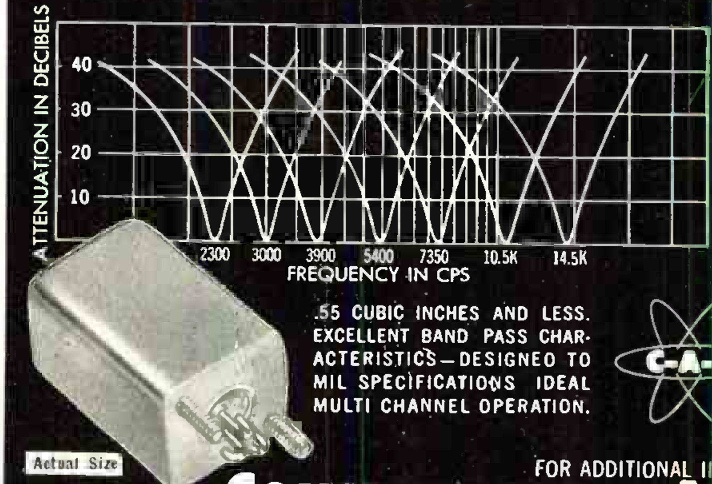
*Nominal Design

A TYPICAL PULSE TRANSFORMER—ONE OF MANY CUSTOM DESIGNS DEVELOPED BY CAC ENGINEERS — HIGHLY STABLE TOROIDAL UNITS — EXHIBIT EXCELLENT CHARACTERISTICS

KEEP YOUR DESIGNS AHEAD WITH **CAC SUBMINIATURES**
APPLICATIONS: FILTERS, CHOKES, TRANSITOR AND PULSE TRANSFORMERS, REACTORS AND INDUCTORS

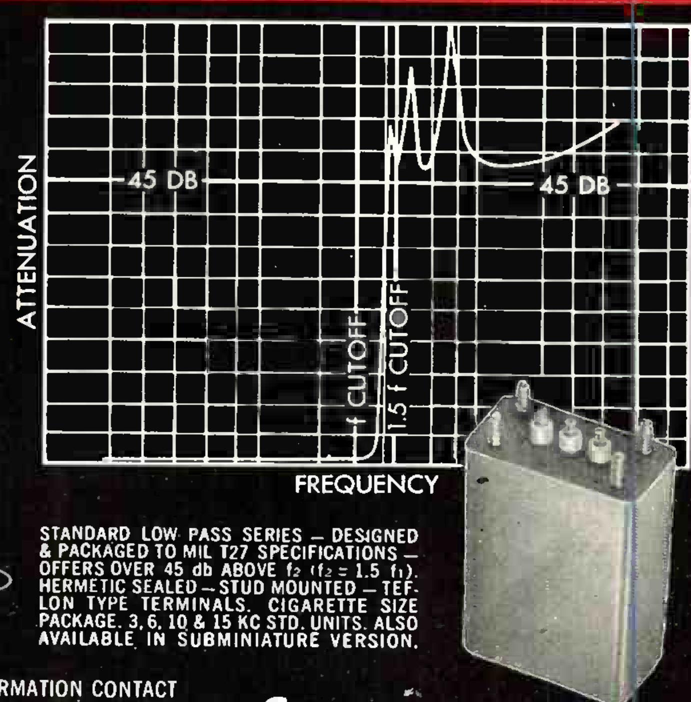
Subminiature Filters

FOR TELEMETERING AND AIRBORNE EQUIPMENT



.55 CUBIC INCHES AND LESS. EXCELLENT BAND PASS CHARACTERISTICS—DESIGNED TO MIL SPECIFICATIONS IDEAL MULTI CHANNEL OPERATION.

C-A-C



STANDARD LOW PASS SERIES — DESIGNED & PACKAGED TO MIL T27 SPECIFICATIONS — OFFERS OVER 45 db ABOVE f_2 ($f_2 = 1.5\ f_1$). HERMETIC SEALED — STUD MOUNTED — TEFLON TYPE TERMINALS. CIGARETTE SIZE PACKAGE. 3, 6, 10 & 15 KC STD. UNITS. ALSO AVAILABLE IN SUBMINIATURE VERSION.

FOR ADDITIONAL INFORMATION CONTACT

COMMUNICATION ACCESSORIES COMPANY

HICKMAN MILLS, MISSOURI • PHONE KANSAS CITY, SOUTH 5528

For product information, use Inquiry card on last page.

www.americanradiohistory.com

LETTERS . . .

(*Continued from page* 34)

used, so that no hardship is suffered by the supplier. The instance described in the October Issue of TELE-TECH is apparently such a case.

3. Selection inevitably ignores the replacement problem. If the performance attribute for which the selection is made is important, then it is hard to see how a responsible producer can ignore the replacement problem. If it is not important, then why select in the first place?

4. Careful engineering design nearly always eliminates any need for selection.

As you have no doubt surmised from the above remarks, my attitude toward selection can be likened to Calvin Coolidge's attitude toward sin. "I'm agin it."

A. K. Wright
Vice-President
Director of Engineering
Tung-Sol Electric, Inc.
95 Eighth Ave.
Newark 4, N. J.

Editors, TELE-TECH:

It is my personal opinion that tube selection as dealt with in this article is a policy which is to be avoided if possible because of long term disadvantages. In most cases of tube selection that we have investigated, the need of selection has occurred because of lack of understanding on the part of equipment designers of full variations to be expected in tube characteristics both from tube to tube and during life.

In some of the commercial applications, selection occurs because of the attempt to get too much performance from a minimum number of tubes. We have on occasion been forced to supply a customer specially selected tubes in order to provide an immediate fix for their difficulties. We deplore the use of this method and believe that the long term solution would be to provide better education about the behavior of tubes to equipment designers.

John H. Wyman
Chief Project Engineer
Red Bank Div.
Bendix Aviation Corp.
Eatontown, N. J.

(The following information was received from J. M. Lang, General Manager, Tube Dept., General Electric Co. Ed.)

From time to time, the technique of special tube selection (where the equipment will perform properly only with tubes whose characteristics fall within a specified range which is less than the normal range of variations associated with the characteristics of the tube) is employed in the manufacture of electronic equipment. Although the type of tube and equipment involved in the special selection varies widely from case to case, certain basic conflicts and difficulties are common to each of the in-

(*Continued on page* 42)

www.americanradiohistory.com

IT'S IN THE BAG!

the *new* audiotape

TRADE MARK

that's 7-WAYS* BETTER than ever!

✵ **IMPROVED BALANCE** between high and low frequencies without sacrificing low-frequency output.

✵ **NEW MOISTURE-REPELLENT BINDER** with lower coefficient of friction. Absolutely eliminates tape squeal under hot, humid conditions. Runs well even on machines badly out of tension adjustment.

✵ **NEW ANTI-TACK AGENT** virtually eliminates possibility of sticking on hot erase and record heads. Especially important to owners of older type machines.

✵ **NEW DRIER-TYPE FORMULA** greatly reduces danger of oxide rub-off, even on dirty heads. Keeps clean heads clean.

✵ **IMPROVED HOT SLITTING** of standard plastic base. Edges of tape cleaner and smoother than ever, danger of tear or breakage greatly reduced.

✵ **NEW LOW BACKGROUND NOISE** through better dispersion of finer oxide particles. A feature of importance to all serious recordists.

✵ **NEW DUST-PROOF PACKAGING** in protective, re-usable polyethylene bag.

Audio Devices now offers you a new and vastly superior professional sound recording tape, at NO INCREASE IN PRICE

Here's a radically improved sound recording tape, perfected after long research in Audio Devices laboratories—a tape that sets completely new standards of performance.

Any *one* of the seven new and improved features listed here would be important news to the tape recordist. Collectively, they spell a degree of perfection heretofore unattainable in any magnetic recording tape!

Such a premium quality product could easily justify a premium price. But it has been made *standard* for *all Audiotape*, on plastic base or Mylar* polyester film—and is available at previous standard prices.

Try the new Audiotape—test it—compare it with any other product on the market. It will speak for itself!

* DuPont Trade Mark

AUDIO DEVICES, Inc.

444 Madison Avenue, New York 22, N. Y.
Offices in Hollywood • Chicago
Export Dept., 13 East 40th St., New York 16, N. Y., Cables "ARLAB"

"they speak for themselves" **audiotape audiodiscs audiopoints audiofilm**

For product information, use inquiry card on last page.

www.americanradiohistory.com

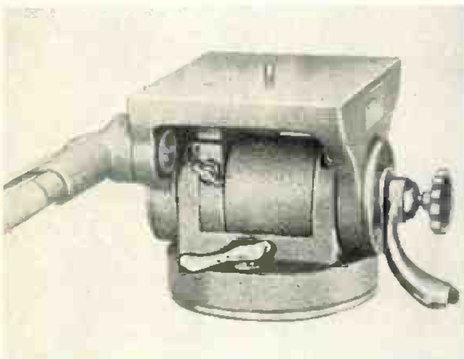
HOW TO GET A HEAD IN TELEVISION

Selection of the proper camera head is important for smooth television and motion picture production. With the many types of heads available, it is often a problem to know which one will best serve the purpose.

Shown here are the various types of camera heads made by Houston Fearless. Each has been designed to fill a specific need. Each has its particular characteristics, features and advantages. The proper choice can be determined by the type, size and weight of the camera to be mounted, the camera accessories to be attached, and the types of shows on which it will be used.

Working closely with the motion picture and television industries over a period of many years, Houston Fearless has engineered this equipment for maximum ease of operation, smooth performance and complete dependability. Exhaustive tests have proved the metals and other materials best suited for the purpose. Precision workmanship assures years of satisfactory service.

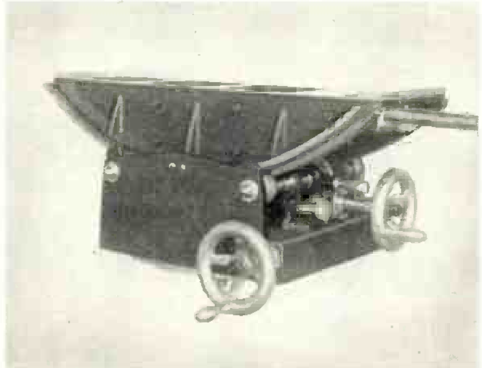
Before deciding on a camera head, camera mount, or film processing equipment, consult your Houston Fearless representative. He will be pleased to analyze your requirements and recommend the equipment that will serve you best. Write or phone: Houston Fearless, 11801 W. Olympic Blvd., Los Angeles 64, Calif., BRadshaw 2-4331. 620 Fifth Ave., New York 20, N. Y. CIrcle 7-2976.



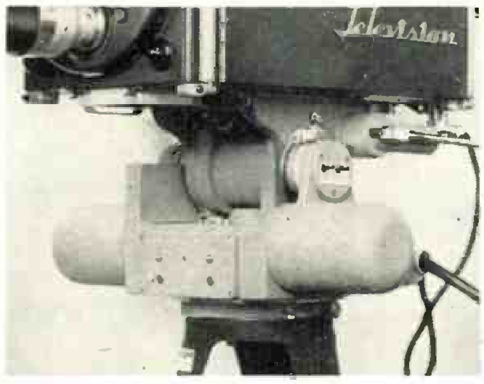
FRICTION HEAD. The most practical head for monochrome TV cameras and motion picture cameras weighing between 80 and 150 lbs. Provides smooth, easy panning and tilting. Pans full 360°. Tilts 45° up and 45° down. Adjustable drag and brakes provided on both actions. Camera is accurately counterbalanced. Adjustable to compensate for extra lenses, etc.

TILT HEAD. For fixed-position TV cameras or microwave parabolas. Friction-type action, but without drag adjustment. Camera or parabola may easily be positioned and locked in place. Calibration scales on both azimuth and tilt allow for quick re-setting of fixed points.

MONOCHROME CRADLE HEAD. Remarkable smoothness and ease of operation for black and white TV cameras are made possible by the perfect balance of the monochrome cradle head. The camera rotates around a constant center of gravity, always in absolute balance. Tilts down 38° and up 30° on ball bearing rollers. Tilt drag is adjustable. In panning, also rides on ball bearings. Brakes on both pan and tilt



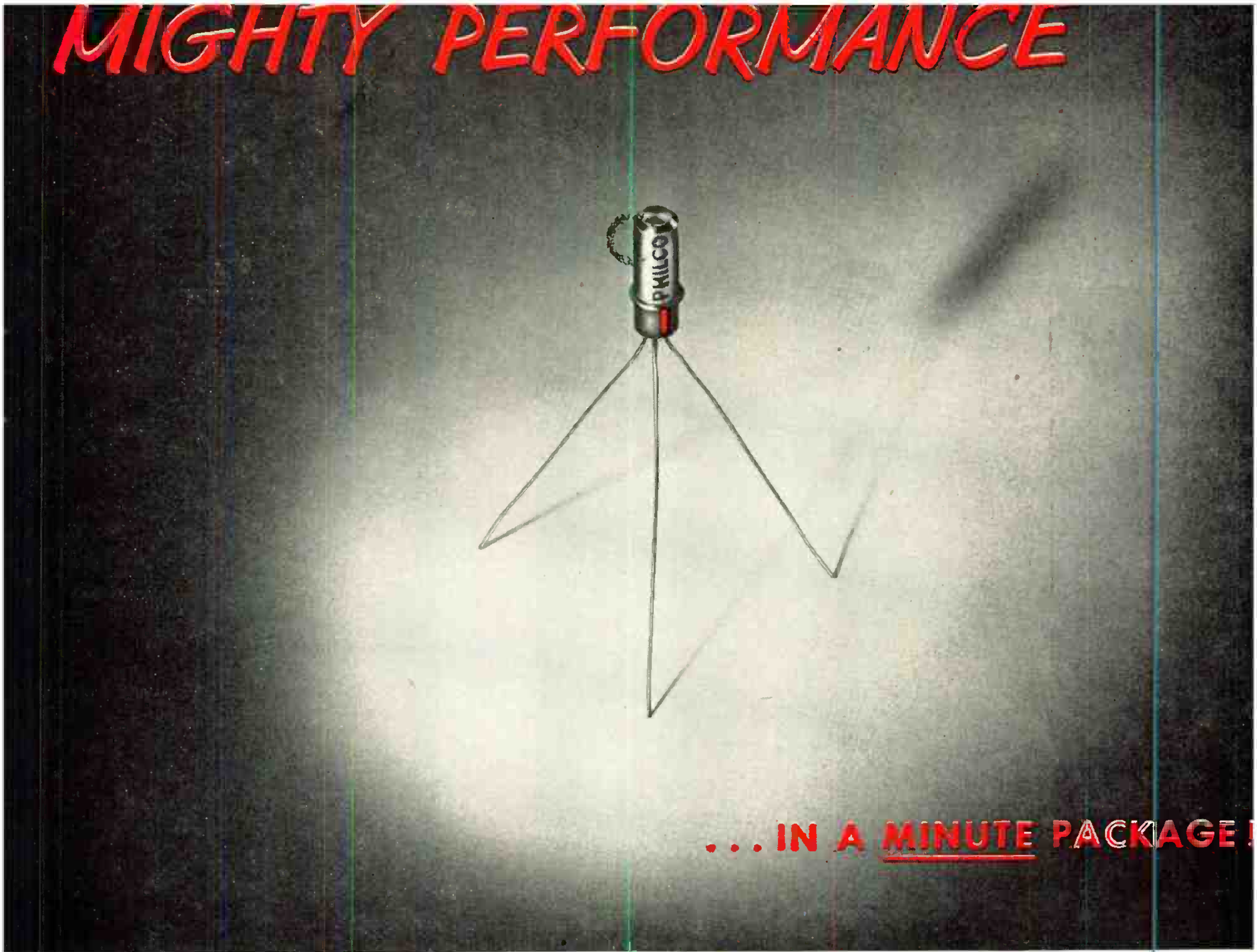
GEARED HEAD. Provides exceptionally smooth, constant-speed panning and tilting for television and 35mm motion picture cameras. Two geared speeds on both the pan and tilt. Gearing can be quickly disengaged so unit operates as a free head. In tilting, the head rotates camera about its center of gravity, maintaining absolute balance at all times. Full 360° panning is smooth and steady.



REMOTE CONTROL HEAD. Makes possible the operation of a TV camera from a remote point several hundred feet away. Panning, tilting, focusing and lens changing are accomplished with small electric motors operated from a portable control panel. Operation is smooth and steady. Speed is variable. Camera can be mounted in extremely high or low positions on stage, in auditoriums, stadiums, on rooftops and other inaccessible places.

COLOR CRADLE HEAD. Specifically designed for RCA color television cameras. Action is similar to monochrome cradle head. On both models, camera, with all accessories attached, can be balanced perfectly when mounted on the head simply by moving the top plate on the head forward or back with a lead screw. Adapted to fit all recommended tripods, pedestals or dollies

www.americanradiohistory.com



with PHILCO *Hermetically Sealed* TRANSISTORS

Uniformity . . . low power consumption . . . small size . . . complete absence of microphonics . . . proven reliability . . . and resistance to shock and vibration. These are the all-important features of Philco alloy junction transistors which make them best for your application.

You will also welcome the simplified circuitry, ease of assembly and cost reductions now possible in transistorized products. And Philco production facilities assure a dependable supply of high quality transistors *—at a price which makes their use practical in new product design!*

Employ Philco alloy junction transistors, and gain the benefits of their superior performance. Take the first step to improve your product and cut costs. Write today to Philco, Dept. T. Get complete technical specifications, price and delivery information on the Philco hermetically sealed transistor.

PHILCO CORPORATION

GOVERNMENT AND INDUSTRIAL DIVISION • **PHILADELPHIA 44, PENNSYLVANIA**

IN CANADA: PHILCO CORPORATION OF CANADA LIMITED, DON MILLS, ONTARIO

www.americanradiohistory.com

Why Ace Shielded Enclosures are your

Best Buy

... ACE offers the *highest* attenuation over the *widest* frequency range, proved by independent testing laboratories.

... ACE takes the guesswork out of shielded enclosure buying. You get all the facts on which to base sound decisions, backed by *guaranteed* test data.

... ACE and only Ace, offers a truly interchangeable-panel enclosure, with bolting interior to the room but external to the shielding medium.

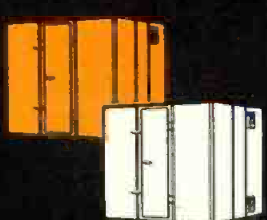
... ACE provides full engineering assistance—assurance that your specific enclosure needs will be met.

... ACE is first and foremost in the design and manufacture of every type of shielded enclosure for electronics, military, and general industry.

...ACE "CELL-TYPE" SCREENED ENCLOSURES

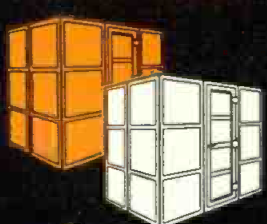
Here's the maximum in screen room performance. A must for laboratories and electrical manufacturers performing tests with highly sensitive equipment. 108db from 14kc to 1000mc; 103db at 3000mc (MIL-S-4957 measurements).

...ACE SOLID SHEET METAL (RFI DESIGN) ENCLOSURES



These enclosures employ the rugged Lindsay Structure, available in either sheet copper or galvanized. They can be transported completely assembled or disassembled; may be used indoors or out. Copper: 100db from 150kc to 1000mc; 70db at 15kc (Uniform-Field measurements). Galvanized: 110db from 14kc to 1000mc; 9db at 60cps; 37db at 1000cps for magnetic fields (MIL-S-4957 measurements).

...ACE SINGLE-SHIELD SCREENED ENCLOSURES



An economical enclosure, available in copper or galvanized wire cloth, that meets basic requirements for suppressing r-f radiations of industrial or laboratory equipment. Copper Screen: 70db from 100kc to 1000mc, 40db at 14kc. Galvanized Screen: 40db from 15kc to 400mc (Uniform-Field measurements).

Write for Catalog and Free Technical Data.

ACE

ACE ENGINEERING & MACHINE CO., INC.

3644 N. Lawrence Street • Philadelphia 40, Pa.

Telephone: REgent 9-1019 • REgent 9-2537 • GArfield 5-1160

LETTERS . . .

(*Continued from page* 38)

dividual situations. These difficulties, from the standpoint of the tube manufacturer, can and often do become major problems. Based on accumulated experiences with special selection problems, the tube iidustry is opposed to any philosophy which considers the special selection of tubes to be an acceptable design technique in the manufacture of electronic equipment.

The question may well be asked: What is fundamentally wrong with special tube selections? First, any special selection necessarily creates a field replacement problem. In the factory production of the equipment, the equipment can be made to operate satisfactorily and pass final inspections—by tube selection. Unfortunately, when equipment difficulties develop in the field, factory-trained technicians are not available to provide the necessary servicing. The available serviceman may discard many good tubes because of the critical requirements of the equipment. In other cases, he may fail to recognize that special tube selection is required and after unsuccessfully replacing several tubes begin to look for the trouble in the other circuit components. Thus, the use of the entire equipment can be readily lost for extended periods because a sufficient quantity of the critical tube type is not available or because the difficulty is not readily analyzed. Maintenance costs and equipment down-time, in such cases, can become excessive.

Also, the degree to which the equipment will accomodate variations in tube characteristics varies widely. Indeed, cases have been reported in which only one tube in twenty-five would function properly in the equipment. Other cases have been reported in which the initial tubes were stabilized under special conditions by the equipment manufacturers. In the field where such specially-stabilized tubes were not available, none of the replacement tubes could be made to work.

A second consequence of the special selection may be noted in the performance of the equipment itself. For example, if the equipment is critical with respect to the characteristic of transconductance in a particular tube, a tube which was initially satisfactory could readily become unsuitable as the result of heater or supply voltage variations and normal tube-life variations. In such a case the over-all performance and life of the equipment may prove to be unsatisfactory—the difficulty being related to the tube selection involved. The critical nature of the equipment's performance, together with excessive maintenance costs, may directly reflect on the original design of the equipment.

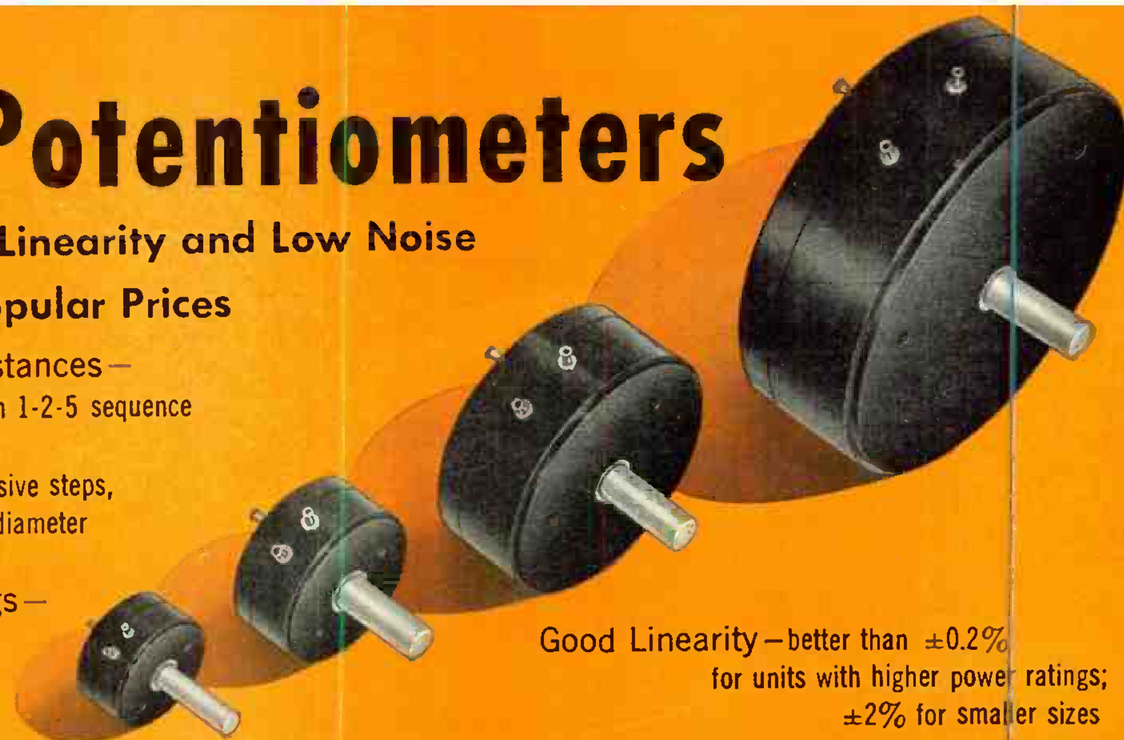
Another aspect which deserves consideration is the fact that in the tube industry essentially the same product is manufactured by several companies. In this respect, the tube industry is

(*Continued on page* 50)

www.americanradiohistory.com

New Potentiometers

Offer Good Linearity and Low Noise at Popular Prices



Wide Range of Stock Resistances—
2 to 500,000 ohms in 1-2-5 sequence

Convenient Sizes—in progressive steps,
from 1¼" to 4¼" diameter

Conservative Power Ratings—
from 2 to 20 watts
at 40° C. ambient

Good Linearity—better than ±0.2%
for units with higher power ratings;
±2% for smaller sizes

Low Cost—prices range from $3.15 for 2-ohm, 2 watt unit
to $10.00 for 500-kilohm, 20-watt potentiometer

Good Linearity at Moderate Cost Resistance wire is uniformly wound and finished card is cemented tightly into base — uniform thickness around base prevents unequal curing and aging out of round — *every* unit produced is inspected for conformance with linearity specifications.

Low Capacity to Ground and Across Windings Outstanding a-c performance is obtained with all-phenolic body, glass-reinforced polyester shaft and phenolic laminated card — minimum metal parts.

Brush and Track Durability Brush is of heat-hardened, precious-metal alloy especially selected for compatibility with winding — low-temperature-coefficient resistance-alloy wire is used — brush track is carefully smoothed and cleaned by special buffing tool that does not cut metal away from finer wire.

Mounting Rigidity and Interchangeability Units are mounted on panel and shelf by screws tapped into base so that they are keyed against rotation.

High Resolution Specially designed precious-metal brush of small-diameter wire touches no more than two wires at a time.

Low Electrical Noise Brush rides on edge of tightly-wound resistance card where wire is firmly seated and easiest to clean — extra-long brush spring provides uniform pressure at all settings — overall mechanical stability and cleanliness, resulting from total enclosure, insure low noise — pots are individually tested for minimum noise.

Bearing Durability Bearings are at extreme ends of enclosure for greatest mechanical stability — brush arm is positively keyed to hub which rotates on brass insert; this bearing is in the same plane as brush, and is closely fitted, minimizing effects of side thrust on shaft — other end of shaft is guided by stainless-steel insert molded in base.

Ganged Units Available for Any Application Individual units are easily set in any desired phase relationship — low-capacitance characteristics of the individual units are retained in ganging.

Over-All Rigidity Cover fits snugly with base and is firmly attached — cover-retaining screw stops brush arm 180° from brush and will not bend or strain the brush spring support.

Continuity Brush is spot-welded to spring arm — electrical terminals are riveted and soldered directly to winding ends and to center tap take-off, for positive electrical connection—no fixed pressure connections.

Ready Accessibility Interior is easily exposed for inspection by removal of single cover-retaining screw, even when pot is mounted.

Three Shafts Available Standard glass-reinforced polyester shaft is supplied and gives best electrical characteristics — where minimum torsional flexing is the primary consideration, all-metal or metal-filled shaft will be supplied.

Total Enclosure with External Phasing Two screws in projecting hub permit phasing, adjusting or removing shaft without opening case and exposing interior to dust — shafts of different lengths or materials can be readily substituted.

Versatility In addition to potentiometers normally stocked, units will be provided on special order with: 360° mechanical rotation — taps as close as ¼" apart along entire winding — resistance values other than standard—resistance functions other than linear—resistance and linearity tolerances better than standard.

Write for the new G-R Potentiometer Bulletin giving complete specifications for units of varying resistance sizes and power ratings.

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U.S.A.

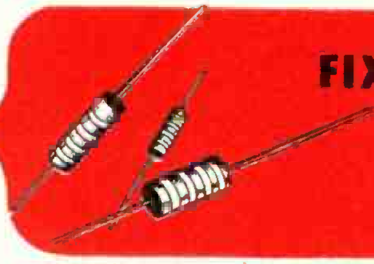
90 West Street NEW YORK 6
8055 13th St., Silver Spring, Md. WASHINGTON, D.C.
920 S. Michigan Avenue CHICAGO 5
1000 N. Seward Street LOS ANGELES 38

www.americanradiohistory.com

Get this 56-page Guide to

STACKPOLE ELECTRONIC COMPONENTS

Electronic Components Division
STACKPOLE CARBON COMPANY
St. Marys, Pa.



FIXED RESISTORS
RETMA and special types

VARIABLE RESISTORS
0.5 and 0.6 watt bushing, tab mounting, printed circuit, and special types

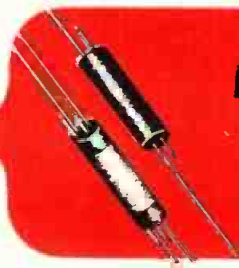
LINE SWITCHES
10 types—circuit arrangements and current capacities for every need

SLIDE SWITCHES
Over 22 low-cost miniature styles for radio and TV receivers, small motors, toys, etc.

LOW-VALUE CAPACITORS
46 stable values in fixed composition types from 0.10 to 10.0 mmf with RETMA 4-band color code

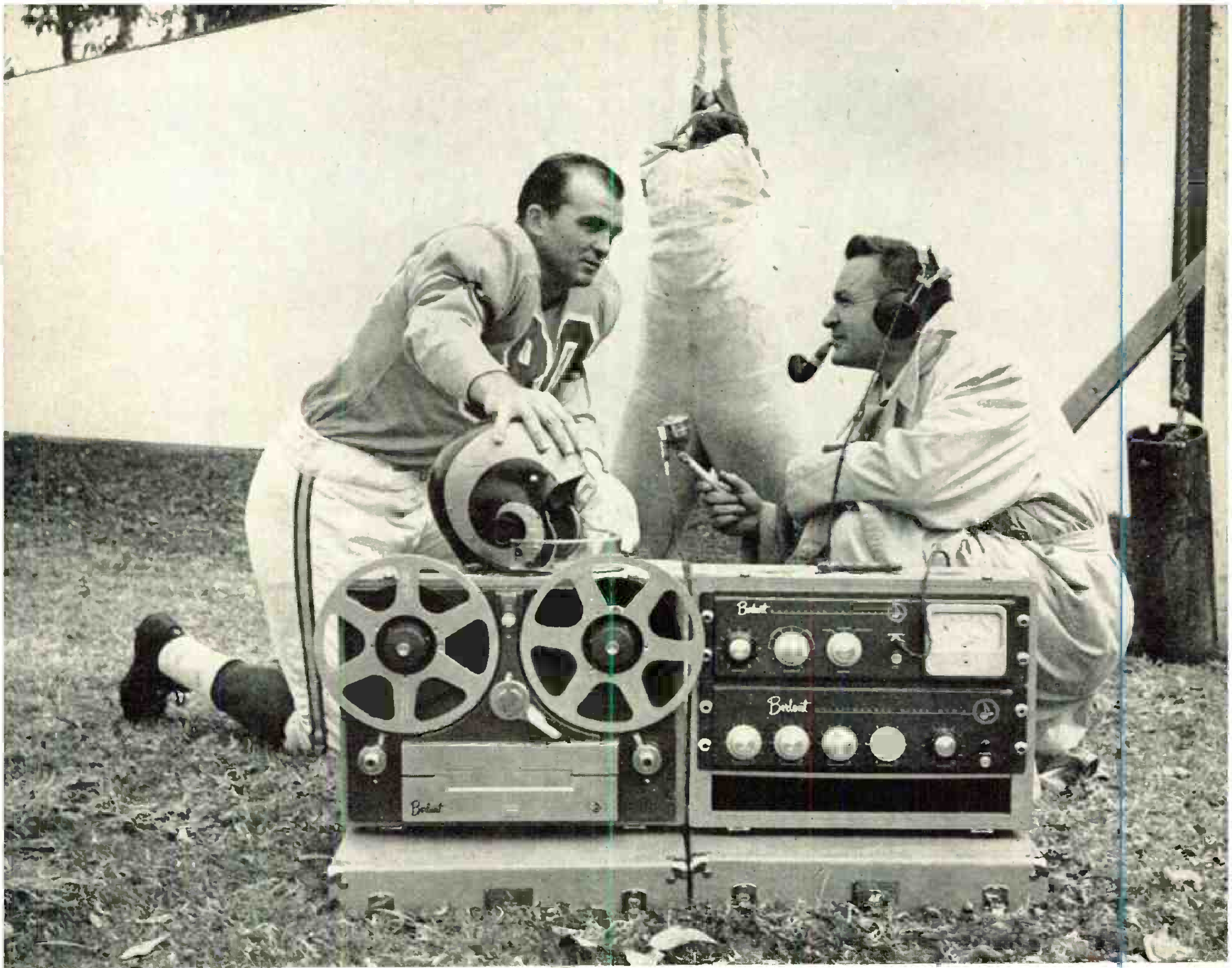
POWDERED IRON CORES
Standard, cup, sleeve, side-molded, and screw core types in any grade

Ceramag® FERROMAGNETIC CORES
Samples and production runs to your exact specifications



MOLDED COIL FORMS
Molded phenolic types with or without iron core sections; powdered iron choke cores

www.americanradiohistory.com



"THIRD DOWN...SIX TO GO!"

"Van called a 57X . . . We split the line wide open and went for a touchdown."

A Monday morning quarterback interview with Los Angeles Rams' star end, Tom Fears, is recorded during a practice session for broadcast at a more convenient time.

The engineer-interviewer is Bert Berlant, designer-manufacturer of the Berlant Broadcast Recorder BR-1, which is being used here.

A coordinated combination of tape recorder and 4-channel mixer in two matched portable cases made easy work out of a one-man recording job in the field.

"Operational simplicity" was one of the things insisted upon by 382 radio station engineers who "wrote the specs" for this recorder in a nationwide survey that resulted in this outstandingly rugged and dependable machine. The BR-1 was specifically designed to serve you better, both in the studio and in the field.

Its roster of exclusive features includes: PROVISION FOR FIVE HEADS (three are standard): an optional switching arrangement allows both single and dual track operation. UNISYNC DRIVE: a completely new hysteresis synchronous direct drive with 99.8% timing accuracy and total temperature rise of 30 degrees. UNIFIED CONTROL: one simple convenient error-proof lever system. A-B TEST FADER: fades from incoming signal to playback without transients or clicks.

And these additional requested features: Fast forward and reverse at any speed. Instantaneous *Reeloks*. Automatic cut-off. Tape tension arms. Adjustable bias . . . and three motors.

All of the above is what *you*, the engineer, wanted. The man in the figure department wanted dependability and low maintenance cost . . . at the right price! We listened to him, too.

$545 IS THE PROFESSIONAL USERS NET FAIR TRADED PRICE.

You'll want to test it yourself, we know. For a distributor close to you, for more complete technical brochure, write: Berlant Concertone
4917 West Jefferson Boulevard,
Dept. D13 Los Angeles 16, California

THIS IS REPORT NO. 2 IN A SERIES OF FIELD TESTS.

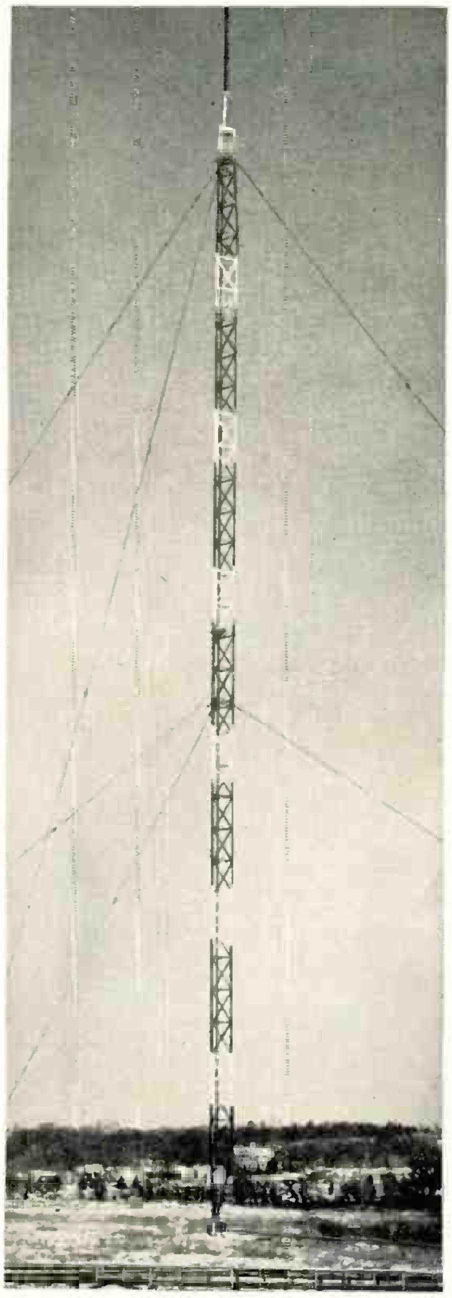
Manufacturers of Concertone...world's foremost high fidelity recorders and accessories.

For product information, use inquiry card on last page.

www.americanradiohistory.com

. . . NOT ONE TRUSCON TOWER

downed in recent eastern hurricanes!



WCOP-FM, Boston, Mass.
Truscon guyed tower, 409 feet tall.

Tall, straight Truscon Towers took the worst that Hurricanes Carol and Hazel had to offer—and Truscon has not had a single report of a Truscon Tower failing before either of these terrific onslaughts. Here, certainly, was a dramatic demonstration of the ability of Truscon Towers to withstand the most severe weather conditions.

You can get this kind of dependable performance every time with a Truscon Tower. Years of unmatched technical experience combined with the most modern facilities go into their manufacture.

Just name the height your antenna must reach; Truscon will engineer and construct the tower you need . . . tall or small . . . guyed or self-supporting . . . for AM, FM, TV, or Microwave transmission. Your phone call or letter to any Truscon district office or to "tower headquarters" in Youngstown will get your tower program going promptly.

TRUSCON — MARK OF MERIT PRODUCTS

TRUSCON STEEL DIVISION
REPUBLIC STEEL
1092 ALBERT ST. • YOUNGSTOWN 1, OHIO
Export Dept: Chrysler Bldg., New York 17, N.Y.

REPUBLIC STEEL

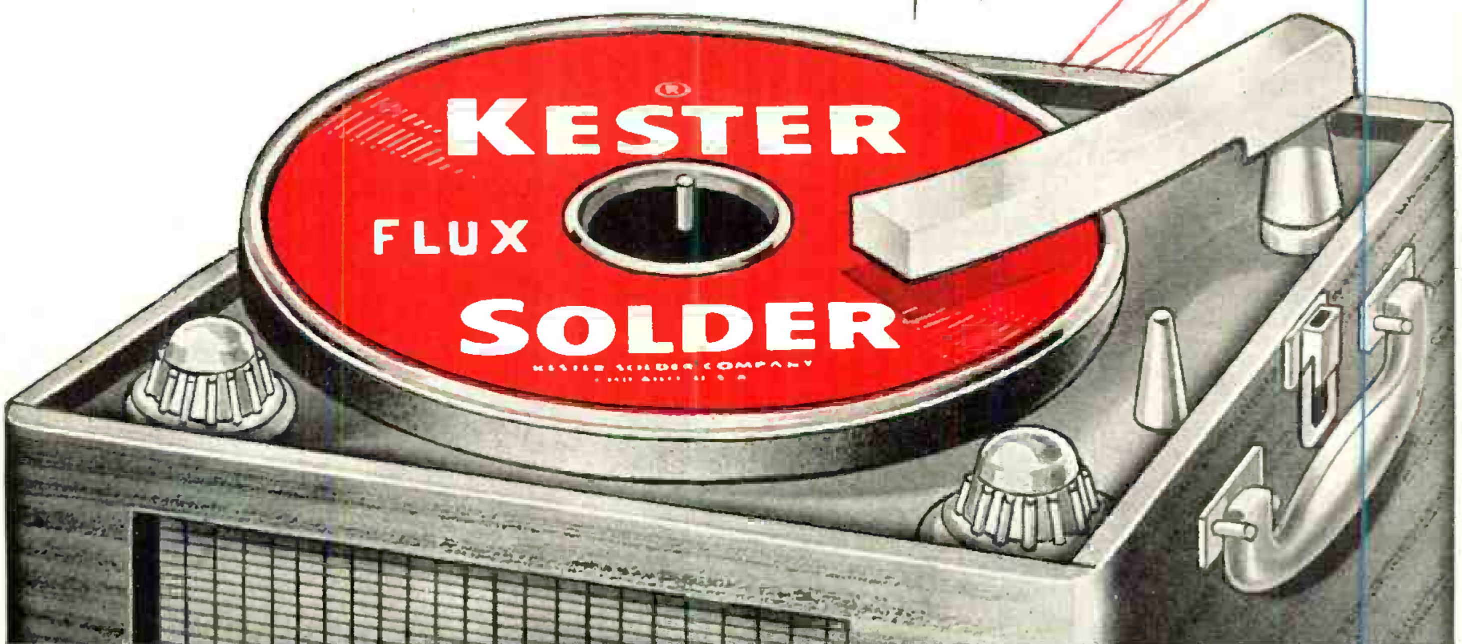
A NAME YOU CAN BUILD ON

www.americanradiohistory.com

tunes UP TIRED ASSEMBLY LINES

"44" RESIN, "RESIN-FIVE" and PLASTIC ROSIN—Kester Flux Core Solders belong at the very top of the solder hit parade when it comes to quality, speed, uniformity and economy. An unbroken record of dependability is what makes Kester a surefire "cure" for lagging production. Better switch now to Kester . . . a real production record maker!

WRITE TODAY for Kester's NEW 78-Page Informative Textbook, "SOLDER . . . Its Fundamentals and Usage."

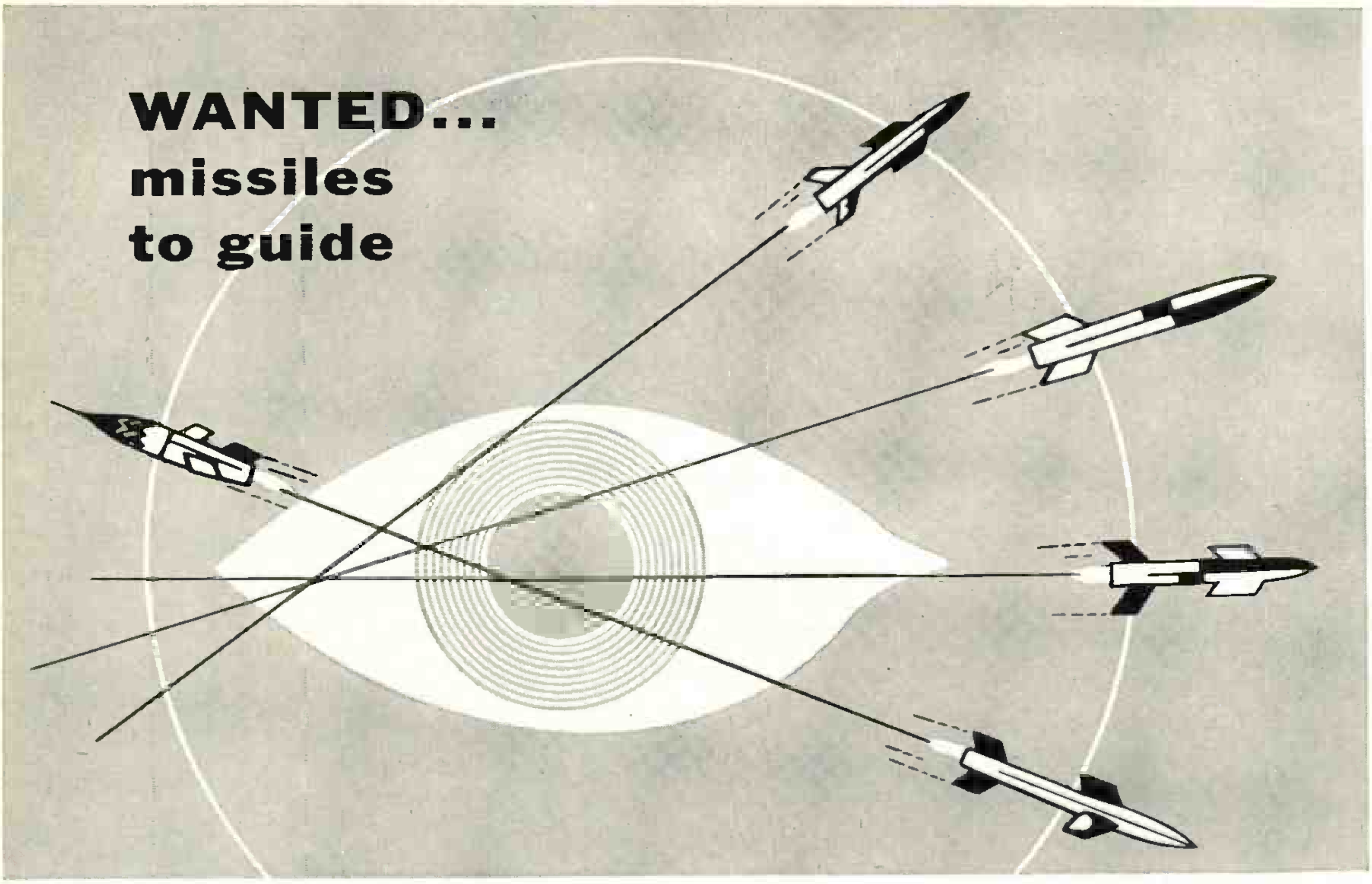


KESTER SOLDER

COMPANY 4210 Wrightwood Avenue, Chicago 39, Illinois; Newark 5, N. J.; Brantford, Canada

For product information, use Inquiry card on last page.

www.americanradiohistory.com



Transmitters and Monitors of proven accuracy and reliability

SYNCHROTEL TRANSMITTERS

for the remote electrical transmission of data such as true airspeed, indicated airspeed, absolute pressure, log absolute pressure, differential pressure, log differential pressure, altitude and Mach number.

PRESSURE MONITORS

to provide control signals which are functions of altitude, absolute pressure, differential pressure, etc.

To CONTROL a guided missile effectively and absolutely is a challenging problem with which hundreds of engineers are grappling every day.

The solution depends upon the efficiency and the reliability of the controlling parts.

For over 25 years Kollsman has been making precision aircraft instruments and equipment used on military and commercial aircraft throughout the world. The talents and skills needed for success in this special and challenging field are equally necessary in the design and manufacture of precision controls for missiles.

Kollsman is presently making Transmitters and Monitors of proven accuracy and reliability for missile control.

Brochures are available on the above two products.

Please write us regarding your specific problems or requirements in the field of missile control.

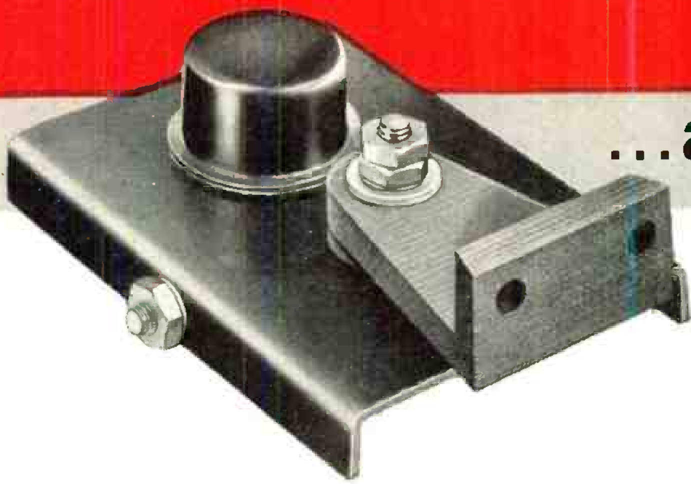
kollsman INSTRUMENT CORP.

80-14 45th AVE., ELMHURST, NEW YORK • GLENDALE, CALIFORNIA • SUBSIDIARY OF *Standard* COIL PRODUCTS CO. INC.

www.americanradiohistory.com

NEW GERMANIUM POWER RECTIFIERS REDUCE VOLUME AND WEIGHT 75%

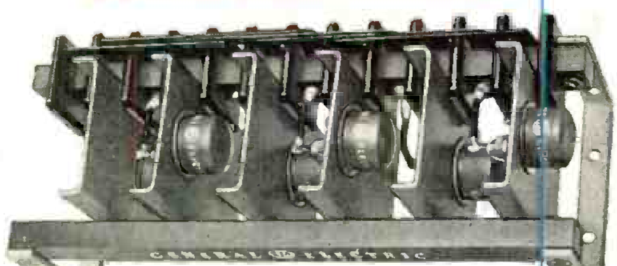
...and actually cost less!



Because of the higher efficiency of germanium, these new G-E rectifiers achieve a full 75% saving in size and weight—and yet actually cost less than any conventional type dry rectifier in use today. This sharply-reduced weight and volume is a result of greatly-increased power per cell in G.E.'s unique low-loss rectifier.

Compare and see! For new efficiency in your 1955 designs go the limit with new G-E Germanium Power Rectifier. Tell your rectification problem to the G-E application engineer—write today to: *General Electric Company, Germanium Products, Section X4815, Electronics Park, Syracuse, New York.*

GERMANIUM POWER RECTIFIERS



OVERALL SIZE IS 4" x 5" x 10"

SAMPLE DELIVERIES ARE SCHEDULED FOR FEB. 1955!

These rectifiers are available in standard combinations consisting of one or more rectifying elements. A few typical ratings are listed below.

CIRCUIT	D-C OUTPUT AT 55° C (Resistive Load)
Half Wave	30 amps @ 60 V 15 amps @ 120 V 10 amps @ 180 V
Full Wave Center Tap	30 amps @ 60 V 10 amps @ 180 V
Full Wave Bridge	10 amps @ 125 V
Three-Phase Half Wave	30 amps @ 95 V 15 amps @ 190 V
Three-Phase Bridge	15 amps @ 190 V
Three-Phase Star	30 amps @ 95 V

Be "money-wise" and "pound-wise" too, with these stand-out design features:

- Weight and volume reduced 75%
- Rectifier losses have been reduced to ⅓ or less
- No forward aging effects...no need for age-compensating devices

Progress Is Our Most Important Product

GENERAL ELECTRIC

For product information, use inquiry card on last page.

www.americanradiohistory.com

LETTERS . . .

(*Continued from page 42*)

rather unique; and, as a result, many of the decisions relating to engineering and manufacturing must be tempered with tube interchangeability considerations. Because of the technical complexity of tubes, industry-wide organizations such as RETMA and JETEC have been formed to define the characteristics of the final product as required to assure interchangeability. Considerable engineering effort and money is expended annually to support these standardization activities which serve the interests of the consumer and tube manufacturer alike. Any example of special selection is inherently in direct conflict with the aims of the industry standardization activities. If unchecked, special selection would lead to the same chaotic field conditions that would result if all efforts at industry standardization were discontinued.

Generally all cases of tube selection can be traced to two causes. The first class inadvertently develops because of neglect or lack of thoroughness in design methods. The second group is intentionally created at the discretion of the circuit design engineer. The former case is generally inexcusable, while the latter most often reflects a lack of proper cooperation between the circuit designer and tube manufacturer. Actually, in some cases, the second group indicates the need for a new tube type. If such is the case, proper coordination with the tube manufacturer will often yield the desired new type—without creating a major field replacement problem. In other cases, the circuit designer is simply attempting to achieve a short-term advantage in performance or cost without regard to more basic and long-range considerations.

For the benefit of the entire electronics industry, effort should be expended to eliminate the practice of special tube selections. The circuit designer, for his part, should conscientiously and realistically design his circuits to accomodate the full range of tube characteristics to be encountered. When unusual or special cases arise in which such practice appears to be impossible, he should consult with the tube manufacturer in an effort to arrive at a mutually satisfactory solution. On the other hand, the tube manufacturer should be sensitive to the changing requirements for tubes which result from the dynamic aspects of the electronics industry.

G. H. Gage, Supervisor
Technical Data Section
Receiving Tube Sub-Dep'tment
General Electric Co.
Schenectady, N. Y.

(*In a RTMA booklet entitled, "Must Tubes Be Selected?" the answer presented below is offered.* Ed.)

The proper solution is in the original design of all equipment. The equipment should function with tubes having characteristics which fall anywhere in the entire range covered by the tube spe-

(*Continued on page 123*)

www.americanradiohistory.com

MICROWAVE SIGNAL GENERATORS

Complete coverage of the range 950-10,800 mcs/sec.

with Polarad single dial operation

Four new Microwave Signal Generators covering the range 950-10,800 mcs/sec. All with famous **Polarad single dial operation**. Each provides the maximum working range possible in one compact signal generator. And, additional Polarad Signal Generators are available to cover 12.8 to 39.7 kmc.

These features on all MSG units assure fast and simple operation: direct reading, single dial frequency control that tracks reflector voltages automatically . . . direct reading attenuator dial . . . conveniently placed controls, in logical sequence . . . high visibility on the face of each instrument.

Polarad Signal Generators are built to the same high standards required for military equipment. They are practical for the factory assembly line—engineered ventilation assures continuous and stable operation of all instrument functions. Components are readily accessible for easy maintenance. And laboratory accuracy is guaranteed under the most rigorous operating conditions.

Write directly to Polarad or your nearest Polarad representative for details.

	MSG-1	MSG-2	MSG-3	MSG-4*
Frequency Range	950-2400 MCS/sec.	2150-4600 MCS/sec.	4450-8000 MCS/sec.	6950-10,800 MCS/sec.
	(Frequency set by means of a single directly calibrated control)			
Frequency Accuracy	±1%	±1%	±1%	±1%
Power Output	1 MW	1 MW	.2 MW	.2 MW
Attenuator Range	120 db	120 db	120 db	120 db
Attenuator Accuracy	±2 db	±2 db	±2 db	±2 db
Output Impedance	50 ohms	50 ohms	50 ohms	50 ohms
Input Power	115V±10% 60 cps	115V±10% 60 cps	115V±10% 50-1000 cps	115V±10% 50-1000 cps
Internal Pulse Modulation:				
Pulse Width	0.5 to 10 microseconds			
Delay	3 to 300 microseconds			
Rate	40 to 4000 pulses per second			
Synchronization	Internal or external, sine wave or pulse			
Internal FM:				
Type	Linear sawtooth			
Rate	40 to 4000 cps			
Synchronization	Internal or external, sine wave or pulse			
Frequency Deviation	±2.5 MCS	±2.5 MCS	±6 MCS	±6 MCS
External Pulse Modulation:				
Polarity	Positive or Negative			
Rate	40 to 4000 pulses per second			
Pulse width	0.5 to 2500 microseconds			
Pulse separation	(For multiple pulses) 1 to 2500 microseconds			
Output Synchronizing Pulses:				
Polarity	Positive, delayed & undelayed			
Rate	40 to 4000 pps			
Voltage	Greater than 25 volts			
Rise time	Less than 1 microsecond			
Size | Approx. weight	17" long x 13¼" high x 15½" deep | 60 lbs.		17" long x 15" high x 19½" deep | 100 lbs.	

*Also available—MSG 4A: 6,950—11,500 MCS/sec.

"THE FINEST SIGNAL GENERATORS OF THEIR KIND" **Polarad** ELECTRONICS CORPORATION

43-20 34th STREET • LONG ISLAND CITY 1, N. Y.

REPRESENTATIVES Albuquerque • Arnprior, Canada • Atlanta • Boston • Chicago • Cleveland • Fort Worth • Kansas City • Los Angeles • New York • Philadelphia • San Francisco • Seattle • St. Paul • Syracuse • Washington, D. C.

www.americanradiohistory.com

FOR TV . . . IT DODGES TROUBLE YOU CAN'T STOP

Radio Relay station on route between Chicago, Ill., and Des Moines, Iowa. Every fifth or sixth relaying tower is a control station, where high-speed switching equipment enables a TV picture to skip out of a troubled channel and into a stand-by protection channel faster than the eye can wink.

There's no way to stop atmospheric changes that threaten television with "fade." But, for TV that travels over Bell's Radio Relay System, Bell Laboratories engineers have devised a way to sidestep Nature's interference.

When a fade threatens — usually before the viewer is aware — an electronic watchman sends a warning signal back by wire to a control station perhaps 200 miles away. An automatic switching mechanism promptly transfers the picture to a clear channel. The entire operation takes 1/500 of a second. When the fade ends, the picture is switched back to the original channel.

This is an important addition to the automatic alarm and maintenance system that guards Bell's Long Distance network for television and telephone calls. It marks a new advance in Bell Laboratories' microwave art, developed to make your Long Distance telephone service, and your TV pictures, better each year.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields.

www.americanradiohistory.com

NEW! HUGHES NOW OFFERS

Silicon Junction Diodes

Hughes continues to set industry standards for quality and reliability of semiconductor devices. These NEW Hughes Silicon Junction Diodes now provide you with devices which will operate at high temperatures. They combine high forward conductance with extremely high back resistance. In several diode types, this resistance is in the order of 10,000 megohms! This means that, in many applications, there is essentially an open circuit in the back direction. The phenomenal back resistance of these diodes has opened up many possibilities for entirely new circuit applications, in addition to meeting requirements for higher temperature operation, which germanium cannot satisfy. Before completing design work on your next equipment, be sure to investigate the outstanding new Hughes Silicon Junction Diodes.

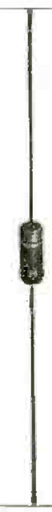
HIGH FORWARD CURRENT

EXTREMELY HIGH BACK RESISTANCE

VERY SHARP BACK VOLTAGE BREAKDOWN

HIGH TEMPERATURE OPERATION

Hughes Subminiature Silicon Junction Diodes are fusion-sealed in a one-piece glass body, impervious to moisture and external contamination. Flexible dumet leads are tinned for easy soldering or spot-welding. The diode envelope is coated with black silicone enamel to shield the crystal from light. Ambient operating temperature range, from −80° C to +200° C. Actual size, diode glass body: 0.265 by 0.103 inches, (approx.) maximum.



HUGHES SILICON JUNCTION DIODES ELECTRICAL CHARACTERISTICS

Type	Saturation Voltage (E_s)	Forward Current at +1V (I_f)	Back Current at 25° C	Back Current at 150° C
HD 6001	25V	15mA	.5μA @ − 25V	.030mA @ − 25V
HD 6002	70V	5mA	.5μA @ − 60V	.030mA @ − 60V
HD 6003	200V	1mA	.5μA @ −175V	.030mA @ −175V
HD 6005	30V	40mA	.025μA @ − 25V	5μA @ − 25V
HD 6006	70V	20mA	.025μA @ − 60V	5μA @ − 60V
HD 6007	150V	7mA	.025μA @ −125V	5μA @ −125V
HD 6008	200V	3mA	.025μA @ −175V	5μA @ −175V
HD 6009	150V	3mA	.5μA @ −125V	.030mA @ −125V

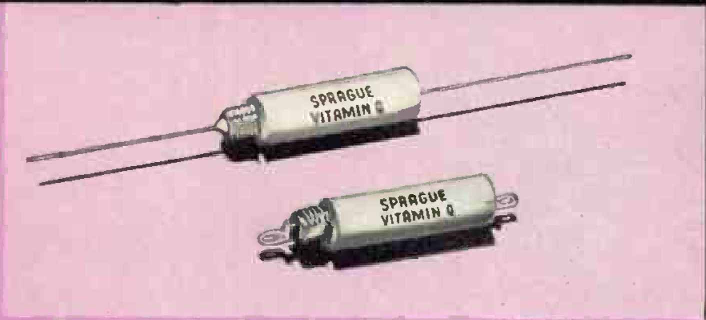
The ORIGINAL Glass-Body, Fusion-Sealed Germanium Diodes.

Hughes SEMICONDUCTOR SALES DEPARTMENT

Aircraft Company, Culver City, Calif. *New York Chicago*

www.americanradiohistory.com

Here's What's New in Vitamin Q® Capacitors



NEW subminiature paper capacitor mounting styles speed and simplify circuit assembly with—

- **Flatted Necks**
- **Solder Tab Terminals**
- **Insulating outer sleeves for 125°C applications**

Now you can have Sprague's famous subminiature paper capacitors in new styles that make vibration-proof mounting simple . . . make harness wiring faster. New straddle milled flats on standard threaded neck units let you insert the neck in flatted openings. A simple nut and lock washer permanently locks the capacitor to the chassis. In addition, you can now obtain Sprague subminiature paper capacitors with solder tab terminals, eliminating the problem of splicing leads to wires. Insulating outer sleeves for 125°C mounting are also available.

Sprague's Vitamin Q capacitors are available in ratings and mechanical designs far beyond those called for in specification MIL-C-25A. For example, both inserted tab and extended foil designs are available in working voltage ratings up to 1000 vdc.

Positive hermetic closure is assured by glass-to-metal solder seals, which unlike rubber compression-type terminals, cannot be twisted during wiring assembly.

Complete information on Sprague subminiature paper capacitors in all thirteen case styles, is provided in Engineering Bulletin 213C, available on letterhead request to the Sprague Electric Company, 233 Marshall Street, North Adams, Massachusetts.

WORLD'S LARGEST CAPACITOR MANUFACTURER

SPRAGUE

Export for the Americas: Sprague Electric International Ltd.
North Adams, Mass. CABLE: SPREXINT

Sprague, on request, will provide you with complete application engineering service for optimum results in the use of subminiature paper capacitors.

www.americanradiohistory.com

TELE-TECH
& Electronic Industries

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

WHAT'S AHEAD FOR '55!

ELECTRONIC BUSINESS

FAIRLY GOOD YEAR is expected, with sales volume perhaps a few percent down in radio-TV, rising nicely in broadcasting and communications, up in industrial and audio, and about level in military. Present inventory is in good shape, auguring well for steady production. Competition should be keen.

MILITARY

GROSS VALUE of government electronic requirements, including those hidden in non-electronic contracts, should remain at about $3.5 billion. Production awards will be as plentiful as last year, but research and development contracts will be more than abundant. Air Force should continue to account for the lion's share of R&D work. Reliability, miniaturization, guided missiles, radar detection and countermeasures will be major engineering interests.

BROADCASTING

RADIO is expected to just about hold its own, while TV continues its growth in facilities and income. Total sale of time by broadcasters will come close to the $1 billion mark. New TV station construction should proceed steadily, but not at the hectic rate of early post-freeze. Crystal gazers predict an average of a little over one new TV station per week will start operation. FCC decision on pay-as-you-see TV may be forthcoming. Community TV will be subject of broadcasters' attention so far as possible encroachment is concerned.

COMMON CARRIER

CLOSELY RELATED to broadcasting problems is question of high common carrier rates for microwave services. Broadcasters hope, and it is more than possible, that FCC will liberalize policy restricting private relay systems. Reason: AT&T monthly rates run as high as 10 times the cost of maintaining privately-owned systems.

COLOR-TV

ESTIMATES for color-TV set production in 1955 have ranged between 250,000 to 300,000 units. These figures may be somewhat optimistic because large scale color picture tube production is still not under way. It is evident that a real effort to materialize color-TV will have to be made in 1955. Keen price competition is making black-and-white units less and less profitable to produce, and color-TV is the only real virgin sales territory. The trick will be to get the public enthusiastic about color, and this can hardly come about unless there are more color programs to see on more color receivers. An initial step might be made by pioneering manufacturers and broadcasters to put receivers into places where people congregate, thus duplicating in a sense the black-and-white situation existing in the immediate post-war period. We can be sure of one thing: If we expect color to get off dead center, set makers will have to prime the pump by selling early models at cost or below. Such expense would be a worthwhile and necessary promotional outlay from venture capital.

NEW DEVELOPMENTS

MORE EXTENSIVE use of automation-computer techniques should make news. Coupled with printed circuits, these improved manufacturing processes promise lower electronic production costs. Transistors in portable radios are in the wind, particularly since the dam has been broken. Also, silicon power transistors for high powers and frequencies are almost a sure bet. Magnetic tape recording standardization should give pre-recorded tape a nice boost. Very small traveling wave tubes and pioneer equipment in the EHF range over 30,000 MC are in the offing.

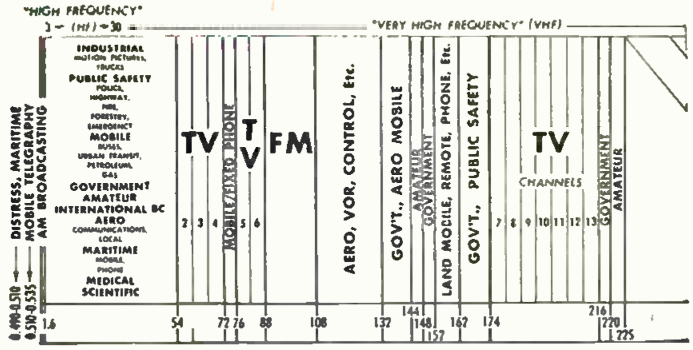
PATENTS

RAMIFICATIONS of big legal battle now in process, and promising to grow, between RCA and other companies will have momentous effect on industry's patent licensing structure. To some concerns, particularly small ones, RCA licenses mean an opportunity to be in business. To others, especially some of the large TV manufacturers, these licenses appear as an unjustified restriction and expense. Whole complex situation is further complicated by recent government anti-trust suit attacking RCA.

www.americanradiohistory.com

RADARSCOPE

Revealing important developments and trends throughout the spectrum for radio, TV and electronic research, manufacturing and operation



IMPACT OF FOREIGN MADE EQUIPMENT on the American market has become a matter of concern—both pro and con—in many quarters. Both set and part manufacturers called to RETMA's attention recently the drastically lower wage rates and production costs, as well as the lower standards of living, in a number of countries which are exporting electronic equipment to this country. Alarm was expressed that this competition might increase to a point where American employment would be affected. At the same time, however the Radio-TV Committee of the RETMA International was taking a contrary view. They adopted a resolution opposing an increase in the American tariff on these items on the grounds that such a move might have an adverse affect on American exports abroad.

OPTIMISM is running high in the West Coast sales picture. A Fall rush on sales is leading top businessmen to predict increased buying through 1955, and well into 1956. For the radio-TV field, the sales outlook is exceptionally rosy, but distribution problems and price stability are plaguing the industry.

TELEMETERING

Radio telemetry has found still another application. At the jet airplane plant of A. V. Roe Canada Ltd. engineers and aerodynamists are now flight-testing their aircraft from a trailer-mounted telemetering pickup station which may be located as much as 100 mi. from the testing area. The massive electronic receiving-recording apparatus inside the trailer is capable of recording 67 separate items of data per sec. in the course of the test flight.

MICA SUBSTITUTES

GRAVE CONCERN was expressed by S. A. Montague, president of the Mica Fabricators Assoc., over published reports that the needs of American industry for mica are now being satisfactorily met by alternate materials. While admitting that a number of applications formerly restricted to raw or natural mica are now being handled by the new insulating materials, he pointed out that a great need still does exist for the higher grades of mica. He listed the shortcomings of the substitute materials as, first, the lack of flexibility and second, the fact that they cannot be split into very thin laminae, increasingly important characteristics since progress in electronic equipment is partly dependent on higher operating temperatures and voltages and closer tolerances. A very difficult situation may easily develop, Mr. Montague warned, if we find that 90% of mica production is replaced by substitutes. The mica manufacturer obviously cannot continue in business if only 10% of his yield—the high grade mica—finds a market.

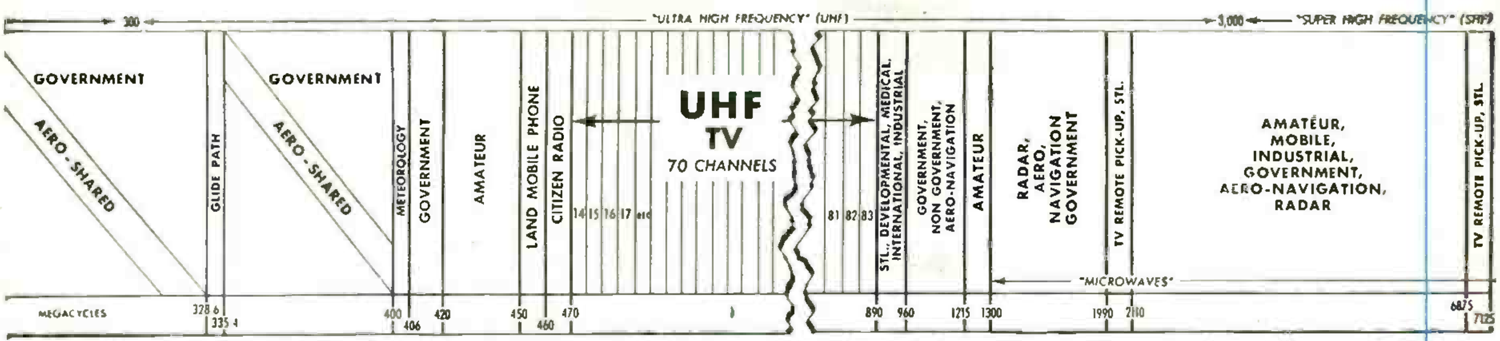
RADIO CONTROL

RADIO-CONTROLLED airport field lights will become a reality if the latest recommendation of the Radio Technical Commission for Aeronautics is adopted. A study completed by Special Committee 56 of the RTCA has ruled favorably on an air-to-ground actuating system, on 121.7, 121.9 and 122.8 MC, which allows the pilot of the incoming aircraft to switch on the landing lights at unattended airfields. They also adopted a system of codes to provide selectivity in those areas where two airports are in close proximity. The committee had vetoed adoption of the previous systems proposed, an audio-actuated system and a high-frequency (3105 KC) radio system, which were found to be too susceptible to influences other than the aircraft.

NUCLEAR TESTS

THE DURABILITY OF ELECTRONIC EQUIPMENT and parts under nuclear bombardment will come under test next month at the AEC's Nevada Proving Grounds. An open invitation has been extended to all manufacturers to provide sample equipment to be exposed to the blast. The resulting evaluation is expected to provide valuable data for Civil Defense agencies. Heading the list of equipment desired are standard AM broadcast transmitters of up to 5 kw output, and transmitting antenna towers suitable for AM broadcast service. These tests are being restricted to typical commercial and domestic electronic systems and equipments. The aim is to ascertain the extent of physical damage which the equipment can be expected to sustain in case of an atomic attack.

www.americanradiohistory.com



TV LIGHTING

NOISE-FREE light bulbs developed by GE for TV broadcast and motion picture studios are expected to improve noticeably the audio portion of TV programs. In explaining the significance of these new bulbs, GE engineers pointed out that the great quantities of light required in the studios are provided by high wattage lamps which tend to generate a good deal of sound. This sound is readily amplified by the metal reflectors. In the TV studio the microphone boom must often be moved close to the lamps, thus the noise is picked up. It reaches the ears of the listener in the form of hum.

NEW EQUIPMENT

MORE EFFICIENT NEWS GATHERING, and swifter dissemination of the news to the public, will result from the improved electronic equipment now on the planning boards, according to GE's Dr. W. R. G. Baker. In a talk to the Radio-TV News Directors Assoc., Dr. Baker listed these possibilities: electronic recorders, to capture still pictures and transmit them directly to the newspaper office; video tape recorders, reduced in size by new circuitry and transistors; TV cameras as small as today's still camera; and small transmitters to relay on-the-spot coverage of news events.

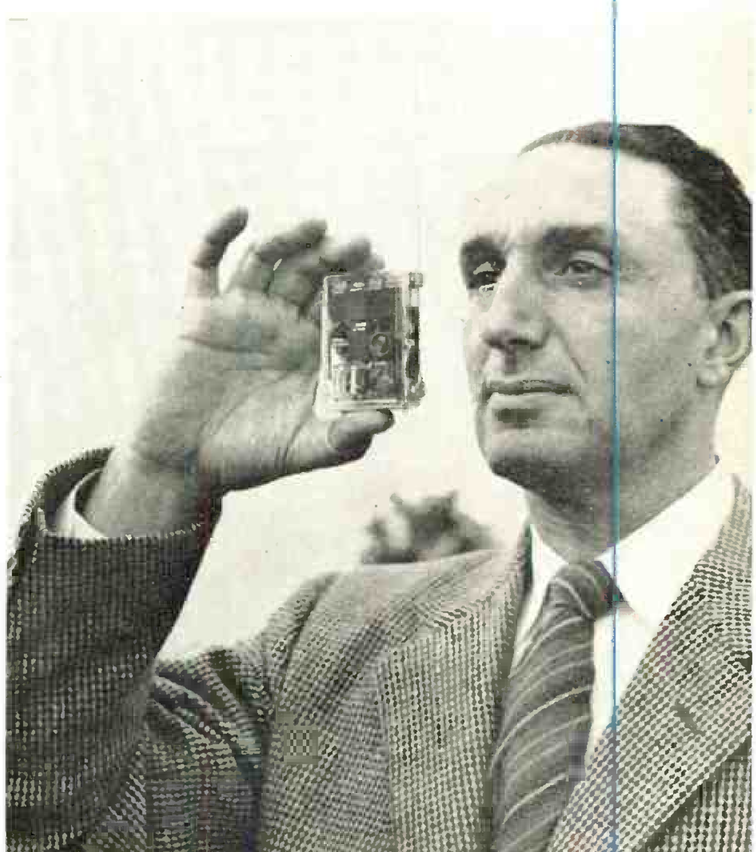
TOWERS

1,000-FT. TV TOWERS, either in the planning stage, or already constructed, are coming in for an increased share of attention from government agencies. A report from the Airspace Subcommittee of the Air Coordinating Committee has recommended adoption of the general principle that "any proposed antenna tower which will extend over 1,000 ft. above ground, unless shielded by existing obstructions, is considered to be an unwarranted hazard to air navigation." In explaining the turnabout from the decision reached a few years ago on this same problem, the ACC pointed out that, at that time, indications were that few such towers would be built. A recent review of the situation has revealed that a number of such towers have already been constructed and more are being planned.

LEGISLATION

ALL OVER THE COUNTRY, state legislatures and city councils are examing proposed bills to license TV-electronic service technicians. The technicians themselves are split in their opinions. Some are in favor of licensing because they think it will get rid of hustler-variety competitors. Others oppose it because government regulation does not guarantee honesty, and may be arbitrarily dangerous. In bellwether New York City, where such legislation is pending, RETMA President Glen McDaniel expressed the Association's opposition to the measure. Unfortunately, district attorneys armed with a handful of sensational fraud cases carry more weight with legislators. TV manufacturers should be aware of three important aspects relating to the governmental licensing of technicians. First, the little shop owner around the corner represents the entire industry in the customer's eyes, and anything that affects the service technician adversely also hurts the manufacturer. Second, increasing regulatory encroachment of this sort can act as a wedge for more of same aimed closer to the set maker. Third, by neglecting to help set up an effective means of self-regulation, the industry itself is at fault for fostering a vacuum which state laws and city ordinances appear all too eager to fill.

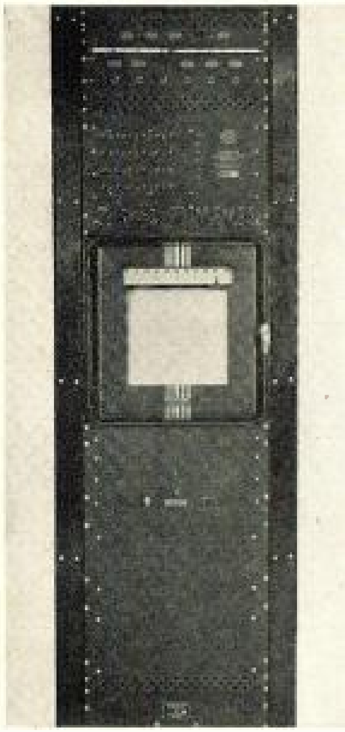
SUN-POWERED TRANSMITTER



Solar energy, alone, is used to power this midget experimental radio transmitter which is being held here by its designer, engineer E. Keonjian, of the G. E. Electronics Lab. Syracuse. The unit employs transistors and selenium solar energy converters. Range is about 100 ft. This could easily be increased, according to the designer, by using more selenium units, or by using germanium or silicon.

www.americanradiohistory.com

High Precision Automatic



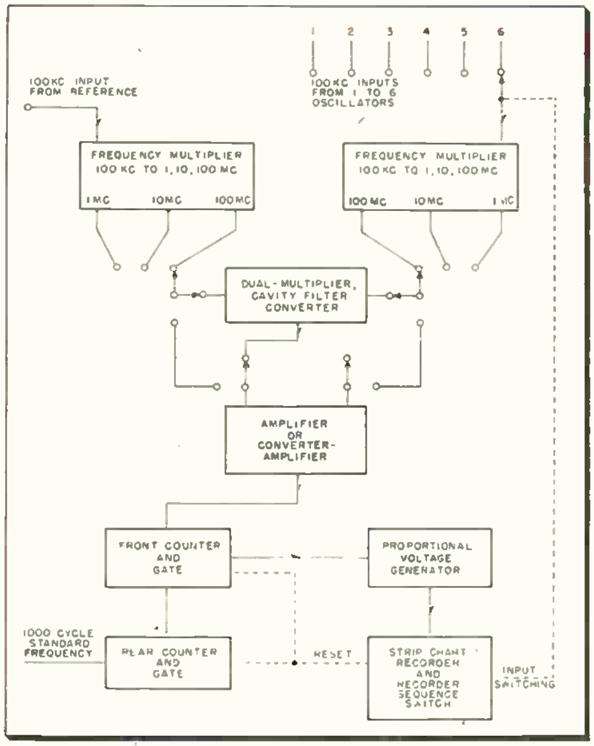


Fig. 1: (l) Automatic beat frequency recorder. Fig. 2: (r) Block diagram of frequency comparator

By JOHN M. SHAULL*
National Bureau of Standards

New wide range beat frequency recorder developed by NBS can detect, and record graphically, frequency deviations in the order of 1 part in 100 billion

THE greatly increased use of more precise frequency standards in technical and scientific work has brought about a need for frequency intercomparison equipment of very high sensitivity.[1,2,3] The recording systems in general use where high precision is required operate over an extremely narrow frequency range to obtain the desired chart resolution. This paper describes a versatile automatic frequency comparator, capable of extremely high precision compared, in an interval of 100 sec, and of operating over a relatively wide frequency range. By means of this equipment, two highly stable 100 KC frequency standards may be with a precision of ± 1 part in 10^{11}, when adjusted over practically any part of their normal operating range. The instrument is also adaptable to a number of laboratory frequency measurements of a more general nature.

The high sensitivity is accomplished by multiplying the frequencies to be compared by 10,000, bringing them to approximately 1000 MC, and using an electronic counter to measure the difference frequency over a precisely known time interval. A dot-printer recorder, operating from a voltage which is proportional to the last three digits of the count for each interval, gives a direct reading chart record of the difference frequencies of as many as six separate oscillators when compared to a common reference oscillator. For use with frequency standards of only moderate stability, three additional sensitivity ranges of lower order are available. In addition, frequency standards ranging from the very low audio frequencies to about 100 KC may be directly recorded with reasonable accuracy.

Equipment

The frequency comparator rack as shown in Fig. 1 contains (from top to bottom) oscillator line terminations and automatic switching panel, electronic counter, recording frequency meter, power supply for the counter, proportional voltage generator, dual channel frequency multiplier-converter and power supply for the multiplier.

A block diagram of the equipment is shown in Fig. 2. The 100 KC output from the reference oscillator is connected directly to the input of the left frequency multiplier. Outputs from as many as six other oscillators are connected through balanced twin-line shielded cables and isolation transformers to a multiple-relay switching unit which connects each oscillator in sequence to the other multiplier channel with very low leakage coupling from the other oscillator lines.

Both of the frequency multiplier

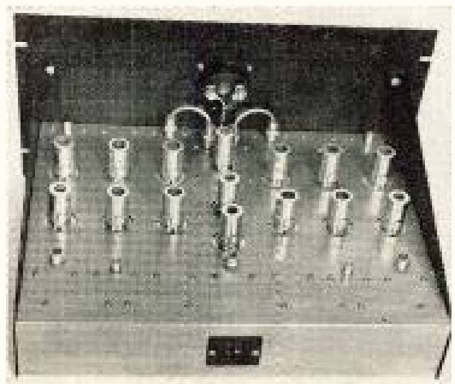
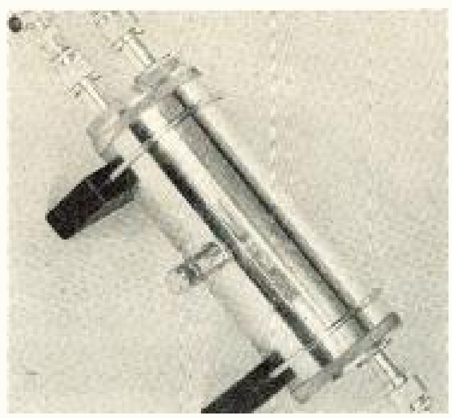


Fig. 3: Dual frequency multiplier and converter

Fig. 4: Auxiliary cavity multiplier-converter



* (Mr. Shaull is now with the Diamond Ordnance Fuse Laboratory, Ordnance Corps, Washington 5, D.C.)

www.americanradiohistory.com

Frequency Comparator and Recorder

channels are identical and are operated from a common external regulated power supply. Balanced-heater and plate-lead r-f filters are provided in the multiplier chassis for each channel to reduce coupling to a negligible amount. Each frequency multiplier channel consists of three decade stages using 2C51 tubes as push-push doublers and push-pull quintuplers in each stage. All coupling transformers and filters are of toroidal type, the lower frequency ranges using ferrite, molybdenum permalloy or powdered iron cores. The higher frequency coils are toroidally wound on textolite cores. Output jacks are provided on each decade for convenience in checking and adjusting the multiplier stages and for use if lower sensitivity special test recordings are desired. At the 100 MC jacks, the 100 KC sidebands and harmonics measured better than 50 db below the desired output. The 100 MC outputs may be connected by short patch cables directly to the converter-amplifier unit between them, as shown on Fig. 3, to obtain the difference frequency at 100 MC and a maximum recording sensitivity of ± 1 part in 10^{10}. For a still higher sensitivity of ± 1 part in 10^{11}, the auxiliary cavity type multiplier-converter unit shown in Fig. 4 may be used. Two 1N21B silicon crystals in coaxial holders, coupled to separate loops within the half-wave-length coaxial cavity filter, generate harmonics of each 100 MC input. A tuning screw permits the cavity resonance to be adjusted to couple the tenth harmonics, at 1000 MC, to a similar loop and crystal converter at the other end of the cavity. A difference frequency between the two 1000 MC signals, at a level of about 20 mv, is available at the converter output. In use the cavity unit is placed on the rear deck of the multiplier chassis and the inputs are connected to the 100 MC jacks by two longer cables that replace the ones used for 100 MC operation. The tee connectors shown on the 100 MC cavity inputs give a better impedance match between the 50 ohm cables and the crystal holders. The built-in bypass capacitors on the input ends of the harmonic-generator crystal holders were replaced with textolite sleeves and a lucite disk was used on the input end of the cavity to allow insulated coupling loops to be used. When the input loops were grounded on one side to the cavity, converter action occurred at 100 MC through circulating ground currents in the coaxial lines and 1000 MC operation could not be obtained. The output of the cavity converter is connected to one of the center jacks which leads to the grid of the converter-amplifier stage. This stage is adjusted to give about the same output voltage when serving either as a 100 MC converter or as an amplifier for the 1000 MC crystal converter. A gain control, barely visible between the tubes, allows the output voltage obtainable from the center rear jack to be adjusted to about 3 v. for proper counter operation. A panel meter, added after the rack photograph was made, permits the beat frequency voltage to the counter to be read conveniently.

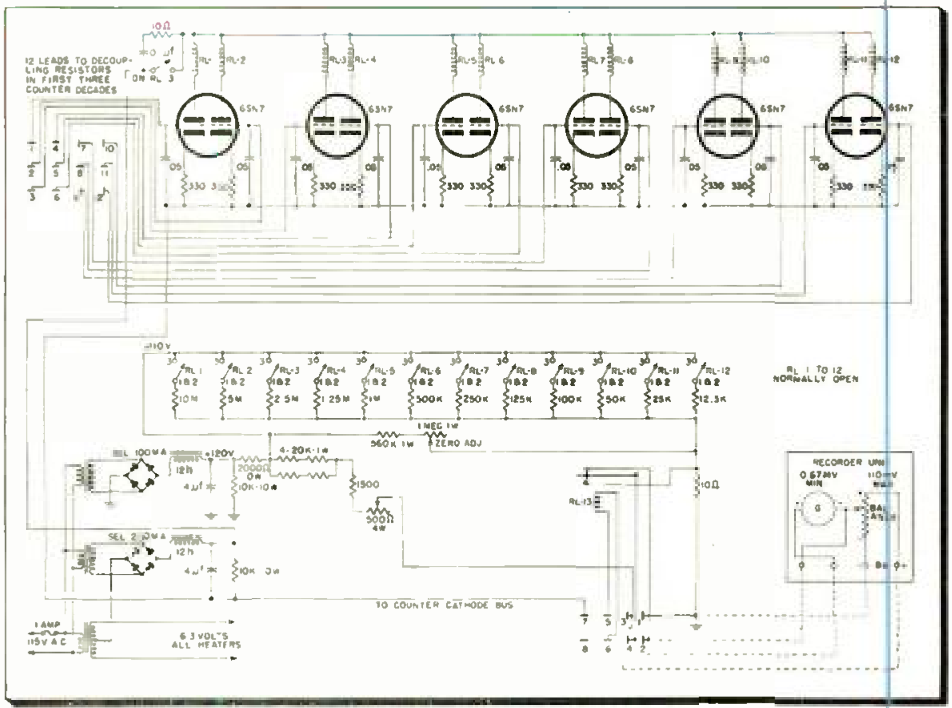


Fig. 5: Output voltage of this generator is proportional to numerical value indicated by lights

Electronic Counters

The electronic counter is a modified commercial unit having six decade counter stages with front readout lights and five additional decade stages within the unit which are used for timing the counting period of the front decades. The megacycle, or input decade stage was replaced with a less critical high-frequency unit having lower power drain, as no frequencies above about 100 KC were to be counted in this application. A second gating stage was installed to allow both front and rear counters to be gated simultaneously. Other circuitry was added to reset the display and counting circuits by means of a contact in the recorder, and to give a delayed starting pulse a few seconds after each oscillator is switched in and equilibrium in the multipliers has been established. When thus started, a 1000 CPS standard frequency is supplied to the timing counter and when it reaches a count of 100,000, after an interval of precisely 100 secs., a pulse is generated and sent to the gating units which stops both counters. During this interval the frequency counter has totalled the difference frequency from the converter-amplifier with a precision of ± 1 count, or to 0.01 CPS. This frequency may be read visually on the front counter lights during the display interval. While on display, control voltages are brought out to the proportional voltage generator through added contacts and isolating resistors for each of the indicator lights on the three front counter decades associated with the last three digits of the displayed number.

The proportional voltage generator shown in Fig. 5 converts the information or count indicated by these twelve lights into a voltage (*Continued on page 126*)

www.americanradiohistory.com

An R. F. Resonant Circuit for Use

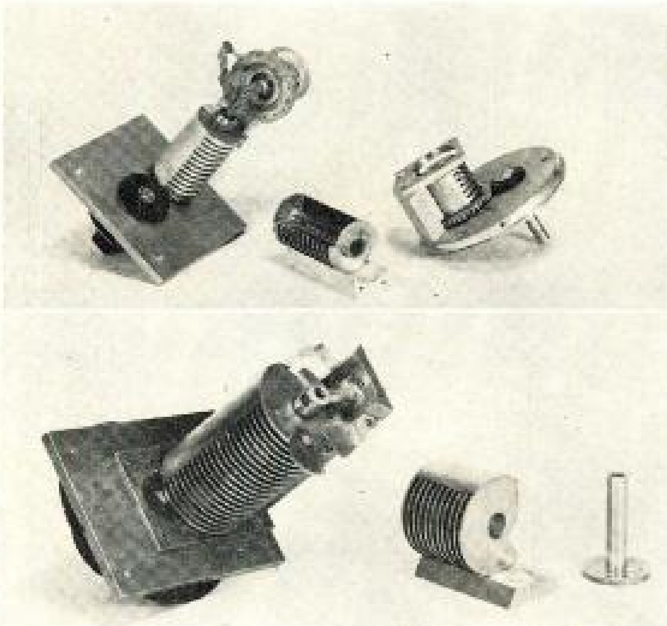
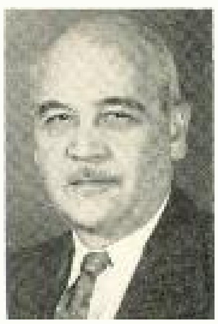


Fig. 1: (l) Eccentric concentric line oscillator. Fig. 2: (r) Examples of two-wire type construction

A variable inductive line type circuit is found to provide stable operation in UHF band. Tube lead inductance is limiting factor in design



By FRANK C. ISELY
Naval Research Labs.
Washington, D. C.

THE frequency range of 300 to 1,000 MC has been a difficult portion of the radio spectrum in which to obtain a good wide coverage resonant circuit for use with oscillators and amplifiers. The advent of UHF-TV has brought forth several circuits but, in general, these have sliding contacts or have a longitudinal plunger motion which may not be conducive to trouble free operation or repeatable accuracy.

A variable inductive line type circuit for use within the range of frequencies from 300 to 1000 MC has now been developed, with a tuning coverage up to two to one, and with no metallic sliding or rotating contacts. The line can be built of metal (brass) or can be of low loss plastic using plated or printed circuit techniques. The theory of the circuit is developed and the methods of calculating size and spacing for a given range are shown below. A straight line tuning characteristic can be obtained within approximately 180° of rotation. These lines may be of the the coaxial or of the two-wire type. Tubes required for wide coverage are of the low inductance lead type, such as the 2C40, RCA Pencil 5876, or W.E. 416A.

Several years ago, a rotating variable inductive line was suggested in which there were no metallic sliding contacts. At that time, only a 1½ to 1 ratio of frequency coverage was secured and the tuning curve was far from linear. Recently, however, several improvements have been made which give more than a two to one coverage and also give a straight line tuning curve within approximately 180° of rotation.

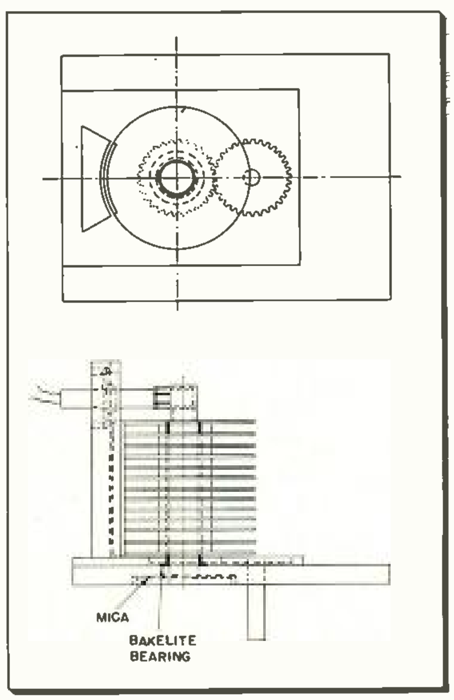
Theoretical Considerations

In a capacitively tuned circuit, the tube loading capacity limits the upper frequency. Similarly, in this inductively tuned circuit the tube lead inductance is the limiting factor. It is also this unknown value of lead inductance that makes it difficult to calculate the factors leading to the design of such an oscillatory circuit. However, calculations can be made and when certain experimental checks are performed, it is possible to design a circuit that will approach the objective.

In an air dielectric transmission line of normal configuration the value of the inductance and capacity per unit length can be calculated and if one of these constants is increased the other is decreased in the same proportions and the velocity of propagation, which is inversely proportional to the square root of the product of L and C, is constant. However, if either L or C could be held constant and the other varied, then the velocity would vary. If such a line were held constant in length, then, since the wave length would be constant, the frequency would vary as the velocity.

Figure 3 shows such a two wire line. It could just as well have a concentric configuration. One part of the line is made of a solid fixed portion; whereas the other rotating portion is made up of a partially slotted cylinder, which can be rotated to place the solid portion either next to the fixed line or farther away. The capacity is almost constant, due to the fringe effect of

Fig. 3: Variable Inductance 2-wire line



www.americanradiohistory.com

at 300-1000 MCs

the closely spaced plates, while the inductance varies from a low value to a high value when the rotatable solid portion moves from close proximity to maximum distance from the fixed solid portion. Figure 1 shows an eccentric concentric oscillator while Fig. 2 shows several of the two wire type.

A line of this type, which is made up of distributed inductance and capacity, can be transformed[2] into a lumped series inductance and capacity, Fig. 4a,b. The resonant frequency

$$f = 1/4C_o L_o \qquad (1)$$

where C_o and L_o are the total capacity and inductance of the line. In such a circuit, the reactance

$$X = (-\sqrt{L_o/C_o})\, C_o + \omega\sqrt{L_o C_o} \qquad (2)$$

which can be expanded into a cotangent series in terms of $\omega\sqrt{L_o C_o}$ and for values of ω somewhat less

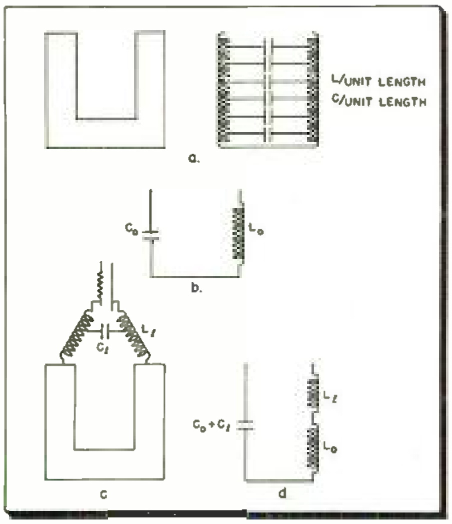


Fig. 4: 2-wire line and equivalent circuits

than the resonant point, the approximate reactance

$$X = (1/\omega C_o) + \omega L_o/3 \qquad (3)$$

This is a negative reactance, that is, capacitive. An inductive reactance may be added which, when equal to the capacitive reactance at a given value of ω, will give a new resonant frequency where the previous approximation is reasonable.

$$\frac{\omega L_e}{3} + (-X) = -\frac{1}{\omega C_o} + \frac{\omega L_o}{3} + \frac{\omega L_e}{3}$$

$$0 = -\frac{1}{\omega C_o} + \omega\left(\frac{L_o + L_e}{3}\right)$$

and

$$f = 1/(2\pi\sqrt{C_o (L_o + L_e)/3})$$

The value L_e may be interpreted as the tube lead inductance. If there is also a small amount of capacity

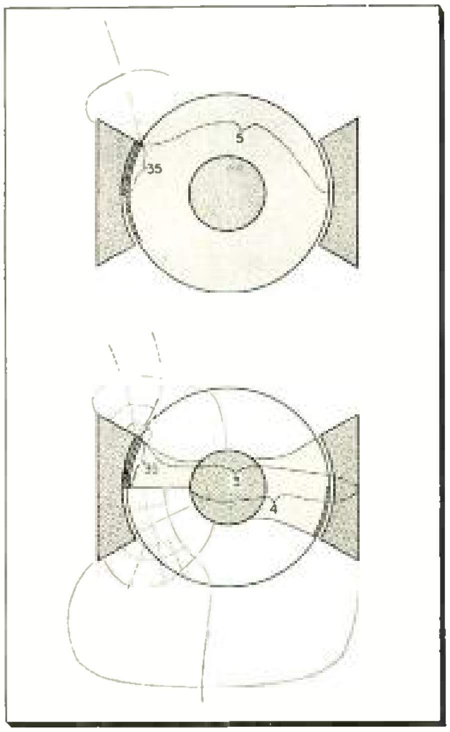


Fig. 5: Field-plotting for 2-wire line

loading, it can be added directly to C_o without much error. Then

$$f = 1/(2\pi\sqrt{(C_o + C_e)(L_o + L_e/3)}) \qquad (4)$$

This is the equation for the loaded line Figure 4c with equivalent circuit Figure 4d. L_e is difficult to evaluate, but if a circuit has been built and the value of f determined, the value of L_e can be calculated and used when other circuits of similar configuration are built.

$$L_e = 3\left(\frac{1}{\omega^2 (C_o + C_e)} - \frac{L_o}{3}\right) \qquad (5)$$

The values of L_o and C_o per unit length can best be determined by the use of field plotting.[3] Field plotting provides a graphical map of the voltage and current lines which can be drawn by means of curvilinear squares as in Fig. 5. The characteristic impedance of any configuration of line may be obtained from

$$Z_o = 377\, N_v/N_f$$

where N_v is the number of voltage spaces between the two parts of the line and N_f is the number of current spaces around one line. From the characteristic impedance, the inductance and capacity per unit

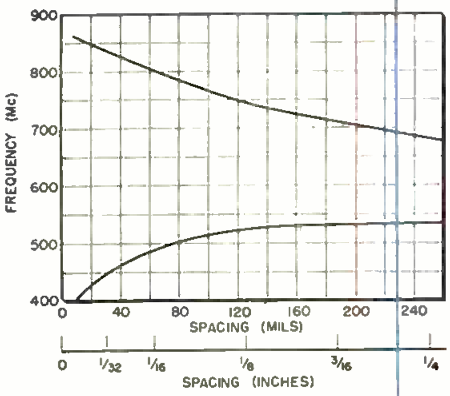


Fig. 6: Frequency vs. spacing, with 416 A tube

length are secured, where

$$L = 33.45 \times Z_o \text{ and } C = 33.45/Z_o.$$

The values of L and C being μμh and μμf per cm.

Eq. 3 is exact only when $\omega << \omega_o$, the resonant frequency of the unloaded line; but it is approximate when ω is as much as ten percent lower than ω_o. When L_e is not known, the frequency of the line, loaded only by the capacity C_e, can be calculated from the equation

$$l = \frac{\lambda}{2\pi}\tan^{-1}\left(\frac{5.3\,\lambda}{CZ_o}\right)$$

This equation is difficult to use but from charts[4] of l and λ for a family of curves of CZ_o, the value of λ can easily be determined. This value of λ actually applies to a line having simple symmetry and is used only as an expedient for the calculation of the frequency. In the lines under discussion, the velocity of propagation varies and is equal to the reciprocal of the square root of LC. Knowing the velocity and wave length, the frequency can be calculated from $f = v/\lambda$. Since L_e has been neglected the calculated high frequency value of f will be higher than the actual high frequency value and strangely enough the calculated low frequency value will be lower than the actual low frequency value. Transit time of the tubes has not been considered.

Design Calculations

In the design of a variable inductive line, compromises must be made, depending on space considerations, tube type, desirability of continuous rotations, and other such factors. A 1-in. to 2-in. diameter rotor has appeared to be about the right size for best results. A larger diameter will give more change in inductance, but will also require a greater non-turnable length of plate lead connection. A 60° solid line and a 60° solid portion on the rotor have been proved experimentally to give the greatest frequency change. Theoretically a 90° section would seem

www.americanradiohistory.com

TABLE 1

Calculation of Frequency
2-inch rotor 60° solid portion, 1/32-inch spacing. $C_e = 4\ \mu\mu f$
(Figure 5a) Z_o = 9.4 ohms C = 3.64 $\mu\mu f$/cm
(Figure 5b) Z_o = 9.9 ohms L = 352 $\mu\mu h$/cm
(Figure 5c) Z_o = 94 ohms L = 3150 $\mu\mu h$/cm

	3.2 cm		4.2 cm		5 cm		8.2 cm	
	H-F	L-F	H-F	L-F	H-F	L-F	H-F	L-F
$Z_o' = \sqrt{\frac{L}{C}}$ (ohms)	9.8	29.4	9.8	29.4	9.8	29.4	9.8	29.4
$C_e Z_o'$ (ohms $\mu\mu f$)	39.28	117.6	39.28	117.6	39.28	117.6	39.28	117.6
λ (cm) from chart	17.4	24	21.5	29	25	32.3	37.5	46
$v = \sqrt{\frac{1}{LC}}$ (cm/sec)	2.8×10^{10}	0.935×10^{10}	2.8	0.935	2.8	0.935	2.8	0.935
f (Mc) = v/λ	1610	390	1305	323	1122	290	747	203
f (Mc) exper.					855	453		
L_e ($\mu\mu h$) Eq. 5					2919			
C_o ($\mu\mu f$)	11.65	11.65	15.29	15.29		18.20	29.9	29.9
$C_o + C_e$ ($\mu\mu f$)	15.65	15.65	19.29	19.29		22.20	33.9	33.9
L_o ($\mu\mu h$)	1129	9770	1479	12800		15200	2980	25000
$(L_o + L_e)/3$ ($\mu\mu h$)	1348	4343	1466	5373		6223	1935	9573
f (Mc) cal Eq. 4	1100	612	948	495		432	622	281
f (Mc) exper.	1040	600	935	510	855	453	653	283

to give a greater tuning frequency ratio but it is likely that the current flow is concentrated more toward the center portion and thus the extra width does not reduce the inductance very much. A two wire line gives somewhat greater frequency coverage unless the concentric type has a fairly large outer conductor of a size similar to a well spaced shield on the two wire line.

Assuming that a 2-in. diameter rotor is to be used, a 60° solid portion, and 1/32 in. spacing between lines, a field plot is made as in Fig. 5. *a* is for the capacity calculations for both the high and low frequency end. *b* is for the high frequency end inductance and c is for the low frequency end inductance. This figure is usable for any size of line, provided all dimensions are scaled proportionately. Table I gives the necessary calculations for lines of four lengths. Actually, the 5 cm length line was built originally and the other lines were built to check the theoretical calculations. The results are within 5%, except for the high frequency end of the 3.2 cm line which is within 10%. In Fig. 5, it will be noticed that an additional fixed line has been added to the rotary portion. This part is connected directly to center post and the plate connection and increases the upper frequency, except in the case of the 3.2 cm line, where the extra capacity to ground of the connecting portion perhaps was responsible for a decrease in frequency.

The spacing between the rotating portion and the solid portion is a determining factor in the frequency coverage, 1/32 in. spacing has been used. Closer spacing, say 1/64 in., might be more difficult to obtain in production, but it could increase the frequency range or give the same coverage for a smaller diameter of unit. Fig. 6 shows the frequency coverage for various spacing. If less coverage is needed for some applications, a 180° rotation can be used with wider spacing.

The center post needs to be fairly small to keep it away from the solid line at the low frequency position but large enough to give good rigidity and good capacity coupling to the center portion of the rotor. The rotor was originally made of a slotted brass tube with 1/8 in. slots and 1/8 in. teeth and a 60° solid portion. The later rotors have been made of a stack of 1/32 in. plates with 1/8 in. spacing, and a 60° solid section of a cylindrical tube soldered thereto. It is believed that in production it would be possible to make the rotor and perhaps the fixed line of molded low loss plastic and use "printed circuit" techniques for plating the metallic portion. In fact, this technique has been tried using a polystyrene rotor and solid section, plated with silver. The only difficulty

(*Continued on page* 134)

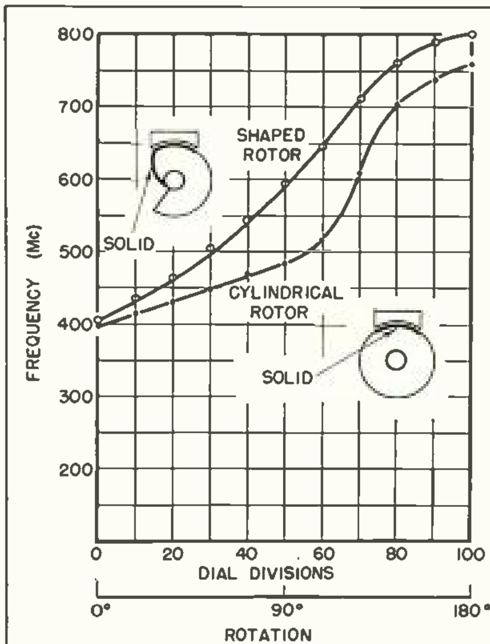


Fig. 7: Tuning curves for 2C40 oscillator, 5.0 cm long, 2-in. rotor with 1/32 in. spacing

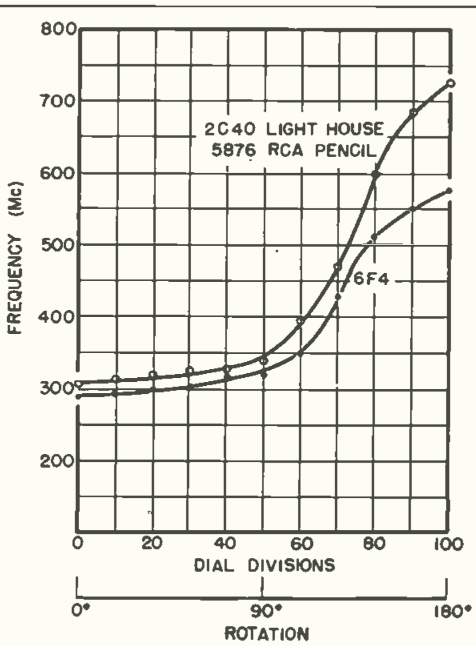


Fig. 8: Non-linearity of this curve for 6.2 cm. oscillator can be improved by loading tube

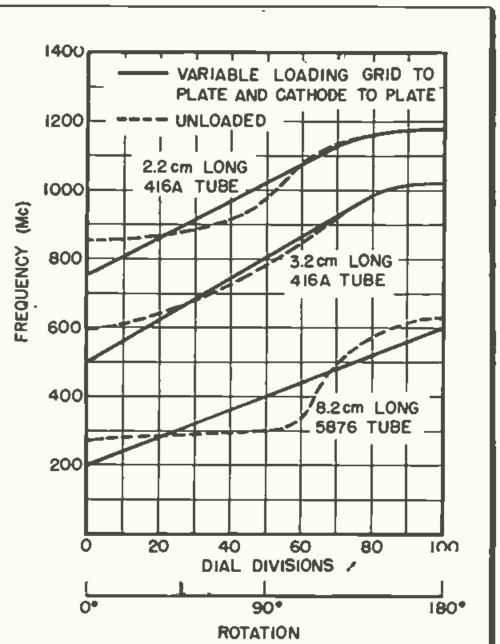
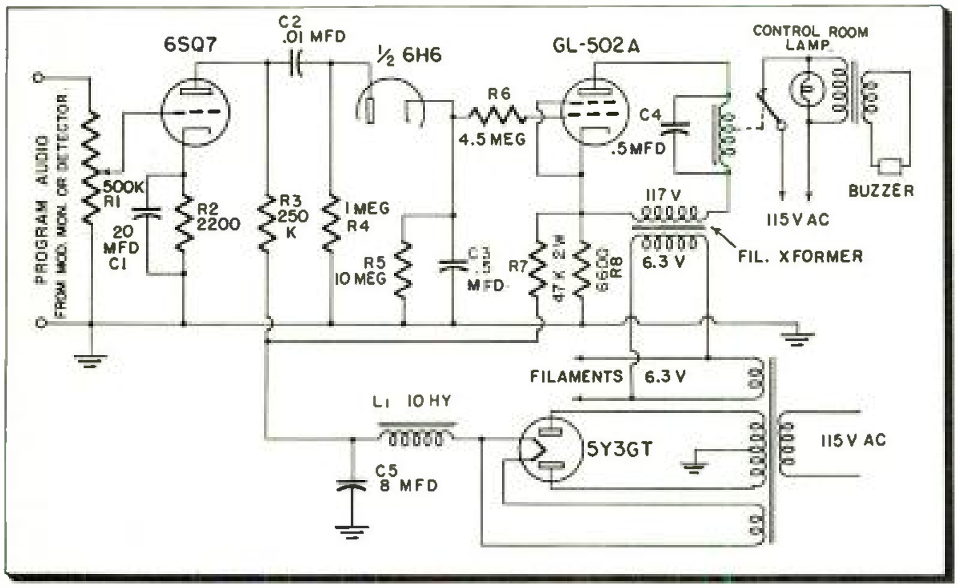


Fig. 9: Effect of tube lead inductance points to need for planar type tube for wide coverage

www.americanradiohistory.com

CUES for BROADCASTERS

Practical ways of improving station operation and efficiency



Circuit of program carrier alarm actuated by carrier modulation to sound buzzer or flash alarm

Program-Carrier Alarm

E. C. SMITH, Chief Engineer, WFIN, Findlay, Ohio

MANY stations are using alarm systems to alert personnel when the transmitter carrier is interrupted. An alarm system is very desirable where studios and transmitters have separate locations, where transmitters are remotely controlled, and where both AM and FM are operated.

A carrier interruption alarm however is inadequate in that it does not indicate when modulation has failed. Here is a unit we have been using at WFIN for several years to indicate program failure.

The unit is actuated by the modulation on the carrier and will sound or flash an alarm a predetermined number of seconds after carrier or program interruption. It thus maintains a constant watch over the entire broadcast system. The time delay is adjusted so that ordinary program pauses will not be long enough to actuate the alarm. Should the unit itself become defective, the alarm will indicate it.

The unit input may be connected to the transmitter modulation monitor audio output, or to a detector output. In our case, we use two alarm channels on the same chassis, one for AM and one for FM, operated from the modulation monitors. The modulation monitors are at the studio control room for our remote control operation. A buzzer is located so it can be heard anywhere outside the control room and a 100 watt lamp serves as the alarm in here because a microphone is in use much of the time.

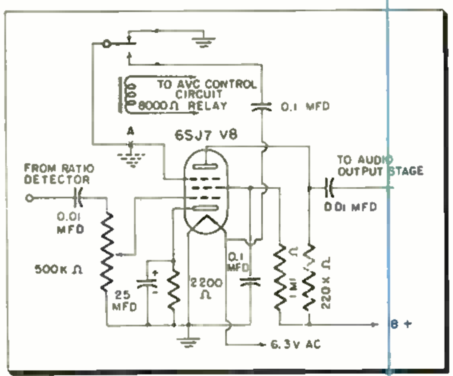
In operation audio voltage is rectified by the 6H6 diode and C3 is charged almost instantly. A positive voltage is applied to the grid of the 502-A causing it to fire. This energizes the plate relay and the alarm is off. With the loss of audio, C3 discharges through R5 slowly, until the 502-A grid becomes negative due to voltage across R8. The 502-A then ceases to conduct, the relay opens and sounds the alarm. Delay time is controlled by the potentiometer R1.

Conelrad Warning Signal

JAMES D. GREEN, WELO Tupelo, Mississippi

A NATIONAL NC-108 FM Receiver is used here for the Conelrad warning service. The usual type AVC controlled relay is used to trigger our warning signal which in this case is neither a bell or light, but is a very loud buzzing noise produced by the receiver. No external wiring or parts other than one 0.1 mfd. capacitor is needed.

Only a simple modification of the original circuit is required. The dotted line grounding the suppressor grid (at point "A") of the first audio tube is the original wiring. This ground should be removed and the suppressor grid connected through a shielded lead to the arm of the control relay. The upper contact of the relay is grounded. The bottom or normally open contact is connected through a 0.1 mfd. capacitor to any convenient point on the 6.3 VAC heater wiring. When the receiver is normally receiving a signal the suppressor grid is grounded through the relay contacts. When the carrier is removed from the air the relay is energized, connecting the suppressor grid through the 0.1 mfd. capacitor to the 6.3 VAC. This applies a low frequency note to the input of the audio amplifier causing a very loud buzzing in the output thereby alerting operating personnel of the Conelrad Alert. The volume



Conelrad warning employs avc controlled relay

of this signal can of course be regulated by varying the value of the capacitor. The volume control setting on the receiver has little or no effect on the volume of the alerting signal.

Checking Turntable Speed

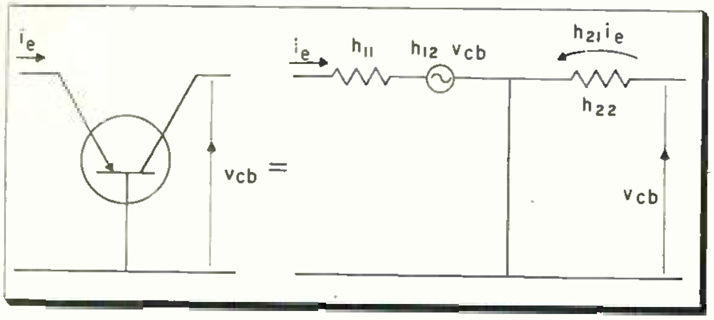
GORDON WILEY, Chief Engineer, WGAW, Gardner, Mass.

THE regular method of checking turntable speed by means of the paper synchronizing disc is not very satisfactory. A neon or fluorescent light must be used and even then (*Continued on page 125*)

$$$ FOR YOUR IDEAS

Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is requested. Our usual rates will be paid for material used.

www.americanradiohistory.com



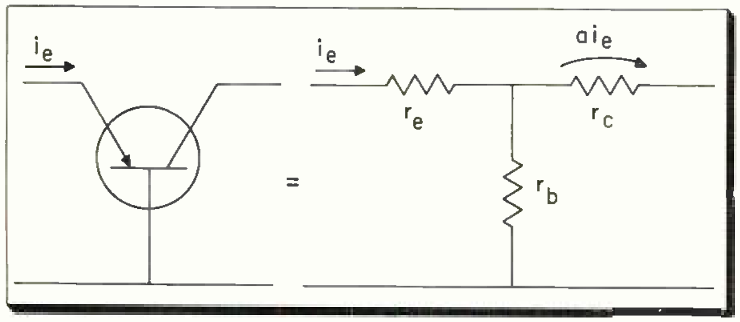


Fig. 1: (l) Low frequency equivalent transistor circuit, h-type Fig. 2: (r) Equivalent transistor circuit, T-type

Variation of Junction Transistor

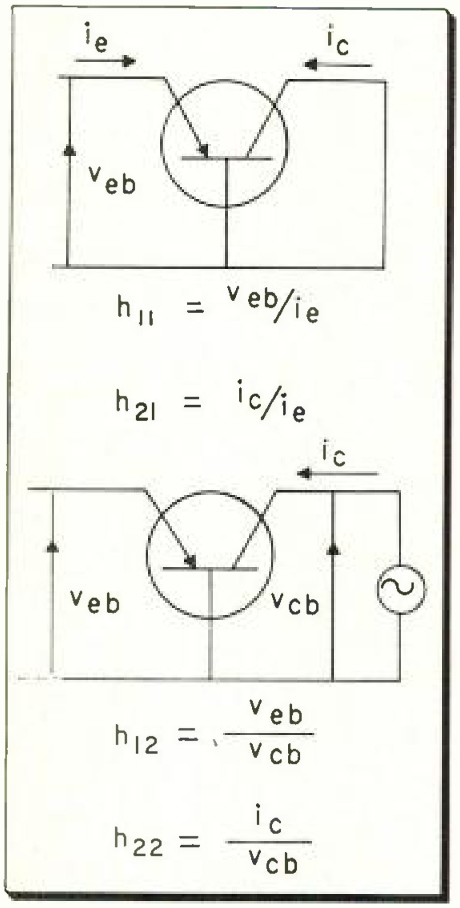


Fig. 3: Measurement of h-parameters

Changes in performance at different operating points and temperatures require close scrutiny in amplifier design

By J. S. SCHAFFNER, Supervisor of Semiconductor Applications Electronics Div., General Electric Co., Syracuse, N. Y.

IN designing small signal transistor amplifiers it is very important that the variation of the parameters of the transistor with operating point be known. (The operating point is defined by the emitter current and the collector-base voltage). Similarly the variation of the static characteristic with temperature is of great importance for the design of bias networks, power amplifiers, etc.

Two types of parameters enter into the design of practical transistor circuits. Parameters of the first type include such information as the maximum power gain, and the minimum noise figure of simple amplifier stages. Parameters of this type are general in nature and therefore non-controversial.

Parameters of the second type give information for the design of actual circuits. Examples of such parameters are α (the short circuit current amplification of the grounded base stage), the frequency at which the magnitude of α is reduced to $1/\sqrt{2}$ of its low frequency value, the open circuit output capacitance and, in a wider sense, the collector voltage-collector current characteristic. There is a large class of such parameters so that some intelligent selection has to be made.

Discussion Points

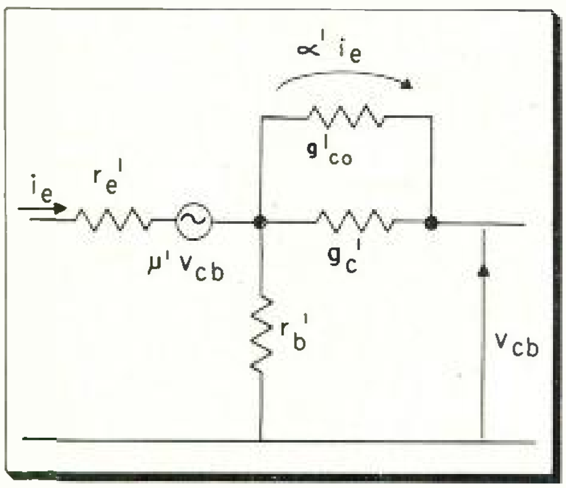
The points we will discuss here are:

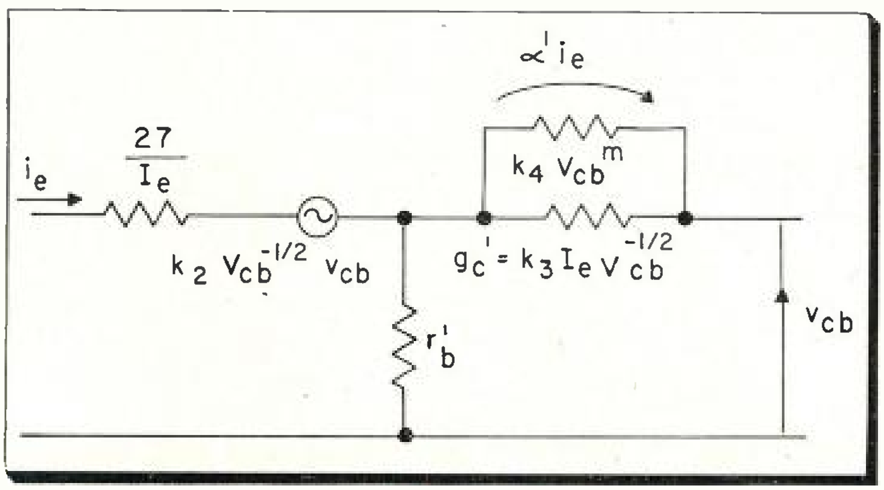
A. Static Characteristics:

1) The emitter current-emitter voltage characteristic with the collector-base voltage as parameter.

2) The collector current-collector voltage characteristic with the emit-

Fig. 4a: (l) Calculated approximate equivalent circuit. Fig. 4b: (r) Representation of transistor by equivalent circuit of Fig. 1





www.americanradiohistory.com

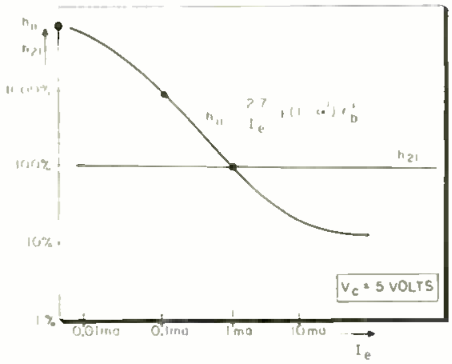


Fig. 5: Parameter h_{11} and h_{21} variation with I_e

Parameters

ter current as parameter.

B. Small Signal Parameters:

The so-called h-parameters for the grounded base configuration. This includes:

h_{11}: the input impedance with the output short circuited to a.c. currents.

h_{12}: the ratio of the voltage appearing across the input of a transistor to the voltage applied across the output with the input open circuited to a.c. currents.

h_{21}: the current amplification with the output short circuited to a.c. currents.

h_{22}: the output admittance with the input open circuited to a.c. currents.

The dimensions of the h-parameters are: h_{11} is an impedance, h_{22} an admittance, h_{12} and h_{22} are dimensionless.

Fig. 1 shows the low frequency equivalent circuit corresponding to the h-parameters. This circuit consists of one resistance (h_{11}), one conductance (h_{22}), one voltage generator proportional to the output voltage ($h_{12}v_{cb}$) and one current generator proportional to the input current ($h_{21}i_e$).

Note that $\alpha = -h_{21}$ for the grounded base configuration. The h-parameters are related to the more commonly used parameters r_e, r_c, r_b and a (Fig. 2) by the approximate equations:

$$a \cong \alpha = -h_{21}$$
$$r_c \cong 1/h_{22}$$
$$r_b = h_{12}/h_{22}$$
$$r_e \cong h_{11} - \frac{h_{12}}{h_{22}}(1 + h_{21})$$

Fig. 3 shows schematically the circuits commonly used for the measurements of the h-parameters.

We shall in this section discuss the variation of the low frequency small signal h-parameters of the grounded base stage. This variation can be calculated almost completely from the properties of the semiconductor material and the geometry of the transistor. The result of this calculation is the approximate equivalent circuit shown in Fig. 4a. (The circuit for high frequencies is considerably more complex.) The equivalent circuit contains six elements. Two of these are in the first approximation independent of the operating point; one is a function of the emitter current only, two are the function of the collector voltage only and one a function of both emitter current and collector voltage. These elements are:

a) r_b' the "Base-spread resistance" is independent of the operating point.

b) α' is independent of the operating point.

c) r_e' is inversely proportional to the emitter current and independent of the collector voltage.

d) μ' is (for alloy transistors) proportional to $V_{cb}^{-1/2}$ where V_{cb} is the voltage between collector and base.

e) g_c' (the collector conductance) is proportional to emitter current and (for alloy transistors) to $V_{cb}^{-1/2}$.

f) g'_{co} (the leakage conductance) increases strongly with the collector voltage: $g'_{co} \cong k\, V^m_{cb}$ and is independent of the emitter current. For a number of transistors $m \cong 1$.

The physical reasons for these changes have been discussed in the literature[1] and will not be repeated here.

We have therefore:

$$\alpha' = \alpha'$$
$$r_b' = r_b'$$
$$r_e' = k_1 I_e^{-1}$$
$$\mu' = k_2 V_{cb}^{-1/2}$$
$$g_c' = k_3 I_e V_{cb}^{-1/2}$$
$$g'_{co} = k_4 V^m_{cb}$$

If we represent the transistor by the equivalent circuit of Fig. 1, we have approximately (Fig. 4b):

$$h_{11} = r_e' + (1 - \alpha)\, r_b' = k_1 I_c^{-1} + (1 - \alpha')\, r_b'$$
$$h_{12} = \mu' + r_b'(g_c + g_{co}) = k_2 V_{cb}^{-1/2} + r_b'(k_3 V_{cb}^{-1/2} I_e + k_4 V_{cb}^m)\, h_{21} - \alpha'$$
$$h_{22} = g_c + g_{co} = k_3 V_{cb}^{-1/2} I_c + k_4 V_{cb}^m$$

Figs. 5-8 show qualitatively the variation of the parameters with the operating point corresponding to these equations.

The performance of a transistor amplifier may change with temperature, particularly if the amplifier has been improperly designed. There are two reasons for this:

a) The static characteristics of the transistor change with temperature. These characteristics, together with the external bias circuits determine the operating point of the transistor. Therefore, as the characteristics change, the operating point, and specifically the emitter current and collector voltage may change. This change in operating point will, in turn, as indicated in the previous section, cause a change of the small signal parameters. In addition, the change in operating point may lead to clipping, distortion, etc.

b) Some of the small signal pa-

(*Continued on page 124*)

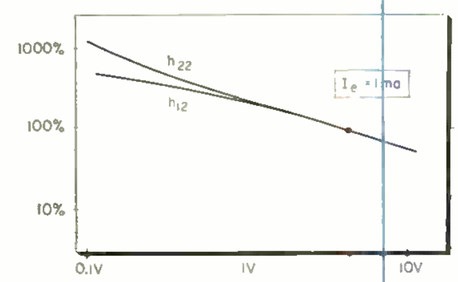


Fig. 6: Parameter h_{12} and h_{22} variation with V_c

Fig. 7: Parameter h_{11} and h_{21} variation with V_c

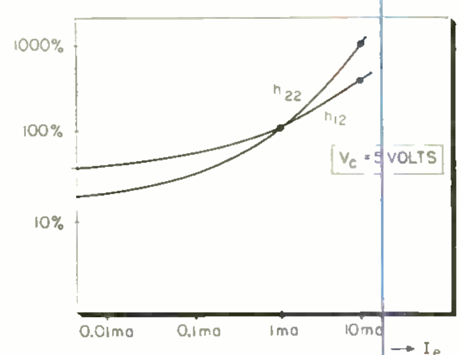


Fig. 8: Parameter h_{12} and h_{22} variation with I_e

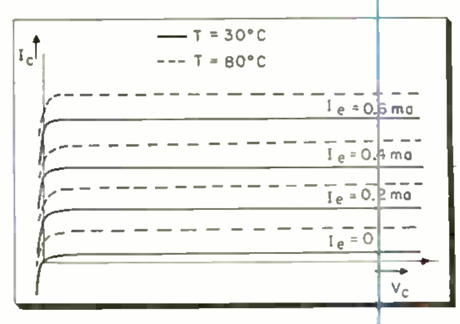


Fig. 9: Temperature-output characteristics

www.americanradiohistory.com

Series Heater and

A review of "do's" and "don'ts" for reliable equipment designers. "Bus-bar paralleling" offers promising technique for transformerless type home TV receivers

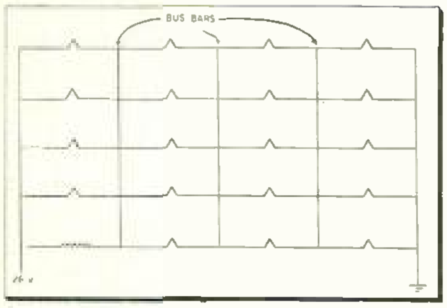


Fig. 1: Paralleling bus-bar type connections used with series heater or filament strings

By Advisory Group on Electron Tubes
Office of the Asst. Secy. of Defense
Research & Development
346 Broadway, New York City

A REPORT on the electron tube surveillance program at Aeronautical Radio, Inc., focused attention on current design and maintenance practices which contribute to high rates of tube failures in electronic equipment. One of the questionable design practices mentioned in the report is the use of series and series parallel arrangements of filaments and heaters across a 26-v. power supply.

The purpose of this article is to discuss the operation of series filaments and heaters in military equipment. Although many problems which plague series heater arrangements are common to parallel arrangement, there are inherent differences that must be considered. Many of these are unfavorable and may adversely affect the reliability of the equipment.

Equipment Limitations

A large percentage of military aircraft are equipped solely with 26-v. dc generating equipment. This introduces certain equipment limitations. Transformers cannot be used to obtain the individual heater or filament voltage unless an inverter is used. The inverter when used presents problems of weight, voltage regulation, and reliability of continued performance which cannot be overlooked. In addition to the inverter weight is the weight of the transformers. As a result of these factors many military equipments have been and are being designed with series and series-parallel filament and heater arrangements.

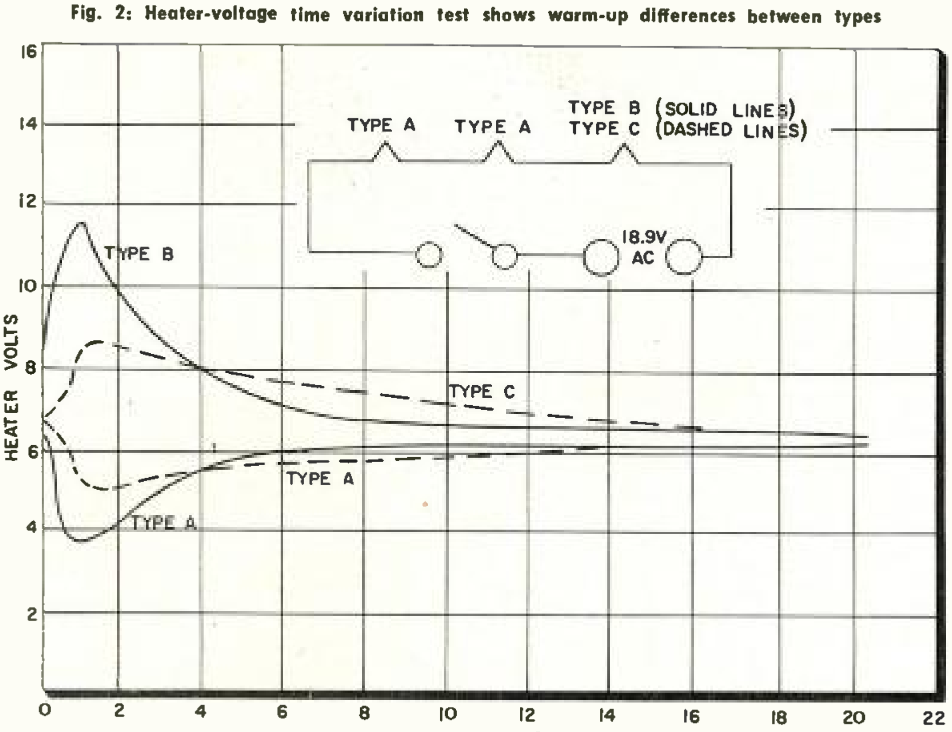
Series heater and filament arrangements have been used in low cost ac/dc home entertainment radios since the late 1930's. The small number of tubes involved made it possible to realize an acceptable degree of reliability with the tubes available at the time. This acceptable degree of reliability was based to a large extent on customer purchase price considerations. In TV receivers the number of tubes and the diversity of tube types was too large to render series strings feasible using tubes having similar properties, from the heater standpoint, since the resulting frequency of service interruptions and maintenance costs were too high for public acceptance. Therefore, the use of series heater strings in TV receivers has, until very recently, been negligible despite their advantages of lower costs and reduced size and weight. Recently certain tube types having 600 mA heaters have been introduced for use in series heater string operation with TV sets. The use of these types may result in acceptable reliability due to additional rating and quality considerations such as: control of warm up time, closer limits on heater current, increased heater cathode voltage ratings for certain types.

When military considerations dictate the use of series heater strings careful design and maintenance practices must be followed. To assist the equipment designer the following recommendations are made:

1. Use only tubes which have adequate MIL-E-1 specification assurance of heater characteristics that are essential to series-heater operation. These characteristics include heater resistance, warm-up time and heater-cathode voltage.
2. Add series resistance, where necessary, to make total of rated tube voltages plus resistor drop equal to supply voltage.
3. Use paralleling bus-bar (cross-ties) connections whenever possible. See Fig. 1.
4. Place the tube near the grounded end of the heater string, in circuit, where hum considerations are important.
5. Place tubes having low heater-cathode voltage ratings near grounded end of heater string.

The nature of operation removes some hazards associated with the higher voltage filament source, but introduces other problems in their stead. This report will be concerned with the higher voltage systems, e.g., 26 v. dc generator supply using

Fig. 2: Heater-voltage time variation test shows warm-up differences between types



www.americanradiohistory.com

Filament Strings in Military Equipment

heater-type tubes.

The problem in designing a series heater string of maintaining the proper steady state voltage across the individual tube seems at first quite simple, nevertheless several problems arise. Present MIL specifications are all based on fixed test point heater voltage allowing the

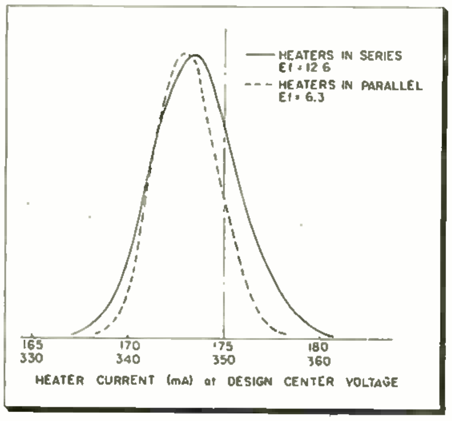


Fig. 3: Comparison of series and parallel heater currents at design center voltage

tolerance on current. The ratings provide limits for heater voltages within which the tube must operate in the application. No characteristics are specified, for the heater, at voltages different from this test point voltage. Since the current is common to all tubes in the series string the voltage drop across individual tubes will vary with the steady state value of heater resistance during the warm up period. These voltage drops will often depart markedly from the steady state design center value specified for the tube type. The materials used in heaters usually have ballasting properties. That is, a rise in resistance for an increase in current. The resistivity of some heaters, for example, increases by a factor of more than seven between room temperature and the operating temperature of the heater. In addition it is unlikely that the common current be the same as the design center value for each type. A heater for which the test point current for example is higher than the string current, has a lower resistance and operates at a lower than normal temperature. The converse is equally true and therein lies one hazard. A heater having a test point current at or near the MIL-E-1 limits (most of these limits presently range from ±8% to ±10% from the design center values for heater current. The ratings for most heater voltage is ±10%, some are presently rated at ±5%) will most likely operate with a heater voltage near or outside the MIL-E-1 ratings for heater voltage (see Fig. 3). Since this represents the steady state condition, supply voltage variations will extend the deviation still further from the ratings. The unfortunate aspect of this operation is that if the tubes have been purposely produced to one side of the current tolerances to improve some property, e.g., low heater current to avoid development of leakage or high heater current to improve emission, operating in a series string with normal current tubes will aggravate the condition.

Another problem to be considered in steady state operation is that of the variability of supply voltage. If the design center value of the supply voltage is greater than the sum of the design center heater voltages a series resistor must be inserted.

Voltage Unbalance During Warm-Up

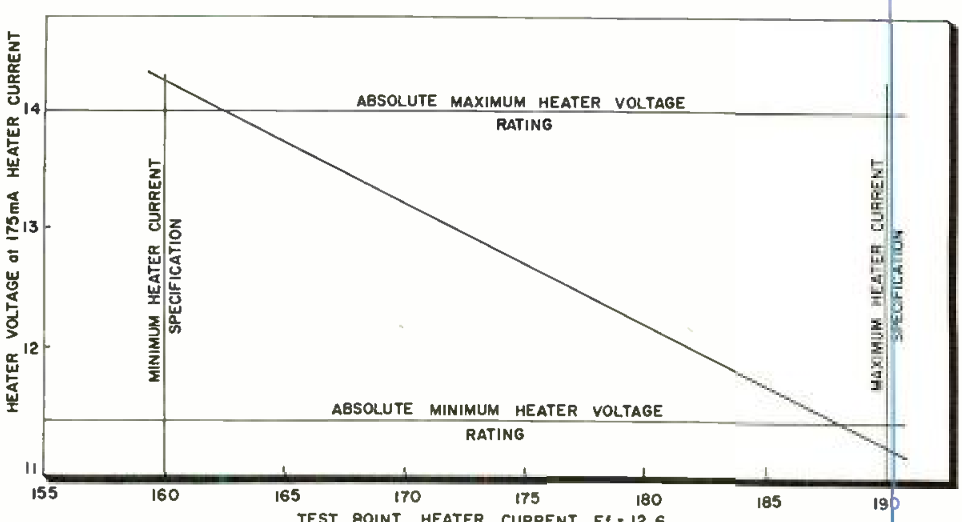
Although the heater voltages in a series string may be properly balanced under steady state conditions, severe unbalance may occur during warm-up. Since the current is common to all tubes in the series string the voltage drop across individual tubes will vary with the instantaneous value of heater resistance. These voltage drops will often depart markedly from the steady state design center value specified for the tube type. A fast heating tube will reach its operating temperature while a slower heating tube may remain relatively cool. Such a fast heating tube in a string of slower heating tubes will reach its normal temperature while the total string resistance is below normal, that is, the current through the string is above normal (see Fig. 2). The fast heating tube, therefore, will be subjected to a heater voltage and temperature greater than the normal value until the entire string reaches a stable condition. The choice of tubes for such applications is very difficult as the lack of specification assurance permits greater variations both among and within tube suppliers.

A test, on a simple heater string, shown in Fig. 2, illustrates typical differences in heating characteristics of these tube types. A voltage of 18.9 v. was applied to the three tubes in series. Two of the tubes in each string were of the same type but the third was different in each test. The heater-voltage variation with time, after the switch was closed, is shown in the figure for each tube. Although the heater-cathode structures of the number three tube in each string were quite similar, the results are quite different.

These high heater voltages during warm-up are conducive to many kinds of difficulties, the rapid heating plus over heating subjects the heater and its insulating coating to considerable mechanical stress. Additionally the sustained high tem-

(Continued on page 118)

Fig. 4: Diagram illustrating that with increasing numbers of series parallel strings the more the distribution of voltage approaches that of conventional parallel tube operation



www.americanradiohistory.com

How to Design

Unique method of tube operation provides extremely stable operation for direct-coupled amplifiers. Fewer tubes needed to obtain required gain

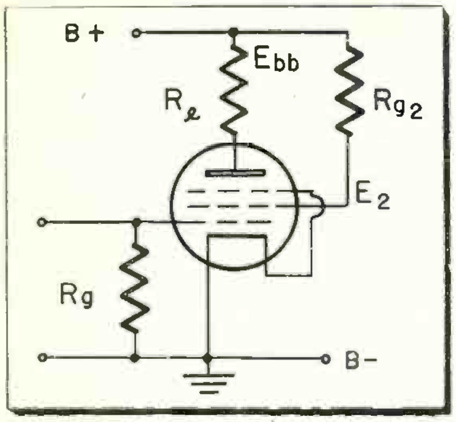


Fig. 1: Basic starved amplifier circuit

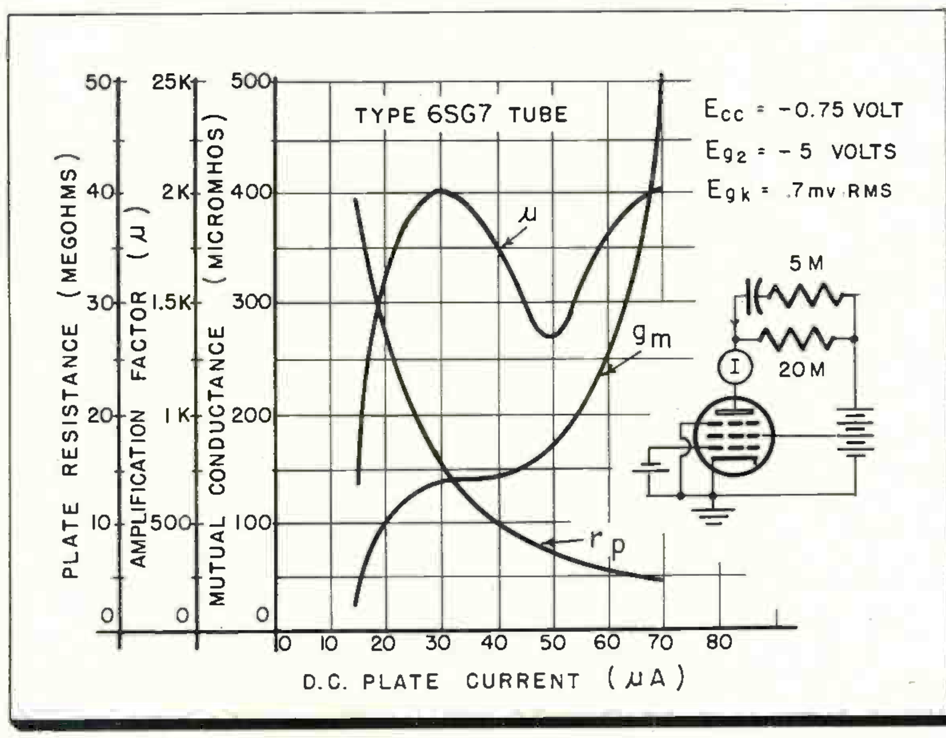
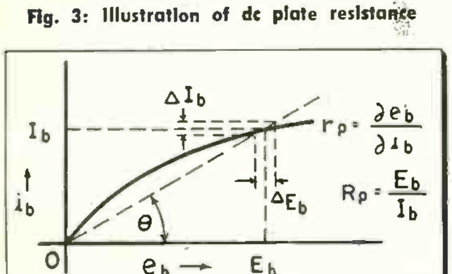


Fig. 2: Variations in tube parameters as a function of 6SG7 tube plate current

STARVED amplifiers have many distinct advantages which, when fully realized and utilized, will make this circuit outstanding in its class. With this mode of operation, one can obtain stable, high gain amplification, requiring fewer tubes for a given gain than with other conventional circuits. The circuital phase shift is therefore reduced (a maximum of 90° phase shift per stage of amplification) and hence more feedback can be applied to the circuit for stability. In fact, such a circuit is ideally suited for operational amplifiers and other such highly degenerate applications where a high base gain is desired for proper operation and then an overall feedback loop is closed to get the nominal gain, bandwidth, stability, etc. Internal feedback loops are readily added to this circuit, the commonest form consisting of screen voltage control. In extreme cases, the signal may be fed into the cathode of the starved stage with feedback loops encompassing both screen and control grids. Because of the high load resistances employed, loading effects of the following stage may be severe unless a cathode follower is resorted to. The starved amplifier-cathode follower combination, however, has the added feature in that, while consisting of a complete and stabilized unit (internal feedback loops from cathode follower load to screen and/or control grid of starved stage), it is capable of delivering power to an external load, while at the same time preserving the high frequency response of the amplifier (which, incidentally is poor to begin with because of the high resistances employed).

Fig. 3: Illustration of dc plate resistance



Amplifier Features

The starved amplifier is shown in Fig. 1. In the circuit illustrated, $E_2 < E_{bb}/10$ and the load resistor is greater than 1 meg. Such a circuit is capable of producing three or more times the gain obtainable from the same tube wired as a conventional amplifier, even though the mutual conductance of the starved tube is considerably decreased. Although certain disadvantages accompany this mode of operation, they are far outweighed by the features gained.

All direct-coupled amplifiers are inherently susceptible to drift because a slight change in grid to cathode voltage in the first stage (due to a slight variation in plate supply or heater voltage, resistor drift, or tube unbalance) is amplified in succeeding stages providing a large change in output voltage. In starved amplifiers, all the gain is concentrated in a single (or comparatively few) stage, thereby confining all minor voltage variations which will have any effect to the input to this one stage. Since the aforementioned is true, if that stage is stabilized, the entire amplifier is stabilized.

Throughout this discussion, it must be borne in mind that the starved amplifier is basically a direct coupled amplifier, lending itself admirably to this application. Problems of interstage coupling, the scourge of direct-coupled design, are reduced to almost nil, since the d.c. voltage appearing on the plate of the starved stage is quite low and can easily be fed into the grid of the succeeding stage with few attendant difficulties.

Multiple Stages

Multiple stages of starved amplification are also easy to come by if the plate load resistors are reduced to more nominal values in all stages following the first. The necessary decoupling for three or more stages

www.americanradiohistory.com

Starved Amplifiers

By GEORGE E. KAUFER
Electronics Res. Lab.
Columbia Univ.
632 W. 125 St.
New York 27, N.Y.

may be made quite thorough and compact by connecting a 2 meg. resistor bypassed with a 0.05µf condenser in series with the plate load to the first stage (or first two stages as the case may be). The reduction in physical size and cost of the decoupling condenser is made possible by the large value series resistor employed. As the current consumed by the input starved stage can be made quite low (the tube is required to handle only a small input swing), the drop across the series element of the filter is not prohibitive.

Mention must be made of the fact that a B— supply is not required for normal operation of a starved amplifier stage. Power supplies employed are standard in every respect. A further saving can be effected in the supply components since current consumption is reduced by this method of operation.

Applications

When we examine the additional features of, (1) inexpensive design which leads to compact packaging due to the minimum number of circuit components needed, (2) long tube life due to the low voltages on the elements and the subsequent low current drawn from the cathode, and (3) the possibility of eliminating all effects due to electrostatic and electromagnetic pickup on the grids of the high gain stages by special design of push-pull circuitry, one can readily realize the vast number of applications which throw themselves open to the starved amplifier, some of which will be discussed later.

Theory

For a pentode with a high load resistance, g_m decreases with increasing plate load if the supply voltage is kept constant. To raise the gain of the stage, we must increase the plate resistance, since $\mu = g_m r_p$. This can be accomplished readily by lowering the screen voltage. The starved stage thusly obtained will then be found to exhibit a higher gain characteristic than that of the pentode with normal screen voltage, high load resistor and the same plate supply voltage. The principle underlying this method of operation is that, although the transconductance is decreased to a small fraction of its normal value, the plate resistance increases at a much greater rate over a portion of the operating curve and hence the μ of the tube increases.

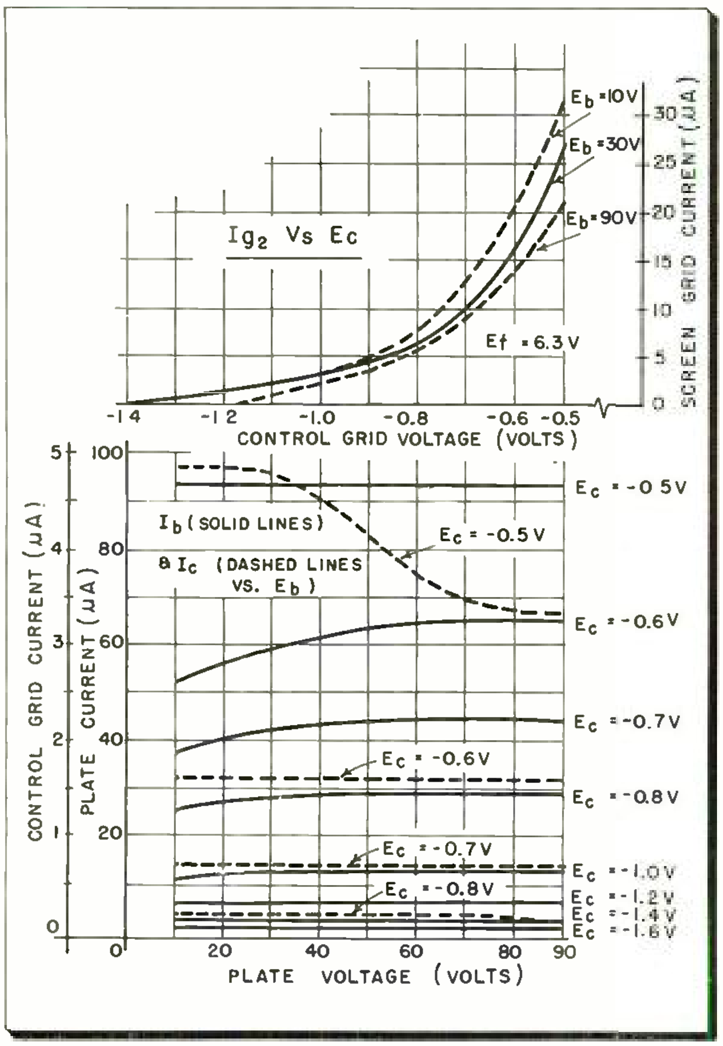
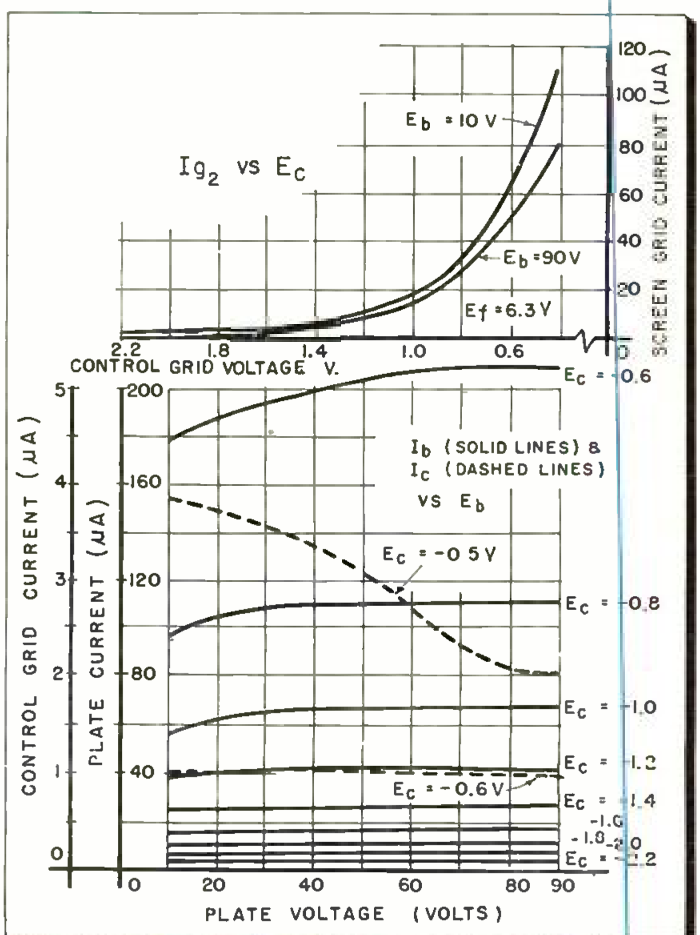


Fig. 4: (l) Static characteristics of 6SG7 with screen voltage 5 v.

Fig. 5: (below) Static characteristics of 6SG7, screen voltage 10 v



www.americanradiohistory.com

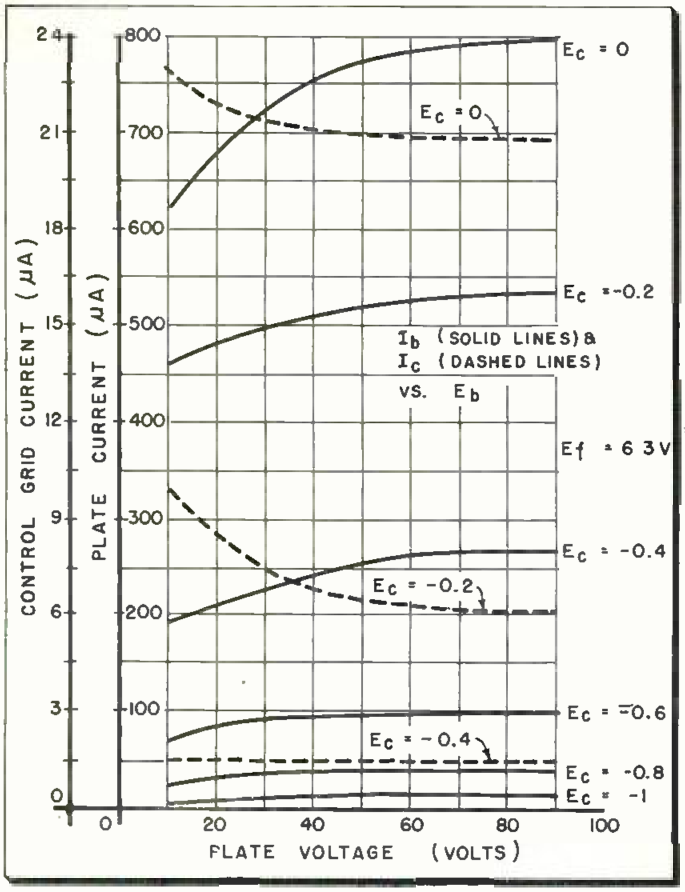
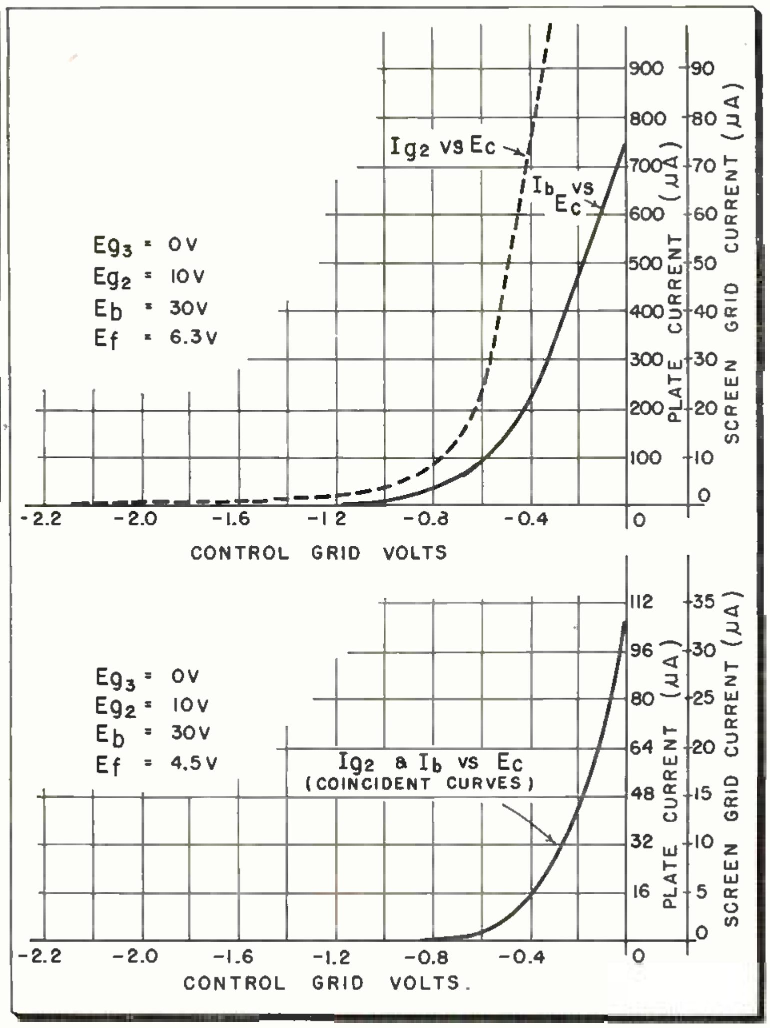


Fig. 6: (above) Static characteristics of 6AG5, screen voltage 10 v.

Fig. 7: (r) Plate and screen current vs control grid voltage of 6AG5



Starved Amplifiers (Continued)

As can be seen from an examination of a typical μ vs i_b curve (see Fig. 2) this analysis cannot be extended to include continuingly increasing values of load resistance, as a point is reached at which the μ of the tube will drop off rapidly and continue to drop at a fast rate as tube current is further decreased. This illustrates the fact that there is an "ideal" operating point for each tube, one which will yield a maximum gain for a given set of operating conditions (for a given screen and plate supply voltage, there is a definite value of plate load resistor which will give maximum stage gain).

It is not possible to maintain zero grid current in a direct-coupled amplifier stage in which plate current is flowing. The grid current is a function of the plate current and may be made relatively constant by operating at low plate currents. The starved amplifier circuit fully utilizes the constant grid current feature as low plate current is inherent in its design. Reference to the curves found in this article indicate the validity of the aforementioned statement where operation does not permit the plate current to exceed fifty μa (quiescent points are usually chosen well below this figure).

Tube Data

Before one can begin to consider the design of a starved stage, he must first become familiar with the orders of magnitude of the tube parameters and their manner of variation under these special operating conditions. We must recall at this point that a starved tube must, by definition, satisfy two stringent requirements: the screen voltage must be less than ten percent of the plate supply voltage and, the current which would flow when the tube is connected as a diode (all grids tied to the plate) must be 1000 or more times larger than the load current when the tube is wired as an amplifier employing a load resistor and the same supply voltage source.

The initial procedure is therefore apparent. Since tube parameters for the low operating potentials used cannot be found in the tube manuals, they must be determined (at least approximately) by the designer. Typical curves for the type 6SG7 octal and the type 6AG5 miniature pentodes have been obtained by the author in the laboratory (see Figs. 4, 5, 6 & 7) and are reproduced here for convenience.

We must differentiate between the ac plate resistance and the dc plate resistance, two entirely different quantities. For a given operating point, this latter value is equal to the reciprocal of the slope of the line joining the origin and the point in question on the plate characteristics of the tube (see Fig. 3). To illustrate this difference even more strongly, it may be cited that under certain conditions of starved operation, the ac plate resistance may be of the order of 40 meg. whereas the dc value is approximately 1 meg.

Analysis Of Results

It is interesting to note that, while five tubes of each type were tested, the resulting data obtained from each differed greatly. In an effort to correlate this discrepancy with a characteristic of the tube which can be measured under normal operating conditions, all tubes were first

(*Continued on page* 104)

www.americanradiohistory.com

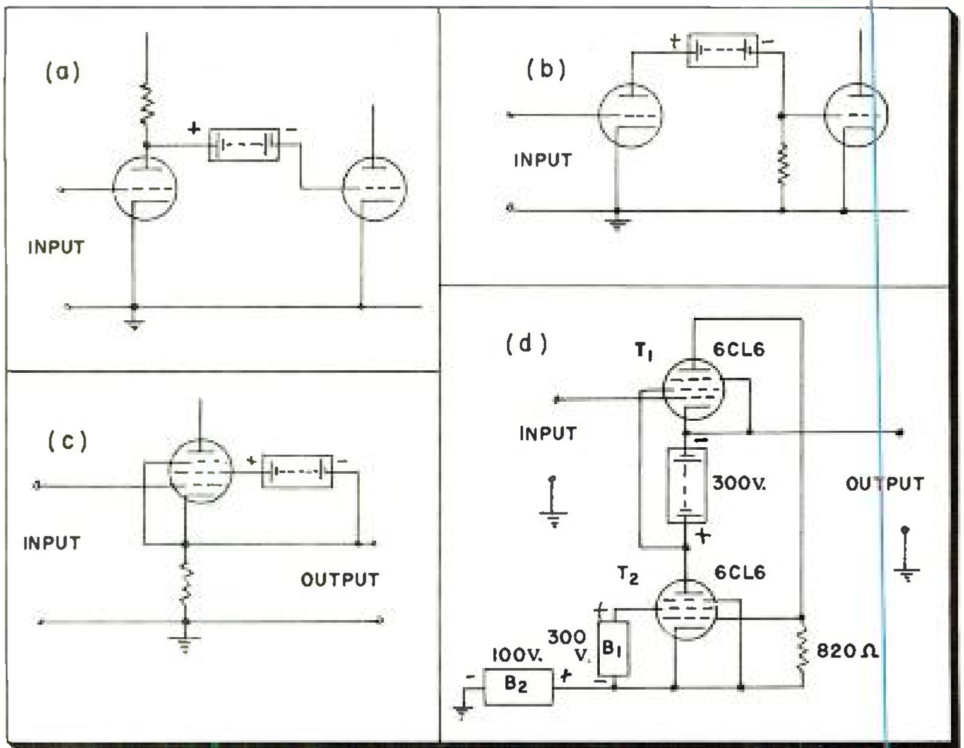
Low-Capacitance Power Supply

A low-capacitance type of ac operated power supply has been developed recently by J. H. Reaves of the National Bureau of Standards. The supply is designed for use in numerous direct-coupled circuit applications where conventional power supplies are unsuitable. The low-capacitance feature, which is achieved primarily by special design of the 60-cycle power transformer, enables the power supply to be employed in wide-band direct-coupled circuits requiring a power source with neither of its terminals grounded or by-passed to ground.

The establishment of proper dc operating potentials for tubes is a frequent and troublesome problem in the design of direct-coupled circuits. One solution is to use a battery in series with the signal source. However, the replacement or maintenance required of a battery, especially in cases where it must supply appreciable power, is a serious disadvantage. A conventional ac operated power supply cannot be substituted in this application because of its capacitive shunting effect on the signal.

In the NBS-developed power supply, the shunting capacitance to ground has been reduced to such a low value as to be negligible in the circuits for which the supply is de-

(*Continued on page* 92)



(a and b) Power supply in interstage coupling. (c) Use in pentode cathode-follower circuit with low input capacitance. (d) Special application in two-tube direct-coupled cathode-follower circuit

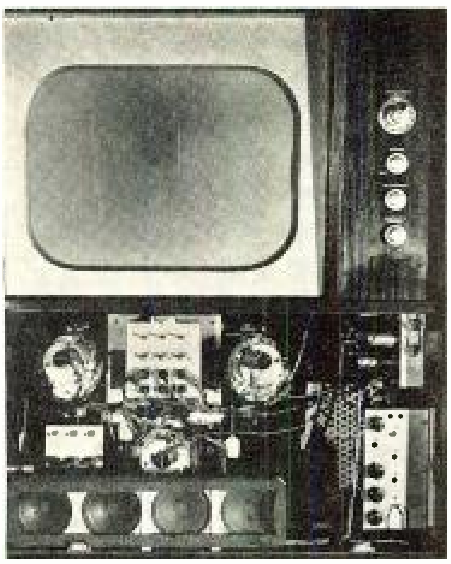
TABLE I—Operating characteristics of one of the electronically regulated models of the NBS low-capacitance power supply.

Rectifier circuit	Rectifier type	Filter circuit	No-load output dc volts	Max-load output dc volts	Max-load current dc ma	DC power max output Watts	Shunt capac. μμf
Fullwave	6 x 4	Elect.	160	156	30	4.7	18.0
		Reg.	200	199	20		

New Color TV Projection System

A developmental projection-type color TV receiver has been unveiled by Hazeltine Corp. By using a folded light path, a 240 sq. in. picture is produced in a cabinet only 24½ in. deep. With some redesign the picture area can be increased to 280 sq. in. without change in cabinet depth.

Color TV projection receiver showing backs of three monochrome crt's below picture screen



The unit employs three 2½ in. crt projection tubes with color phosphors, one green, one blue and one yellow with a red optical filter (red phosphors evidently do not have sufficient output). The tubes require 25 kv, and draw about 200 μa in the red tube, less in the others. Through an elaborate lens and mirror arrangement, the images on the three tubes are enlarged and fused on the flat screen.

Credit for the optical work goes to American Optical Co. Libby-Owens-Ford made the mirrors. Interim quantities of the tube may be obtained from North American Philips. Large scale production, should demand warrant it, will be undertaken by Tung-Sol. Pre-production models can be supplied in four months, and mass production can start six months later. Hazeltine will not do any mass producing.

Based on a yearly production of 100,000 units, the projection system would sell for approximately $250, excluding the basic receiver chassis. This would be equivalent to a direct view color tube with deflection components.

According to Hazeltine's Vice President in Charge of Research, A. V. Loughren, projection is "no longer out of the picture." In competition with the direct view picture tube, projection offers certain advantages and drawbacks at the present state of the art. Among the factors in projection's favor are low cost crt tube replacement (about $12 each), no problem with color purity, and simple control of color characteristics in manufacturing.

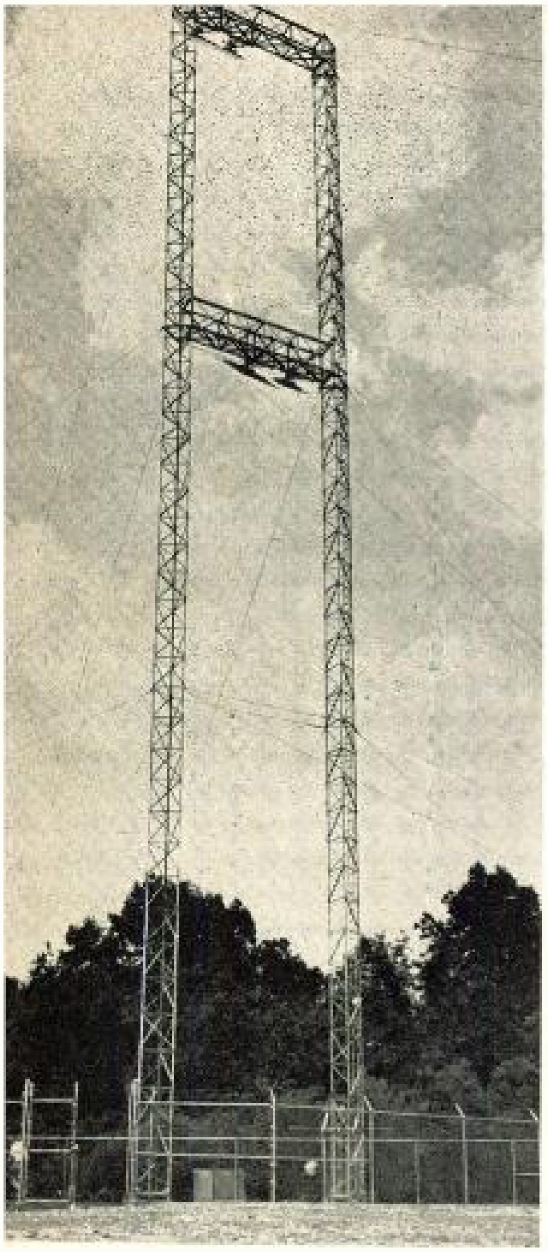
Among the disadvantages pertaining to color projection are lower contrast, light directivity necessary to achieve sufficient light output, resulting in brightness loss outside the normal viewing area, and possible dust collection on critical internal surfaces. Initially, registration sta-

(*Continued on page* 117)

www.americanradiohistory.com

Strength and Behavior

The ability to maintain directivity, of prime largely upon guy wire size, tension, angle



Typical microwave tower construction

By Dr. D. A. LIAMIN
Chief Engineer
Tower Structures Inc.
Gregg St., Lodi, N.J.

THERE is a definite tendency on the part of those interested in strength and rigidity of guyed towers to establish some kind of a yard stick by means of which the physical properties of a tower can easily be determined. Unfortunately, because of the great variety in antennae types, their geometrics, their required limits of deflection, their loadings and, finally, the local weather conditions, there is no way to standardize tower structures and, therefore, no way to generalize their physical properties.

When a tower is up and the construction and erection costs are paid, it is obviously too late to learn whether or not the tower will meet the imposed requirements. On the other hand, analytical methods are not yet available for general use. The stress analyses, especially those dealing with elasticity, deformation and deflections, are in most cases tedious and require considerable erudition, experience and patience for proper execution. Let us note that the conventional method of stress analysis involving static laws alone as is the practice in dealing with rigid structures such as bridges, self-sustaining towers, etc. is not applicable to guyed towers, since the latter represent a combination of rigid and elastic systems in equilibrium. Thus, for instance, a guyed tower cannot be considered as a continuous beam, since its supports are flexible and not unyielding. Furthermore, the elasticity of each guy is a function of three (3) variables: that of direct cable stretch, its sag and the angle at which the wind acts on the guy. As a result, the overall deflection of each guy tier is not a linear function of wind pressure intensity.

The essential object of mathematical stress analysis is to learn something about the probable distribution of stresses in an imperfect, humanly made structure. Such analysis, applied to complex structures is quite accurate for small loads and low stresses. At heavy loads approaching the elastic limit of the material, the calculated stresses become noticeably affected by the sizable deflections. This situation causes the assumption of superposition of effects to be inaccurate and makes the injection of corrective coefficients mandatory, all of which increases the complexity of calculations.

Microwave

Another difficulty is added by the fact that in complicated structures such as a tower sustained by supports acting at an obtuse angle, the tower will not deflect collinearly during the gradual increase in loading, so that the mathematical analysis must be applied to each redundant beam separately as well as to the structure as a whole. This immediately involves the setting-up of a multitude of simultaneous equations, making the calculations quite burdensome.

The aim of this presentation is to find a practical and yet accurate and simple method for the determination of a tower's adequacy for a given task. For this purpose, a few empirical equations of fair accuracy are derived and represent a short-cut substitute for the tedious fundamental calculations.

The most troublesome problem is the determination of the aerodynamic effects of wind on tower attachments such as paraboloids, horns, passive reflectors, etc. Quite often these attachments are grouped closely together as, for instance, two paraboloids, or reflectors mounted back to back; in this case the effect of wind pressure when acting from different directions becomes erratic. The most reliable method is, of course, that of a wind tunnel test. Considering, however, that such a test involves the necessity of placing in a wind tunnel a part of a tower

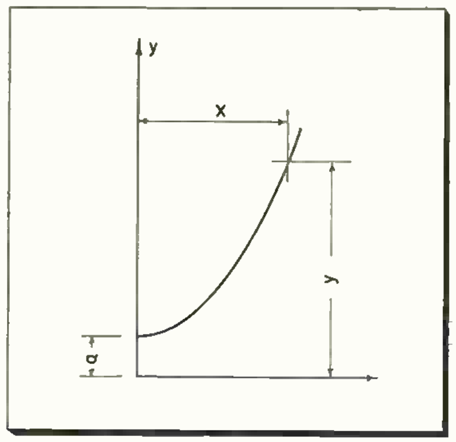


Fig. 1: Catenary formed by suspended cable

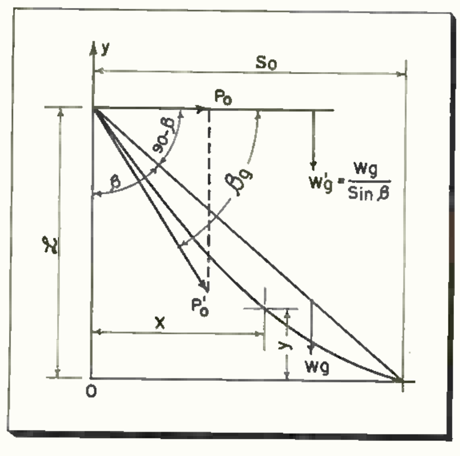


Fig. 2: Horizontal and vertical components

www.americanradiohistory.com

# of Guyed Towers

Part One
Of Two Parts

importance in microwave work, depends of inclination and the guying pattern

with 10 ft. diameter paraboloids mounted on it, it becomes obvious that such a procedure is cumbersome, time consuming and costly. As a compromise, it is believed that only such parts as paraboloids may be tunnel tested. It must be realized that a wind pressure of 30 lbs. per sq. ft. on a 10 ft. dia. paraboloid produces a force of over one ton.

A paraboloid acts as an airfoil when the wind direction is other than normal to its face, producing component forces the magnitude of which must be known in order to calculate the twist moment. In certain cases, up to ten of such paraboloids are supported by one tower. The distance of the paraboloid, from the center of tower, depends usually upon the tower design and, therefore, cannot be standardized.

Depending upon the locality, the tower and the antenna may become covered with ice. In Northern States, for instance, cases of 2 in. of icing are not uncommon.

In addition to the added weight, the iced tower and the antenna present a much larger area to the wind pressure, resulting in a marked increase in tower strain.

Loading Characteristics

One of the advantages of a microwave system over wire lines is its operational reliability at a minimum of maintenance cost. Since the microwave beams are highly directional, the antenna must be rigid, i.e. its permissible twist and sway should lie within narrow limits, the margin of which must be maintained at practically all weather conditions.

In Southern States, the icing conditions are absent, but winds of hurricane force must be taken into consideration.

In guyed towers, the twist and sway are effectively restrained by guys. The tower, itself, may be considered as a supporting stick, which must be strong enough to withstand the vertical loads and the lateral pressure of the wind.

The manner in which a tower should be guyed is chosen in such a way as to produce a maximum resistance to twist and sway. Note that the permissible deflections of a vertical radiator are much less rigorous than those of a microwave tower.

The magnitude of twist and sway of a guyed tower is governed by the size of guy wires, their number, their initial tension, their angle of inclination to the vertical and by the general pattern of the guying system.

It becomes clear that for specified maximum allowable twist and sway angles, the first thing on schedule is to establish the most effective guying pattern for the particular case and then to calculate the necessary guy wire sizes, guy tensions (at load and at no load), guy initial tensions, etc. Knowing the magnitude and direction of outside forces acting on the tower, a structure of adequate strength is then designed.

The pertinent calculations are tedious but by no means subtle, involving the solution of several simultaneous equations governing the equilibrium stage.

Nomenclature

P_0, P_1, P_2, P_3, etc.* = horizontal component forces of guy wire tensions.

A = metallic cross-sectional area of guy wire (sq. in.).

w_I = weight of ice covering the cable per foot of its length (lbs.).

w_g = weight of bare cable per ft. of its length (lbs.).

w_r = resultant force acting on the cable per ft. of its length (lbs.).

L = height of guy wire attachment above foundation (ft.).

l_0, l_w, l_L = length of guy wire between points of attachment (ft.).

E = modulus of elasticity of guy wire.

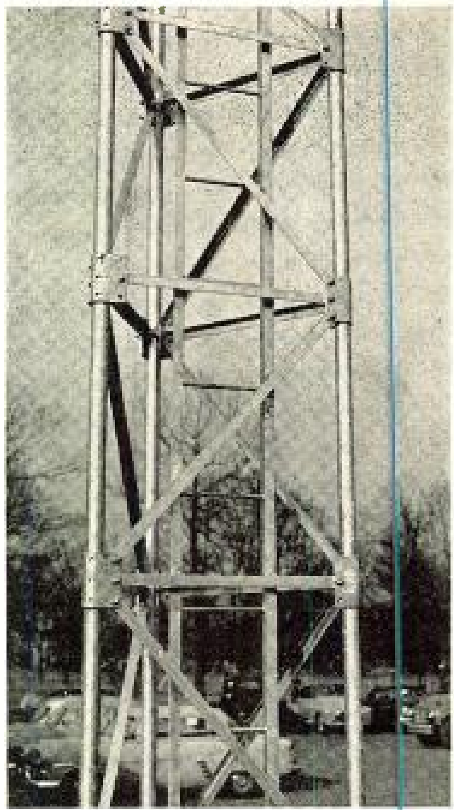
ϕ = angle formed between w_r and w_g (degrees).

β = angle formed between the chord of the guy wire and the vertical (degrees).

θ = angle between wind direction and the vertical plane in which the guy wire lies (degrees).

Δ_1, Δ_2, Δ_3 = horizontal deflections of points of guy wire attachment, (ft.).

W = resultant horiz. force due to wind or auxiliary loadings acting



Heavy cross-bracing minimizes twist

at guy attachment points (lbs.).

X & Y = coordinates of CG of tower (ft.).

a = horizontal distance between points of guy wire attachment (ft.).

ρ = angle of tower twist (radians).

δ = angle of tower sway (radians).

R = radius of circle circumscribed around the triangular section of tower at points of upper guy wire attachments (ft.). (R = .5773 a).

* The actual guy tensions and the actual deflections are indicated by superscripts, thus: P^1_1, P^1_2, P^1_3 etc.

Elasticity and Geometrics

A catenary is a curve formed by a freely suspended perfectly flexible cable of uniform weight.

With reference to Fig. 1, the general equation of a catenary is:

$$y = \left(\frac{a}{2}\right)\left(e^{\frac{x}{a}} + e^{\frac{-x}{a}}\right) \qquad (1)$$

or, if expressed in terms of hyperbolic functions,

$$y = \left(a \operatorname{Cosh} \frac{x}{a}\right) \qquad (1\text{-}1)$$

When a = 6, 7 or 8, the catenary approaches the parabola very closely. The general equation of a parabola is: $y^2 = 2px$, where p is its parameter. In guyed towers the ratio of deflection to chord length is under normal conditions never less than 1 to 5, at which ratio the error involved by using the parabolic equation is less than 7%. Since the use of parabolic functions greatly

www.americanradiohistory.com

Guyed Towers (Continued)

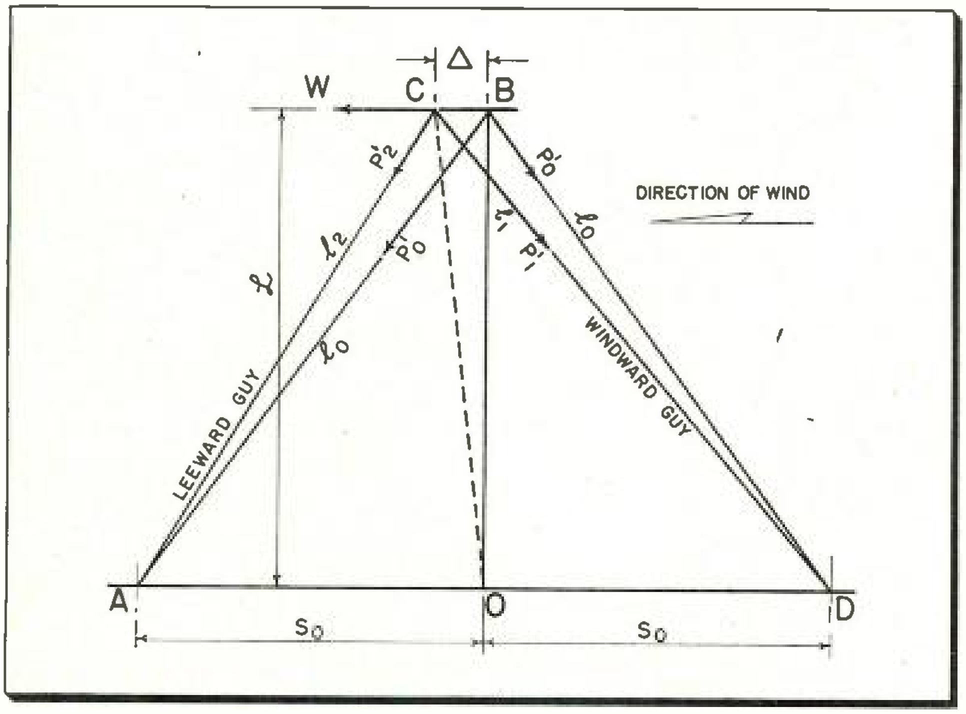


Fig. 3: Analyzing the case of 2 guys lying in a plane parallel to the wind direction

simplifies the process of calculations, the following analysis is based on the assumption that the load is uniformly distributed along the chord.

With the above assumption, the relationship between tension, sag and length of the suspended cable can be easily established as follows:

The differential equation of the cable with the origin of coordinates at 0 (See Fig. 2) is:

$$\frac{d^2y}{dx} = \frac{w_g}{(P_o \sin\beta)}$$

Note that if w_g represents the weight of cable per ft. length, then its weight per ft. of its horizontal projection is **(w_g/Sinβ).**

$$y = \int\int\left[\left(\frac{w_g}{P_o \sin\beta}\right)dx\right]dx$$

Integrating twice, obtain:

$$y = \left(\frac{w_g x^2}{2 P_o \sin\beta} + C_1 x + C_2\right)$$

When $x = o$, $y = (s_o \, ctg\,\beta)$,
i.e. $c_2 = (s_o \, ctg\,\beta)$

When $x = s_o$, $y = o$ and $\left(\frac{w_g s_o}{2 P_o \sin\beta}\right) + c_1 s_o + (s_o ctg\beta) = o$

It follows that $c_1 = -\left(ctg\beta + \frac{w_g s_o}{2 P_o \sin\beta}\right)$

The elastic equation of the cable in algebraic form is then:

$$y = \left(\frac{w_g x^2}{2 P_o \sin\beta} - \frac{w_g x s_o}{2 P_o \sin\beta} + s_o ctg\beta - x\,ctg\beta\right) \quad (2)$$

The tangent or the slope of the cable at point A is:

$$tg\,(\beta_g) = \left(\frac{dx}{dy}\right)_{x=o} = -\left(ctg\beta + \frac{w_g s_o}{2 P_o \sin\beta}\right) \quad (3)$$

Note that the negative sign indicates a "down" slope.

With reference to Fig. 2, we see that the relation between the tension in the cable (P^1_0) (at the point of its attachment to the tower) and its horizontal component (P_0) is:

$$P_o = (P_o^1) \cos\beta_g \quad (4)$$

The length of the cable can be calculated using Eq. 2 as follows:

$$\frac{dy}{dx} = \left[\left(\frac{w_g x}{P_o \sin\beta}\right) - (ctg\beta) - \left(\frac{w_g s_o}{2 P_o^1 \sin\beta}\right)\right] \quad (5)$$

If d(s) is an infinitesimal length of cable, then

$$d(s) = \sqrt{(dx)^2 + (dy)^2} = \left[\sqrt{1 + \left(\frac{w_g x}{P_o \sin\beta} - ctg\beta - \frac{w_g s_o}{2 P_o \sin\beta}\right)^2}\right]dx$$

and

$$s = \int_{x=0}^{x=s_o}\left[\sqrt{1.0 + \left(\frac{w_g x}{P_o \sin\beta} - ctg\beta - \frac{w_g s_o}{2 P_o \sin\beta}\right)^2}\right]dx$$

Let: $\left(\frac{w_g x}{P_o \sin\beta} - ctg\beta - \frac{w_g s_o}{2 P_o \sin\beta}\right) = Z$,

so that: $dx = \left(\frac{P_o \sin\beta}{w_g}\right) dz$

Upon substitution obtain:

$$s = \int_{x=o}^{x=s_o}\left(\frac{P_o \sin\beta}{w_g}\right)\sqrt{1.00 + z^2}\,dz$$

and, upon integration:

$$s = \left(\frac{P_o \sin\beta}{2 w_g}\right)\Big[(Z)\sqrt{1.0 + z^2} + \log_e (z + \sqrt{1.0 + z^2})\Big]_{x=o}^{x=s_o} \quad (6)$$

Note, that when $x = o$,

$$z = -\left(\frac{w_g s_o}{2 P_o \sin\beta}\right) - (ctg\beta)$$

and when $x = s_o$,

$$z = +\left(\frac{w_g s_o}{2 P_o \sin\beta}\right) - (ctg\beta)$$

Eq. 6 may be closely approximated by:

$$s = \left(\frac{s_o}{\sin\beta} + \frac{w_g^2 \sin\beta \, s_o^3}{24 P_o^2}\right) \quad (7)$$

For example, let $w_g = .796$, $s_o = 600$, $\beta = 45°$ and $P_o = 1{,}500$.

Eq. 6 yields s = 850.3304 and Eq. 7 gives s = 850.3163.

Thus, the approximation is within 1/600 of 1%. Of course with decreased tension, i.e. when the cable becomes relatively slack, this approximation becomes less exact. For all practical cases however, this approximation is thought to be fully adequate.

Cable Elasticity

The length of the cable increases or decreases proportionately to tension. This phenomenon occurs due to the elasticity and to structural adjustment of the cable.

In accordance with Hooke's Law, this stretch of the cable can be expressed mathematically as follows.

$$\Delta = \text{Elongation} = \frac{(s)(P_1 - P_2)}{A \times E} \quad (8)$$

here, s = length of cable, (ft.).

- P_1 and P_2 are tension forces applied to the cable, (lbs.).
- A is the metallic cross-sectional area of the cable, (sq. in.).
- E is the modulus of elasticity of the cable.

The modulus of elasticity varies with the type of cable and its mate-

(*Continued on page 112*)

www.americanradiohistory.com

Television Stations on the Air

Complete geographical listing of stations on air in the United States and territories, presenting data on each one in following order: Call Letters; Channel No.; Business Address; Network; Video erp (kw); Antenna Height (ft. above average terrain); Chief Engineer; Station Manager. (NCE) Non-commercial educational station. (TS) Time shared. Key to network affiliations: (A) American, (C) Columbia, (D) Du Mont, and (N) National Broadcasting Companies.

ALABAMA

BIRMINGHAM
WABT; 13; P.O. Box 2553; N, A, D; 316; 840; J. V. Sanderson; Henry P. Johnson
WBRC-TV; 6; Red Mountain; C; 100; 1470; Robert L. DuPriest; J. Robert Kerns

DECATUR
WMSL-TV; 23; 703 Bank St.; N; 15.5; 350; John Short; Bill Guy

MOBILE
WALA-TV; 10; 210 Government St.; N, A, C; 316; 635; A. R. Bell; H. K. Martin

MONTGOMERY
WCOV-TV; 20; Adrian Lane; C, D, A; 15.9; 436; W. D. Weatherly; Hugh M. Smith

ARIZONA

MESA (Phoenix)
KVAR; 12; 1101 N. Central, Phoenix; N, D; 33; 1550; Andy Anderson; Dwight Harkins

PHOENIX
KOOL-TV; 10; 511 W. Adams St.; A, 316; 1620; Clifford Miller; Charles H. Garland
KPHO-TV; 5; 631 N. 1st Ave.; C, D; 17.5; 400; George L. McClanathan; Richard B. Rawls

TUCSON
KOPO-TV; 13; 115 W. Drachman; C, D; 33; 480; Paul Benewitz; E. S. Mittendorf
KVOA-TV; 4; 209 W. Elm; N, A; 5.37; 30; Raymond H. Holsclaw; R. B. Williams

YUMA
KIVA; 11; P.O. Box 1708; N, D, 30; 440; Roland Yount; Bob Harker

ARKANSAS

FORT SMITH
KFSA-TV; 22; 920 Rogers; N, D, A, C; 22; 270; R. W. Platt, Jr., Weldon Stamps

LITTLE ROCK
KARK-TV; 4; 1001 Spring; N, D; 58; 521; Champ Smith; Doug Romine

PINE BLUFF
KATV; 7; 620 Beech, Little Rock; C, A; 172.6; 1015; A. R. Gorrett; John H. Fugate

CALIFORNIA

BAKERSFIELD
KBAK-TV; 29; P.O. Box 1448; A, D; 20; 850; Donald E. Anderson; Al Constant
KERO-TV; 10; 1420 Truxtun Ave.; N, C; 33; 3728; E. A. Andress; Gene De Young

CHICO
KHSL-TV; 12; 350 Wall St.; C, N, A, D; 63.1; 1260; Russell B. Pope; M. F. Woodling

EUREKA
KIEM-TV; 3; P.O. Box 1021; A, N, C, D; 14.1; 3000; Donald King; Donald H. Telford

FRESNO
KJEO; 47; P.O. Box 1708; A, C; 440; 1789; Jack McIlwain; Charles Theodore
KMJ-TV; 24; 1515 Van Ness, Squaw Valley; N, C; 33; 3344; J. B. Hancock; Perry Nelson

LOS ANGELES
KABC-TV; 7; Prospect & Talmadge; A; 118; 2985; Phil Caldwell; Frank King
KCOP; 13; 1000 Cahuenga Blvd.; Hollywood; None; 30.9; 2950; Marvin Wentworth; Jack Heintz
KHJ-TV; 9; 1313 N. Vine St.; D; 30.4; 3100; Robert Arne; John T. Reynolds
KNXT; 2; 1313 N. Vine St.; C; 46.8; 3140; Herbert Pangborn; James T. Aubrey, Jr.
KRCA; 4; Sunset & Vine; N; 47; 3200; John B. Knight, Jr.; Thomas C. McCray
KTLA; 5; 5451 Marathon St.; —; 30; 2921; Raymond Moore; Klaus Landsberg
KTTV; 11; 5746 Sunset Blvd; None; 108; 2600; Edward E. Benham; Richard A. Moore

SACRAMENTO
KCCC-TV; 40; Hotel Senator; N, A, C, D; 193; 480; Paul E. Leake; Ashley L. Robinson

SALINAS
KSBW-TV; 8; 238 John St.; C, N, A, D; 11.5; 2573; George A. Freeman; W. M. Oates

SAN DIEGO
KFMB-TV; 8; 1405 5th Ave.; C, A, D; 54; 750; Charles Abel; George Whitney
KFSD-TV; 10; U.S. Grant Hotel; N; 63; 732; LeRoy A. Bellwood; John C. Merino

SAN FRANCISCO
KGO-TV; 7; 277 Golden Gate Ave.; A; 316; 1210; Harry N. Jacobs; Vincent A. Francis
KPIX; 5; 2655 Van Ness Ave.; C, D; 100; 1140; A. E. Towne; P. A. Lasky
KQED; 9 (NCE); 165 Post St.; None; 30.9; 640; Larry M. Reed; James Day
KRON-TV; 4; 929 Mission St.; N; 100; 1310; J. L. Berryhill; Harold P. See
KSAN-TV; 32; 1355 Market St.; None; 20; 1090; —; Norwood J. Patterson

SAN LUIS OBISPO
KVEC-TV; 6; Mt. View & Hill Sts.; D; 19.8; 1263; James Cochrane; Les Hacker

SANTA BARBARA
KEYT; 3; 730 Miramonte Dr.; N, A, C, D; 50; 3010; Lloyd Jones; Colin M. Selph

STOCKTON
KOVR; 13; 225 E. Miner Ave.; D; 141; 3244; Stanton D. Bennett; A. E. Joscelyn
KTVU; 36; 2293 E. Main St.; N; 53.7; 1620; Wm. Bruce Joyner; Dave M. Greene

TULARE
KVVG; 27; 1385 E. Tulare St.; D; 47.5; 1630; Dan Ferguson; Cordell W. Fray

COLORADO

COLORADO SPRINGS
KKTV; 11; 512 S. Tejon; C, A, D; 45; 1760; Willis Shanks; James D. Russell
KRDO-TV; 13; 399 S. 8th St.; N; 11.31; 465; Herbert H. Schubarth; Harry Hath

DENVER
KBTV; 9; 1089 Bannock; A; 282; 953; Carl Bliesner; Joseph Herold
KFEL-TV; 2; 550 Lincoln; D; 100; 778; Rhean O. Cunningham; Gene O'Fallon
KLZ-TV; 7; 131 Speer Blvd.; C, 316; 1010; Eugene F. Jenkins; Hugh B. Terry
KOA-TV; 4; 1625 California St.; N; 100; 1030; J. A. Slusser; Don Searle

GRAND JUNCTION
KFXJ-TV; 5; Hillcrest Manor; N, D; 1.29; 340; Cecil Whitchurch; Rex Howell

PUEBLO
KCSJ-TV; 5; 2226 Television Lane; N; 18; 400; Marion Cunningham; Douglas D. Kahle

CONNECTICUT

BRIDGEPORT
WICC-TV; 43; P.O. Box 9140; A, D; 18; 1000; Alvin Andrus; Philip Merryman

HARTFORD
WGTH-TV; 18; 54 Pratt St.; A, D; 214; 640; Rogers B. Holt; Fred W. Wagenvoord

NEW BRITAIN
WKNB-TV; 30; 1422 New Britain Ave., W. Hartford; C; 215; 970; John P. Shipley; Peter B. Kenney

NEW HAVEN
WNHC-TV; 8; 1110 Chapel St.; N, C, A, D; 108.81; 712; Vincent Delaurentis; Edward C. Obrist

WATERBURY
WATR-TV; 53; 440 Meadow St.; A; 24.5; 800; Andrew Toross; Samuel Elman

DELAWARE

WILMINGTON
WDEL-TV; 12; 1003 West St.; N; 9; 480; L. O. Piersol; Barton K. Feroe

DISTRICT OF COLUMBIA

WASHINGTON
WMAL-TV; 7; 4461 Connecticut Ave., N.W.; A; 22; 515; Frank W. Harvey; Charles L. Kelly
WRC-TV; 4; Sheraton-Park Hotel; N; 100; 500; J. G. Rogers; Carleton D. Smith
WTOP-TV; 9; 4001 Brandywine St., N.W.; C; 316; 530; Granville Klink, Jr.; John S. Hayes
WTTG; 5; Raleigh Hotel; D; 17.5; 587; M. M. Burleson; L. G. Arries, Jr.

FLORIDA

FORT LAUDERDALE
WFTL-TV; 23; 229 S.E. 1st Ave.; N; 20; 288; Richard Northey; Noran E. Kersta
WITV; 17; P.O. Box 78; A, D; 43; 762; William Latham; Blayne Butcher

FORT MYERS
WINK-TV; 11; 54 Palm Beach Blvd.; A; 12; 350; Bob Bachman; A. J. Bauer

JACKSONVILLE
WJHP-TV; 36; 4038 Phillips Highway; N, A, D; 246; 477; Beecher Hayford; T. S. Gilchrist, Jr.
WMBR-TV; 4; 605 S. Main St.; C, A, D; 100; 438; Ernest B. Vordermark; Glenn Marshall, Jr.

MIAMI
WTVJ; 4; 316 N. Miami Ave.; C, N, A, D; 100; 950; Earl Lewis; Lee Ruwitch

ORLANDO
WDBO-TV; 6; 30 S. Ivanhoe Blvd.; C, A, N, D; 100; 543; J. E. Yarbrough; Harold P. Danforth

PANAMA CITY
WJDM; 7; P.O. Box 428; N, A; 10.36; 585; Jim Smith; Harry C. Babb

PENSACOLA
WEAR-TV; 3; P.O. Box 1188; A, D; 55.4; 580; James C. Smith; Mel Wheeler

ST. PETERSBURG
WSUN-TV; 38; P.O. Box 240; A, C, N, D; 245; 460; L. Link; G. Robinson

WEST PALM BEACH
WIRK-TV; 21; 711 S. Flagler Drive; A, N, D; 20; 262; Earl Heglund; J. S. Field
WJNO-TV; 5; 5 Cocoanut Row; N; 100; 550; Walter R. Brown; Walter L. Dennis

GEORGIA

ALBANY
WALB-TV; 10; P.O. Box 139; N, A, D; 112; 390; John L. Rivard; Tommie R. Stillwagon

ATLANTA
WAGA-TV; 5; 1018 W. Peachtree St.; C, D; 100; 530; Hugo A. Bondy; Glenn Jackson
WLWA; 11; 1611 W. Peachtree St., N.E.; A, D; 316; 545; Harvey J. Aderhold; W. P. Robinson
WSB-TV; 2; 1601 W. Peachtree St., N.E.; N; 100; 932; R. A. Holbrook; Marcus Bartlett

AUGUSTA
WJBF-TV; 6; 1305 Georgia Ave.; N, A, D; 100; 600; John B. Jopling; D. M. Kelly, Jr.
WRDW-TV; 12; Georgia at Observatory Ave.; C; 101.3; 658; Joseph Gill; Roger S. LaReau

COLUMBUS
WDAK-TV; 28; 1307 1st Ave.; N, A, D; 138; 647; R. R. Owen; E. F. MacLeod
WRBL-TV; 4; 1350 13th Ave.; C; 27.5; 360; Frank Hardman; J. W. Woodruff, Jr.

MACON
WMAZ-TV; 13; Bankers Insurance Building; C, A, D; 60; 440; George P. Rankin; Wilton E. Cobb
WNEX-TV; 47; 710 Persons Building; N; 16.85; 496; Charles A. Walker; Al Lowe

ROME
WROM-TV; 9; Horseleg Mountain; None; 30.9; 780; Thomas H. Robertson; Edward N. McKay

SAVANNAH
WTOC-TV; 11; 516 Abercorn St.; C, A; 60; 471; Kyle E. Goodman; W. T. Knight, Jr.

IDAHO

BOISE
KBOI; 2; 311 N. 10th St.; C, D; 14; 4400; James A. Johntz; Earl Glade, Jr.
KIDO-TV; 7; 709 Idaho St.; N, A; 53; 850; H. W. Toedtemeier; W. E. Wagstaff

IDAHO FALLS
KID-TV; 3; P.O. Box 701; C, N, A, D; 100; 1620; Carroll Secrist; C. N. Layne

ILLINOIS

BELLEVILLE
WTVI; 54; Boatmen's Bank Building, St. Louis, Mo.; D, C; 245; 630; Richard J. Trompeter; John D. Scheuer, Jr.

BLOOMINGTON
WBLN; 15; Hwys. 150 & 66; A; 16.8; 454; Bob Coddington; Jerrel Henry

CHAMPAIGN
WCIA; 3; 509 S. Neil St.; C, N, D; 100; 940; Robert L. Myers; August C. Meyer

CHICAGO
WBBM-TV; 2; 410 N. Michigan Ave.; C; 18; 650; Joseph F. Novy; E. H. Shomo
WBKB; 7; 20 N. Wacker Dr.; A; 316; 666; William P. Kusack; Sterling C. Quinlan
WGN-TV; 9; 441 N. Michigan Ave.; D; 120; 585; Carl J. Meyers; Frank P. Schreiber
WNBQ; 5; Merchandise Mart; N; 100; 747; Howard

(For TV Stations Coming on the Air see February 1955 issue of TELE-TECH)

www.americanradiohistory.com

Television Stations (Continued)

C. Luttgens; Jules Herbuveaux

DANVILLE
WDAN-TV; 24; 1500 N. Washington Ave.; A; 19; 445, Orville Neely; Max Shaffer

DECATUR
WTVP; 17; Southside Dr.; A, D; 150; 545; Hubert F. Abfalter; Stephen W. Pozgay

HARRISBURG
WSIL-TV; 22; 21½ W. Poplar St.; A; 17.8; 550; C. R. Gillman; O. L. Turner, Jr.

PEORIA
WEEK-TV; 43; Commercial Natl. Bank Bldg.; N, C; 175; 546; Wayne Lovely; Fred C. Mueller
WTVH-TV; 19; 410 Fayett St.; C, A; 214; 300; Wallace Wurz; Edward Smith

QUINCY
WGEM-TV; 10; 513 Hampshire St.; N, A; 50.2; 814; Frank E. Laughlin; Joseph S. Bonansinga

ROCK ISLAND
WHBF-TV; 4; Telco Building; C, A, D; 100; 370; Robert J. Sinnett; Leslie C. Johnson

ROCKFORD
WREX-TV; 13; Auburn & Winnebago Rds.; C, A; 45.7; 715; Howard Elliott; Joe Baisch
WTVO; 39; N. Meridian Rd.; N, D; 19.6; 650; Herbert Eckstein; Harold Froelich

SPRINGFIELD
WICS; 20; 523 E. Capitol; N, A, D; 18; 455; Bazil O'Hagan; Milton Friedland

INDIANA

BLOOMINGTON
WTTV; 4; Hillside Dr.; N, D; 100; 1000; Carl Onken; Robert Lemon

ELKHART
WSJV; 52; 116 S. 2nd St.; N, A, D; 225; 410; Lester William Zellmer; John F. Dille

EVANSVILLE
WFIE; 62; 1115 Mt. Auburn Rd.; N, A, D; 69.5; 550; Harvey Shellito; Ted Nelson

FORT WAYNE
WKJG-TV; 33; 220 E. Jefferson St.; N, A, D; 270; 775; Eugene A. Chase; Edward G. Thoms

INDIANAPOLIS
WFBM-TV; 6; 1330 N. Meridian St.; C; 100; 990; H. S. Holland; Harry M. Bittner, Jr.
WISH-TV; 8; 1440 N. Meridian St.; C, A, D, N; 316; 473; Stokes Gresham, Jr.; Robert B. McConnell

LAFAYETTE
WFAM-TV; 59; McCarty Lane; N, A, D, C; 20; 400; Richard Cochran; Herbert Nelson

MUNCIE
WLBC-TV; 49; U.S. Highway 35; C, N, A, D; 14.6; 500; Maury Crain; Dan Burton

SOUTH BEND
WSBT-TV; 34; Tribune Building; C, D; 204; 536; Arthur R. O'Neil; Neal B. Welch

TERRE HAUTE
WTHI-TV; 10; 918 Ohio St.; C, A, D; 316; 500; Don Pettit; Joseph M. Higgins

WATERLOO
WINT; 15; Lincoln Tower, Ft. Wayne; C; 240; 805; Charles Wallace; Ben B. Baylor

IOWA

AMES
WOI-TV; 5; Service Building, Iowa State College; C, A, D; 100; 553; Keith K. Ketcham; Richard B. Hull

CEDAR RAPIDS
KCRI-TV; 9; 104 1st St., S.W.; A, D; 33; 325; Carl R. Rollert; Wade S. Patterson
WMT-TV; 2; 602 Old Marion Rd.; C; 100; 670; George P. Hixenbaugh; William B. Quarton

DAVENPORT
WOC-TV; 6; 805 Brady; N; 100; 643; Paul Arvidson; Ernest C. Sanders

DES MOINES
KGTV; 17; 2nd Ave. & Hobson Rd.; A, C, D; 18.5; 492; Walter R. Hariv; Leo Howard
WHO-TV; 13; 1100 Walnut St.; N; 316; 780; Reed E. Snyder; Paul A. Loyet

FORT DODGE
KQTV; 21; Warden Building; A; 18; 652; G. David Sinclair; Edward Breen

MASON CITY
KGLO-TV; 3; 2nd & Pennsylvania Ave.; C, D; 100; 460; Roger Sawyer; Herbert R. Ohrt

SIOUX CITY
KTIV; 4; 10th & Grandview; N; 52; 770; Al Smith; Dietrich Dirks
KVTV; 9; 614 Pierce St.; C, A, D; 100; 705; Charles Prohaska; Robert R. Tincher

WATERLOO
KWWL-TV; 7; Russell-Lamson Hotel; N, D, A; 30; 830; T. W. Kirksey; R. J. McElroy

KANSAS

GREAT BEND
KCKT-TV; 2; P.O. Box 182; N; 100; 969; Kenneth H. Cook; Les Ware

HUTCHINSON
KTVH; 12; 1800 N. Plum; C, A, D; 240; 811; Robert B. Marye; Howard O. Peterson

PITTSBURG
KOAM-TV; 7; P.O. Box 609; N, A, D; 98; 550; Lea Stafford; R. E. Wade

TOPEKA
WIBW-TV; 13; 1035 Topeka Blvd.; C, D, A; 879; 1007; Gilbert Voiles; Ben Ludy

WICHITA
KAKE-TV; 10; 204 N. Waco Ave.; A; 316; 1030; Harold H. Newby; Martin Umansky
KEDD; 16; P.O. Box 1740; N, A; 249; 667; George Smith; John E. North

KENTUCKY

HENDERSON
WEHT; 50; P.O. Box 395, Evansville, Ind.; C; 11; 594; Robert M. Cleveland; Cecil Sansbury

LOUISVILLE
WAVE-TV; 3; 334 E. Broadway; N, A, D; 100; 914; W. E. Hudson; Nathan Lord
WHAS-TV; 11; 525 W. Broadway; C; 316; 531; Orrin W. Towner; Neil Cline

LOUISIANA

ALEXANDRIA
KALB-TV; 5; 6th & Washington; N, A, C, D; 28.5; 591; Jesse R. Sexton; Willard L. Cobb

BATON ROUGE
WAFB-TV; 28; 929 Government St.; C, A, N, D; 200; 515; Don Allen; Tom E. Gibbens

LAKE CHARLES
KPLC-TV; 7; 320 Division St.; N; 52; 490; William R. Schock; David Wilson
KTAG-TV; 25; P.O. Box 173; C, D, A; 21; 333; Maurice Wynne; James W. Lucas

MONROE
KNOE-TV; 8; Knoe Road; C, N, A, D; 230; 774; Jack Ratliff; Paul H. Goldman

NEW ORLEANS
WDSU-TV; 6; 520 Royal St.; N, A, C, D; 100; 395; Lindsey G. Riddle; Robert D. Swezey
WJMR-TV; 61; Jung Hotel; C, A, D; 100; 436; Jack Petrik; James Gordon

SHREVEPORT
KSLA; 12; Travis & Edwards Sts.; N, C, A, D; 13; 270; Morris C. Borton, Jr.; Deane R. Flett

MAINE

BANGOR
WABI-TV; 5; 57 State St.; C, N, A, D; 30; 673; Walter Dickson; Leon P. Gorman, Jr.
WTWO; 2; 46 Hammond St.; —; 14.15; 641; William Clark; Murray Carpenter

LEWISTON
WLAM-TV; 17; 129 Lisbon St.; D; 15.8; —; Henry G. Root; Elden Shute

POLAND SPRING
WMTW; 8; 477 Congress St., Portland; C, A; 105; 3840; Parker L. Vincent; John H. Norton, Jr.

PORTLAND
WCSH-TV; 6; 157 High St.; N; 100; 590; D. H. Smith; W. H. Rines
WGAN-TV; 13; 390 Congress St.; C; 316; 626; Roger W. Hodgkins; C. E. Gotchell
WPMT; 53; 645A Congress St.; D; 22.2; 267; Fred Crandon; George E. Custis, Jr.

MARYLAND

BALTIMORE
WAAM; 13; 3725 Malden Ave.; A, D; 316; 555; Glenn Lahman; Ken Carter
WBAL-TV; 11; 2610 N. Charles St.; N; 316; 546; William C. Boreham; Leslie H. Pearo, Jr.
WMAR-TV; 2; Old Sun Building; C; 100; 380; C. G. Nopper; E. K. Jett

SALISBURY
WBOC-TV; 16; N. Salisbury Blvd.; A, D; 15.1; 832; Jack W. Ward; Charles J. Truitt

MASSACHUSETTS

ADAMS (Pittsfield)
WMGT; 19; 8 Bank Row, Pittsfield; D; 50; 2100; Leonard Lovendal; John T. Parsons

BOSTON
WBZ-TV; 4; 1170 Soldiers Field Rd.; N; 100; 529; W. H. Hauser; W. C. Swartley
WNAC-TV; 7; 21 Brookline Ave.; C, A, D; 316; 480; H. B. Whittemore; Linus Travers

CAMBRIDGE
WTAO-TV; 56; 439 Concord Ave.; D; 20; 470; Carmen J. Ferraro; Ted Pitman

SPRINGFIELD
WHYN-TV; 55; 1300 Liberty St.; C, D; 182; 989; Harold Schumacher; Charles N. DeRose
WWLP; 61; 61 Chestnut St.; N, A; 146; 700; George R. Townsend; William L. Putnam

WORCESTER
WWOR-TV; 14; P.O. Box 609; A, D; 16.2; 812; Donald P. Wise; Ansel E. Gridley

MICHIGAN

ANN ARBOR
WPAG-TV; 20; Hutzel Building; D; 1.75; 343; Donald Z. Bowdosh; Edward F. Baughn

BAY CITY
WNEM-TV; 5; 814 Adams St.; N, D; 100; 520; Hugh M. Woolsey; John H. Bone

CADILLAC
WWTV; 13; 214 N. Mitchell; C, A, D; 93.4; 883; A. W. Daubendick; L. T. Matthews

DETROIT
WJBK-TV; 2; 500 Masonic Temple; C; 100; 1057; Paul Frincke; Gayle V. Grubb
WWJ-TV; 4; 622 W. Lafayette Blvd.; N; 100; 1000; E. J. Love; E. K. Wheeler
WXYZ-TV; 7; 1700 Mutual Building; A; 316; 468; Charles F. Kacher; James G. Riddell

EAST LANSING
WKAR-TV; 60 (NCE); Michigan State College; None; 205; 980; Linn P. Towsley; Armand L. Hunter

GRAND RAPIDS
WOOD-TV; 8; 1408 McKay Tower; N, C, A, D; 316; 1000; Louis Bergenroth; Willard Schroeder

KALAMAZOO
WKZO-TV; 3; 124 W. Michigan Ave.; C, N, A, D; 100; 1000; Arthur E. Covell; Carl E. Lee

LANSING
WJIM-TV; 6; Saginaw & Howard Sts.; N, C, A, D; 100; 454; Charles L. Brady; Willard E. Walbridge
WTOM-TV; 54; 407-11 N. Washington; A, D; 20; 378; William H. Cruse; John C. Pomeroy

SAGINAW
WKNX-TV; 57; 221 S. Washington; C, A; 207; 440; Max W. Thomas; Howard H. Wolfe

TRAVERSE CITY
WPBN-TV; 7; Paul Bunyan Building; N; 51.3; 760; William H. Kiker; Les Biederman

MINNESOTA

AUSTIN
KMMT; 6; 405A N. Main St.; A, D; 14.8; 445; John Ecklin; L. L. McCurnin

DULUTH
KDAL-TV; 3; 10 E. Superior St.; N; 100; 809; R. A. Dettman; Dalton LeMasurier

MINNEAPOLIS
WCCO-TV; 4; 50 S. 9th St.; C, D; 100; 542; John M. Sherman; F. VanKonynenburg
WTCN-TV; 11 (TS WMIN-TV, St. Paul); 2925 Dean Blvd.; A, D; 316; 470; M. N. Fleming; Joseph Merkle

ROCHESTER
KROC-TV; 10; Station KROC-TV; N; 100; 620; Robert W. Cross; David Gentling

SAINT PAUL
KSTP-TV; 5; 3415 University Ave., Minneapolis; N; 100; 563; William Sadler; Stanley Hubbard
WMIN-TV; 11 (TS WTCN-TV, Minneapolis); 538 Hamm Building; A, D; 316; 470; Warren Fritz; N. L. Bentson

MISSISSIPPI

JACKSON
WJTV; 25; P.O. Box 3459; C, D; 17.7; 750; J. R. Whitworth; Jay Scott
WLBT; 3; 715 S. Jefferson; N; 100; 681; Robert R. Smathers; Fred L. Beard
WSLI-TV; 12; P.O. Box 8187; A; 214; 700; C. A. Perkins; Owens F. Alexander

MERIDIAN
WTOK-TV; 11; Southern Building; C, N, A, D; 31; 585; Joe H. Saxon; Robert Wright

MISSOURI

CAPE GIRARDEAU
KFVS-TV; 12; 324 Broadway; C; 85; 990; Robert O. Hirsch; Oscar C. Hirsch

COLUMBIA
KOMU-TV; 8; Highway 63 S.; N, C, A, D; 48.7; 794; Duane M. Weise; George J. Kopel

HANNIBAL
KHQA-TV; 7; 510 Main St., Quincy, Ill.; C, D; 316; 886; J. E. Gray; Walter J. Rothschild

JOPLIN
KSWM-TV; 12; 1928 W. 13th St.; C; 58.9; 506; Jack Langford; Austin A. Harrison

KANSAS CITY
KCMO-TV; 5; 125 E. 31st St.; A, D; 70; 450; Karl Troeglen; E. K. Hartenbower
KMBC-TV; 9; 222 W. 11th St.; C; 316; 1079; Henry E. Goldenberg; John T. Schilling

 (For TV Stations Coming on the Air see February 1955 issue of TELE-TECH)

www.americanradiohistory.com

WDAF-TV; 4; 3030 Summit; N; 100; 750; J. A. Flaherty; H. D. Fitzer

ST. JOSEPH
KFEQ-TV; 2; KFEQ Building; C, D; 52; 810; J. Wesley Koch; Barton Pitts

ST. LOUIS
KETC; 9 (NCE); Washington University; None; 29.5; 560; Jack Chenoweth; Martin Quigley

KSD-TV; 5; 1111 Olive St.; N, C, A; 100; 510; J. E. Risk; George M. Burbach

KWK-TV; 4; 1215 Cole St.; C; 100; 521; N. J. Zehr; Robert T. Convey

SEDALIA
KDRO-TV; 6; 2100 W. Broadway; None; 16.4; 350; Roscoe Maricle; Herbert W. Brondes

SPRINGFIELD
KTTS-TV; 10; 330 E. Walnut; C, D; 12.76; 265; William F. Curry; G. Pearson Ward

KYTV; 3; 999 W. Sunshine; N, A; 61; 500; E. Dennis White; Ralph L. Stufflebam

MONTANA

BILLINGS
KOOK-TV; 2; P.O. Box 1498; C, A, D, N; 17.5; 800; Grant French; V. V. Clark

BUTTE
KXLF-TV; 6; 1681 George; N, D; 2; 688; Jack Provis; E. B. Craney

GREAT FALLS
KFBB-TV; 5; P.O. Box 1139; C, D, A; 25.1; 220; Wilbur Myhre; LeRoy Stahl

MISSOULA
KGVO-TV; 13; 127 E. Main; C, D, A, N; 58.78; 3920; Amos Hargrove; A. J. Mosby

NEBRASKA

KEARNEY
KHOL-TV; 13; P.O. Box 336; Holdrege; A, C, D; 287.8; 585; Jack Lewis; Duane L. Watts

LINCOLN
KOLN-TV; 10; 40 & W Sts.; C, A, D; 316; 1000; D. R. Taylor; James Ebel

KUON-TV; 12 (NCE); University of Nebraska; None; —; —; —; John K. Selleck

OMAHA
KMTV; 3; 2615 Farnam; C, A, D; 100; 590; R. J. Schroeder; Owen Saddler

WOW-TV; 6; Insurance Building; N, A, D; 100; 580; G. Flynn; Frank Fogarty

NEVADA

LAS VEGAS
KLAS-TV; 8; Wilbur Clark's Desert Inn; C, A, N, D; 29; 380; Peter H. Gingros; Jean Paul King

RENO
KZTV; 8; 770 E. 5th St.; C, A, D, N; 2.63; 137; Thomas Hughes; Harry Huey

NEW HAMPSHIRE

MANCHESTER
WMUR-TV; 9; 1819 Elm St.; A, D; 112; 1022; Charles Halle; Hervey Carter

NEW JERSEY

ASBURY PARK
WRTV; 58; Eatontown Traffic Circle, Eatontown; None; 17.1; 440; Lee Reckling; Harold C. Burke

NEWARK
WATV; 13; 1020 Broad St.; None; 180; 1200; Frank V. Bremer; I. R. Rosenhaus

NEW MEXICO

ALBUQUERQUE
KGGM-TV; 13; P.O. Box 1294; C; 10.8; 4250; Leonard F. Dodds; A. R. Hebenstreit

KOAT-TV; 7; 122 Tulane Dr., S.E.; A, D; 25.6; 540; William Carman; A. M. Cadwell

KOB-TV; 4; 1430 Coal Ave., S.W.; N; 11; 4203; George S. Johnson; J. I. Meyerson

ROSWELL
KSWS-TV; 8; 1723 W. 2nd St.; N, C, A, D; 115; 905; Ray Summersgill; J. C. Porter

NEW YORK

ALBANY
WROW-TV; 41; P.O. Box 4100; A, D, C; 269; 810; Charles Heisler; Isabella Arden

WTRI; 35; P.O. Box 4035; C; 162; 1000; A. H. Chismark; Richard B. Wheeler

BINGHAMTON
WNBF-TV; 12; P.O. Box 48; N, C, A, D; 250; 820; L. H. Stantz; G. R. Dunham

BLOOMINGDALE
WIRI; 5; 301 Cornelia St., Plattsburg; —; 19.95; 1205; John Nazok; Joel H. Scheier

BUFFALO
WBEN-TV; 4; Hotel Statler; C; 54; 1206; R. G. Beerbower; C. Robert Thompson

WBUF-TV; 17; 184 Barton St.; A, D, C; 229; 475; Ernest Rety; Sherwin Grossman

WGR-TV; 2; 184 Barton St.; N; 100; 436; Karl B. Hoffman; Joseph Bernard

CARTHAGE
WCNY-TV; 7; P.O. Box 211, Watertown; C, A; 174; 721; Maynard Davis; James W. Higgins

KINGSTON
WKNY-TV; 66; 601 Broadway; C, N, D; 21.4; 616; Carl C. Egolf; Robert L. Sabin

NEW YORK
WABC-TV; 7; 7 W. 66 St.; A; 110; 1380; Frank Marx; John H. Mitchell

WABD; 5; 515 Madison Ave.; D; 16.7; 1540; Rodney D. Chipp; Norman Knight

WCBS-TV; 2; 485 Madison Ave.; C; 42.7; 1290; R. G. Thompson; Samuel Cook Digges

WOR-TV; 9; 1440 Broadway; None; 130; 1240; Charles H. Singer; Gordon Gray

WPIX; 11; 220 E. 42 St.; None; 100; 1410; Otis S. Freeman; Fred M. Thrower

WRCA-TV; 4; 30 Rockefeller Plaza; N; 30; 1445; A. E. Jackson; Hamilton Shea

ROCHESTER
WHAM-TV; 5; Carlson Rd.; N; 100; 511; K. Gardner; W. Fay

WHEC-TV; 10 (TS WVET-TV) 40 Franklin St.; C, A; 123; 447; B. C. O'Brien; C. G. DeLaney

WVET-TV; 10 (TS WHEC-TV) 17 Clinton Ave., S; C, A; 125; 580; Ray Jabes; Erwin F. Lyke

SCHENECTADY
WRGB; 6; 1 River Rd.; A, N, C, D; 93; 1019; W. J. Purcell; R. B. Hanna, Jr.

SYRACUSE
WHEN-TV; 8; 101 Court St.; C, A, D; 190; 960; Frank Spain; Paul Adanti

WSYR-TV; 3; 224 Harrison St.; N; 100; 1000; Albert J. Eicholzen; E. R. Vade Bonceour

UTICA
WKTV; 13; Smith Hill Rd.; N, A, C, D; 187; 830; De Forest T. Layton, Jr.; Michael C. Fusco

NORTH CAROLINA

ASHEVILLE
WISE-TV; 62; 100 College St.; C, N; 24; 650; John Randolph; Gordon O. Williamson

WLOS-TV; 13; 288 Macon Ave.; A, D; 170; 6089; Charles W. Sumner; Charles B. Britt

CHARLOTTE
WAYS-TV; 36; 3229 South Blvd.; A, N, D; 22.8; 360; B. C. Stewart; James P. Poston

WBTV; 3; Wilder Building; C, D, N; 100; 1090; Thomas E. Howard; Charles H. Crutchfield

DURHAM
WTVD; 11; P.O. Box 2009; N, A; 47.8; 1000; Henry Cronin; Harman Duncan

GREENSBORO
WFMY-TV; 2; White & Phillips Aves.; C, A, D; 100; 717; William E. Neill; Gaines Kelley

GREENVILLE
WNCT; 9; P.O. Box 898; C, N, A, D; 100; 856, Hank Tribley; A. Hartwell Campbell

RALEIGH
WNAO-TV; 28; 219 S. McDowell; C, A, N, D; 182; 463; Peter Miller; Charles G. Baskerville

WILMINGTON
WMFD-TV; 6; 225 Princess St.; N; 32; 380; E. I. Herring, Jr.; R. A. Dunlea, Jr.

WINSTON-SALEM
WSJS-TV; 12; 419-21 N. Spruce St.; N; 40; 370; Phil Hedrick; Harold Essex

WTOB-TV; 26; 300 S. Stratford Rd.; A, D; 13.7; 570; James H. Hoke; John G. Johnson

NORTH DAKOTA

BISMARCK
KFYR-TV; 5; 200½ 4th St.; N, C, D; 100; 533; Ivar Nelson; F. E. Fitzsimonds

FARGO
WDAY-TV; 6; Black Building; N, C, A; 66; 433; Julius Hetland; Tom Barnes

MINOT
KCJB-TV; 13; 15A Central Ave.; C, N, A, D; 30; 420; Joe Main; John W. Boler

VALLEY CITY
KXJB-TV; 4; P.O. Box 626, Fargo; C, D; 100; 1090; Robert Ridgeway; William L. Hurley

OHIO

AKRON
WAKR-TV; 49; 853 Copley Rd.; A; 18.24; 370; Irwin L. Knopp; S. Bernard Berk

ASHTABULA
WICA-TV; 15; Jefferson Rd.; C; 19.2; 360; F. N. Bernato; J. A. Colin

CINCINNATI
WCET; 48 (NCE); 1243 Elm St.; None; 11.9; 583; James R. Leonard; Uberto T. Neely

WCPO-TV; 9; 2345 Symmes St.; D, A; 250; 665; Paul G. Adams; M. C. Watters

WKRC-TV; 12; Times-Star Building; C; 250; 612; George A. Wilson; U. A. Latham

WLWT; 5; 140 W. 9th St.; N; 100; 677; R. J. Rockwell; John T. Murphy

CLEVELAND
WEWS; 5; 1816 E. 13th St.; C; 93; 1020; Joseph B. Epperson; James C. Hanrahan

WNBK; 3; 815 Superior Ave.; N; 100; 1000; S. E. Leonard; Lloyd E. Yoder

WXEL; 8; 1630 Euclid Ave.; A, D; 46; 1000; H. A. Brinkman; Franklin Snyder

COLUMBUS
WBNS-TV; 10; 33 N. High St.; C; 219; 450; Lester H. Nafzger; Richard A. Borel

WLWC; 4; 3195 Olentangy River Rd.; N; 100; 436; Charles Sloan; James Leonard

WTVN-TV; 6; 753 Harmon Ave.; A, D; 100; 570; William H. Hansher; J. W. McGough

DAYTON
WHIO-TV; 7; 1414 Wilmington Ave.; C, A, D; 316; 1145; Ernest L. Adams; Robert Moody

WLWD; 2; 4595 S. Dixie Highway; N, A; 100; 510; L. G. Sturgill; H. P. Lasker

LIMA
WLOK-TV; 73; 1424 Rice Ave.; N, C, D; 16; 340; Darrel J. Hunter; R. O. Runnerstrom

STEUBENVILLE
WSTV-TV; 9; Exchange Realty Building; C, A; 229; 950; Charles S. Shepherd; John J. Laux

TOLEDO
WSPD-TV; 13; 136 Huron St.; C; 48; 510; William M. Stringfellow; Allen Haid

YOUNGSTOWN
WFMJ-TV; 21; 101 W. Boardman St.; N; 175; 964; Frank A. Dieringer; Mitchell Stanley

WKBN-TV; 27; 3930 Sunset Blvd.; C, A, D; 160; 553; B. T. Wilkens; W. P. Williamson, Jr.

ZANESVILLE
WHIZ-TV; 18; Lind Arcade Building; N, C, A, D; 15.8; 535; William A. Hunt, Sr.; Vernon A. Nolte

OKLAHOMA

ADA
KTEN; 10; P.O. Box 10; A; 252; 1000; Fred Smith; Bill Hoover

ENID
KGEO-TV; 5; 206 E. Randolph; A; 100; 819; William Teitzel; George Streets

LAWTON
KSWO-TV; 7; P.O. Box 1385; D; 9.7; 541; Willard Cochran; Ross Baker

MUSKOGEE
KTVX; 8; 1850 S. Boulder, Tulsa; A, D; 316; 1013; Louis Brown; Ted Cromer

OKLAHOMA CITY
KMPT-TV; 19; 128 W. Commerce; D; 189; 978; John T. Galbreath; Byron James Walters, Jr.

KTVQ; 25; 1901 Classen Blvd.; A, N, C; 275; 460; Harold L. Coomes; J. Harry Abbott

KWTV; 9; P.O. Box 8788; C, D; 316; 1530; Morris W. Thomas; Edgard T. Bell

WKY-TV; 4; 500 E. Britton Rd.; N, A; 100; 935; H. J. Lovell; P. A. Sugg

TULSA
KOTV; 6; 302 S. Frankfort; C, D, A; 100; 1328; George G. Jacobs; Dick Campbell

KVOO-TV; 2; 311 S. Denver; N; 22; 442; John Bushnell; C. B. Akers

OREGON

EUGENE
KVAL-TV; 13; Blanton Heights; N, A, D; 56; 1055; A. Barnard; S. W. McCready

MEDFORD
KBES-TV; 5; 2000 Crater Lake Highway; C, N, D, A; 28.8; 430; N. L. Williams; Everett A. Faber

PORTLAND
KOIN-TV; 6; 140 S. W. Columbia; C, A; 100; 1530; Louis Bookwalter; C. Howard Lane

KPTV; 27; 735 S.W. 20th Pl.; N, A, D; 204; 1310; William H. McAlister; Russell K. Olsen

PENNSYLVANIA

ALLENTOWN
WFMZ-TV; 67; N. 7th St. Pike; None; 97.7; 970; Carl Egolf; Raymond F. Kohn

ALTOONA
WFBG-TV; 10; 1320-32 11th Ave.; A, C, D, N; 316; 990; K. R. Brubaker; Jack M. Snyder

BETHLEHEM
WLEV-TV; 51; 801 Hamilton St., Allentown; N; 7.41; 600; J. E. Mathiot; Thomas R. Nunan, Jr.

EASTON
WGLV; 57; 40 N. 4th St.; A, D; 100; 1063; Charles R. Thon; Nelson S. Rounsley

ERIE
WICU; 12; 3514 State St.; N, A, D; 30; 115; Michael Csop; Ben McLaughlin

WSEE; 35; 1220 Peach St.; C, D; 192.2; 948; Edward G. Zellefrow; Charles E. Denny

HARRISBURG
WCMB-TV; 27; 228 Court St.; D; 240; 927; J. Howard Bair; Ed K. Smith

WHP-TV; 55; 216 Locust St.; C; 253; 910; E. Daniel Leibensperger; A. K. Redmond

WTPA; 71; 3235 Hoffman St.; A; 175; 904; Paul Gross; David J. Bennett

JOHNSTOWN
WARD-TV; 56; 235 Franklin St.; C, D, A; 20; 610; Millard Coleman; Robert Nelson

WJAC-TV; 6; 329 Main St.; N, C, D; 70.8; 1120;

(Continued on page 82)

(For TV Stations Coming on the Air see February 1955 issue of TELE-TECH)

www.americanradiohistory.com

1954-1955 Statistics of the

ANNUAL BILL OF U. S. FOR RADIO-TV 1954

Sale of Time By Broadcasters	$ 950,000,000
Talent Costs	175,000,000
Electricity, Batteries, etc., to operate 160,000,000	
Radio & TV Receivers	600,000,000
10,000,000 Radio Sets, at Retail Value	400,000,000
7,100,000 Television Sets, at Retail Value	1,278,000,000
Phono Records, 230,000,000 at Retail Value	276,000,000
Radio-TV Servicing and Installation: (Retail Value)	
88 Million Replacement Receiving Tubes	259,960,000
5½ Million Replacement TV Picture Tubes	209,000,000
Radio-TV Component Parts, Antennas, Accessories	400,000,000
Labor	750,000,000
TOTAL	$5,297,960,000

RADIO AND TV SETS IN U. S.; WORLD

	January 1, 1955 Radio	TV
United States homes* with:	50,000,000	30,000,000
Secondary sets in above homes	37,000,000	1,400,000
Sets in business places, institutions	8,000,000	1,600,000
Auto sets	32,000,000	
TOTAL	127,000,000	33,000,000
Total Radio-TV sets in U. S.	160,000,000	
Total *radio* sets in rest of world: North America, 11,000,000; South America, 12,000,000; Europe, 71,000,000; Asia, 18,000,000; Australia, 6,830,000; Africa 3,900,000	122,700,000	
TOTAL radio sets in world	249,700,000	

* Note: *Caldwell-Clements' figure on "homes" includes every dwelling unit, whether individual or family, and includes permanent residents in hotels, apartment-hotels and apartment houses.*

PRODUCTION OF CIVILIAN RADIO SETS — 1922 TO 1954

	Total Civilian Radio Sets Manufactured		Total Receiving Tubes * Manufactured		Automobile Sets Manufactured		Auto Sets In Use	Homes With Radio Sets	Total Radio Sets in use in U. S.	
	Number	Retail Value	Number	Retail Value	Number	Retail Value	Number	Number	Number	
1922	100,000	$ 5,000,000	1,000,000	$ 6,000,000	....	....	260,000	260,000	400,000	1922
1923	550,000	30,000,000	4,500,000	12,000,000	....	....	1,000,000	1,100,000	1,100,000	1923
1924	1,500,000	100,000,000	12,000,000	36,000,000	....	....	2,500,000	3,000,000	3,000,000	1924
1925	2,000,000	165,000,000	20,000,000	48,000,000	....	....	3,500,000	4,000,000	4,000,000	1925
1926	1,750,000	200,000,000	30,000,000	58,000,000	....	....	5,000,000	5,700,000	5,700,000	1926
1927	1,350,000	168,000,000	41,200,000	67,300,000	....	....	6,500,000	7,000,000	7,000,000	1927
1928	3,281,000	400,000,000	50,200,000	110,250,000	....	....	7,500,000	8,500,000	8,500,000	1928
1929	4,428,000	600,000,000	69,000,000	172,500,000	....	....	9,000,000	10,500,000	10,500,000	1929
1930	3,827,800	300,000,000	52,000,000	119,600,000	34,000	$ 3,000,000	12,048,762	13,000,000	13,000,000	1930
1931	3,420,000	225,000,000	53,000,000	69,550,000	108,000	5,940,000	14,000,000	22,000,000	15,000,000	1931
1932	3,000,000	140,000,000	44,300,000	48,730,000	143,000	7,150,000	16,809,562	26,000,000	18,000,000	1932
1933	3,806,000	180,500,000	59,000,000	49,000,000	724,000	28,598,000	20,402,369	30,500,000	22,000,000	1933
1934	4,084,000	214,500,000	58,000,000	36,600,000	780,000	28,000,000	21,456,000	33,000,000	26,000,000	1934
1935	6,026,800	330,192,480	71,000,000	50,000,000	1,125,000	54,562,500	22,869,000	37,600,000	30,500,000	1935
1936	8,248,000	450,000,000	98,000,000	69,000,000	1,412,000	69,188,000	24,600,000	40,800,000	33,000,000	1936
1937	8,064,780	450,000,000	91,000,000	85,000,000	1,750,000	87,500,000	26,666,500	45,300,000	37,600,000	1937
1938	6,000,000	210,000,000	75,000,000	93,000,000	800,000	32,000,000	28,000,000	51,000,000	40,800,000	1938
1939	10,500,000	354,000,000	91,000,000	114,000,000	1,200,000	48,000,000	28,700,000	56,000,000	45,300,000	1939
1940	11,800,000	450,000,000	115,000,000	115,000,000	1,700,000	60,000,000	29,200,000	59,340,000	51,000,000	1940
1941	13,000,000	460,000,000	130,000,000	143,000,000	2,000,000	70,000,000	29,700,000	58,000,000	56,000,000	1941
1942	4,400,000	154,000,000	87,700,000	94,000,000	350,000	12,250,000	30,800,000	57,000,000	59,340,000	1942
1943	....	....	17,000,000	19,000,000	....	....	8,000,000	32,000,000	58,000,000	1943
1944	....	....	22,000,000	25,000,000	....	....	7,000,000	33,000,000	57,000,000	1944
1945	500 000	20,000,000	30,000,000	35,000,000	....	....	6,000,000	34,000,000	56,000,000	1945
1946	14,000,000	700,000,000	190,000,000	200,000,000	1,200,000	72,000,000	7,000,000	35,000,000	60,000,000	1946
1947	17,000,000	800,000,000	220,000,000	260,000,000	2,500,000	150,000,000	9,000,000	37,000,000	66,000,000	1947
1948	16,000,000	700,000,000	200,000,000	230,000,000	2,800,000	200,000,000	11,000,000	40,000,000	74,000,000	1948
1949	10,000,000	500,000,000	200,000,000	350,000,000	3,500,000	240,000,000	14,000,000	42,000,000	81,000,000	1949
1950	14,600,000	721,000,000	383,000,000	644,000,000	4,760,000	248,000,000	17,000,000	45,000,000	90,000,000	1950
1951	13,000,000	605,000,000	430,000,000	640,000,000	4,800,000	255,000,000	20,000,000	45,850,000	100,000,000	1951
1952	10,000,000	500,000,000	370,000,000	740,000,000	2,750,000	148,000,000	25 000 000	46,000,000	114,500,000	1952
1953	13,400,000	536,000 000	410,000,000	920,000,000	4,800,000	250,000,000	29,000,000	48,000,000	120,500,000	1953
1954	10,000,000	400,000,000	400,000,000	880,000,000	4,300,000	220,000,000	32,000,000	50,000,000	127,000,000	1954

* Total tubes include those used in TV. Replacements accounted for about 25% in 1954.

PRODUCTION OF PRINCIPAL COMPONENTS USED in RADIO-TV RECEIVERS

Year	Transformers	Coils	Capacitors, (Electrolytic)	Capacitors, (Mica)	Capacitors (Ceramic)	Capacitors	Resistors, (Composition)	Resistors, (Wire Wound)	Loudspeakers	Year
1946	49	149	22	69	284	155	477	29	14	1946
1947	70	193	27	84	349	196	608	37	17	1947
1948	46	250	28	86	357	212	654	42	17	1948
1949	39	196	25	74	310	218	670	50	13	1949
1950	65	332	44	106	417	351	1090	70	22	1950
1951	47	288	38	90	394	284	862	59	19	1951
1952	56	305	42	100	433	312	948	67	17	1952
1953	63	323	43	103	455	325	900	69	21	1953
1954	54	276	37	88	390	278	770	59	18	1954

(Figures are in Millions of Units.)

www.americanradiohistory.com

TV-Radio-Electronic Industries

VITAL TELEVISION STATISTICS 1946-1954

	Total TV Sets Manufactured		Receiving Tubes Used in New TV Sets and for Replacements		Total TV Picture Tubes Manufactured		Total Receiving Sets Manufactured	TV Stations on the Air	Total TV Sets in use in U. S.	At Close of
	Number	Retail Value	Number	Retail Value	Number	Retail Value	AM-FM-TV			
1946	10,000	$ 5,000,000	350,000	$ 588,000	20,000	$ 100,000	14,010,000	5	8,000	1946
1947	250,000	100,000,000	8,500,000	15,000,000	300,000	150,000	17,250,000	20	250,000	1947
1948	1,000,000	350,000,000	32,200,000	53,000,000	1,500,000	75,000,000	17,000,000	44	1,000,000	1948
1949	3,000,000	950,000,000	87,000,000	146,000,000	3,500,000	210,000,000	13,000,000	100	4,000,000	1949
1950	7,500,000	2,700,000,000	225,000,000	378,000,000	8,000,000	400,000,000	22,100,000	107	10,500,000	1950
1951	5,600,000	2,100,000,000	161,000,000	270,000,000	6,000,000	300,000,000	19,100,000	108	15,750,000	1951
1952	6,300,000	2,360,000,000	168,000,000	380,000,000	6,500,000	260,000,000	16,300,000	123	22,000,000	1952
1953	7,300,000	1,675,000,000	210,000,000	400,000,000	9,000,000	360,000,000	20,700,000	350	28,000,000	1953
1954	7,100,000*	1,278,000,000	215,200,000	409,000,000	10,300,000	360,500,000	17,700,000	415	33,000,000	1954

* Estimated retail sales including carryovers.

Hi-Fi Estimates for 1955

Total Sales (Retail)	$300,000,000
Recorders	30,000,000
Phonos	25,500,000
Misc. Combos	30,000,000
Cabinets (Custom)	15,000,000
Hi-Fi Records	50,000,000
Hi-Fi Needles	5,500,000
Magnetic Tape (40% of total market)	4,500,000
Speakers	30,000,000
Tuners	45,000,000
Amplifiers	55,500,000
Misc.	9,000,000

Color-TV Estimates for 1955

Total Color-TV Sets to be manufactured	200,000
Total Color-TV Sets to be sold	160,000
Retail value of sales	$128,000,000

1954 STATISTICAL ANALYSIS OF TV STATIONS

TV stations with video output (kw) in ranges

	to 50	51 to 100	101 to 200	201 to 300	301 to 316
No. Stations	152	131	44	38	33
Avg. Video erp (kw)	22.9	90	153.6	239.4	316
Avg. No. Cameras	3.9	4.4	6.5	3	4.25
Avg. receivers in area	226,547	357,031	607,746	250,000	359,096
Avg. Antenna Ht. (ft.)	970	793	1144	732	857
Avg. Xmttr. output (kw)	3.6	16.8	17.3	17.8	39
% with Color Equipt.	16.4	55.7	25	47.3	66.6
% Color Expan. Plans	32.9	55.7	47.5	68.2	57.5

TV stations covering areas with no. receivers in ranges

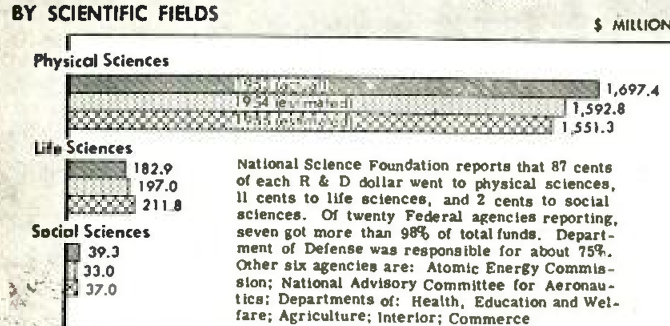
	to 25,000	25,001 to 50,000	50,001 to 100,000	100,001 to 500,000	500,001 to Million	over Million
(Video erp to 50 kw)						
No. Stations	23	33	34	39	15	8
Avg. Video erp (kw)	18.5	22.5	19.3	27.9	27	26.1
Avg. No. Cameras	2.3	1.6	2.2	3	7	25.5
Avg. Antenna Ht. (ft.)	703	619	848	1255	708	1774
Avg. Xmttr. Output (kw)	2.8	3	3.5	3.8	5	4.3
No. Color Equipment	1	2	3	13	5	4
No. Color Plans	4	8	15	14	3	3
(Video erp 51-100 kw)						
No. Stations	4	11	29	60	12	8
Avg. Video erp (kw)	78.8	80.3	83.5	95.4	89.9	99
Avg. No. Cameras	2.5	2	2.6	4.6	6.8	10.3
Avg. Antenna Ht. (ft.)	1505	800	707	763	887	820
Avg. Xmttr. Output (kw)	10.7	11.1	12.3	20.1	18.4	16.2
No. Color Equipment	1	2	6	44	11	6
No. Color Plans	0	4	13	39	8	7
(Video erp 101-200 kw)						
No. Stations	1	3	8	20	1	7
Avg. Video erp (kw)	115	126	142	160.4	141	123.7
Avg. No. Cameras	2	2	2.4	3.3	5	25.4
Avg. Antenna Ht. (ft.)	905	686	791	885	3244	1522
Avg. Xmttr. Output (kw)	7.5	15	12.3	14.5	25	138
No. Color Equipment	0	0	1	7	0	2
No. Color Plans	0	1	4	11	0	3
(Video erp 201-300 kw)						
No. Stations	1	2	4	25	2	2
Avg. Video erp (kw)	214	255.9	257	235.1	232	227.5
Avg. No. Cameras	2	1	2.3	3.3	3	3
Avg. Antenna Ht. (ft.)	616	523	689	758	626	780
Avg. Xmttr. Output (kw)	59.5	20	14	16	18.5	22.5
No. Color Equipment	0	0	1	14	1	1
No. Color Plans	0	1	2	19	2	2
(Video erp 316 kw)						
No. Stations	0	1	3	20	5	2
Avg. Video erp (kw)		316	316	316	316	316
Avg. No. Cameras		7	2.3	3.6	6	10
Avg. Antenna Ht. (ft.)		1642	1027	881	713	740
Avg. Xmttr. Output (kw)		22.8	44.6	40.2	40.6	33.3
No. Color Equipment		0	1	19	3	2
No. Color Plans		0	2	12	2	2

1954 ELECTRONIC MARKETS

Estimated annual purchases by various segments of the electronic industries, including those made within and between these divisions.

Government	$3,500,000,000
Manufacturers	3,000,000,000
Service outlets	800,000,000
Industrial end users	80,000,000
Broadcasters	65,000,000
Communications, commercial	60,000,000
Amateurs, experimenters	40,000,000
Civilian electronic labs	35,000,000
Recording studios	25,000,000

OBLIGATIONS FOR RESEARCH AND DEVELOPMENT BY SCIENTIFIC FIELDS



National Science Foundation reports that 87 cents of each R & D dollar went to physical sciences, 11 cents to life sciences, and 2 cents to social sciences. Of twenty Federal agencies reporting, seven got more than 98% of total funds. Department of Defense was responsible for about 75%. Other six agencies are: Atomic Energy Commission; National Advisory Committee for Aeronautics; Departments of: Health, Education and Welfare; Agriculture; Interior; Commerce

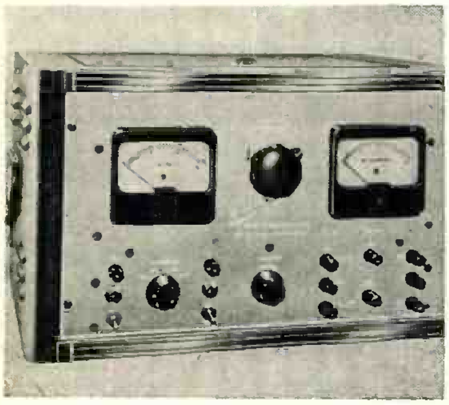
More Statistics on pages 3 and 117

www.americanradiohistory.com

New Technical Products

D. C. POWER SUPPLY

The Type 806 voltage regulated dc power supply, features a wider than usual output range with a B supply ranging from 0 to +600 v., 0 to 200 ma, and a C supply from 0 to —250 v., 0 to



5 ma. The unit offers a fixed voltage of 250 v., 0 to 50 ma, derived from the C supply, and an unregulated 6.3 v., 10 amp, center-tapped, filament supply. It will provide klystrons with up to —600 v. cathode voltage, and an additional 0 to —250 v. for the reflector. Furnished to operate from either 115 or 230 v. ac, 50/60 cps single phase. **Polytechnic Research & Development Co., Inc., 202 Tillary St., Brooklyn 1, N.Y.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-22)

OSCILLOSCOPE

The Model 0-10 oscilloscope, designed for the professional serviceman or engineer, features characteristics that make it valuable for TV Color work. Has essentially flat vertical channel response from 5 cps to 5 mc. Down only 1½ db at 3.58 mc—color TV sync burst frequency. Employs printed circuit boards for reduced kit construction time and stable circuit operation. Uses

full sweep generator circuit which will produce stable linear sweeps up to 500,000 cps, and employs a full 5 in. cathode ray tube (5UP1). **Heath Co., 305 Territorial Rd., Benton Harbor, Mich.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-25)

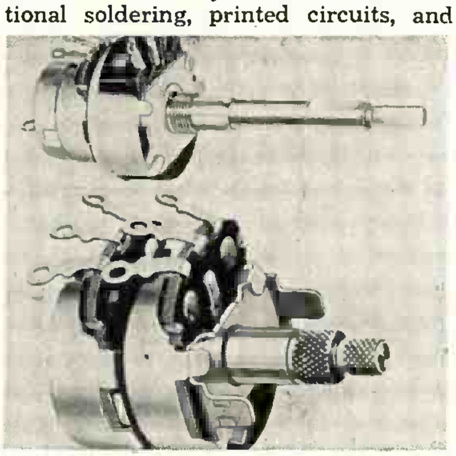
SIGNAL GENERATOR

The Model 552 standard r-f signal generator covers the frequency range from 32 kc to 70 mc in seven ranges. Signals from less than 1,0 mv. to the high voltage requirements of bridge

measurements can be obtained. Circuitry consists of an r-f oscillator, modulating amplifier, VTVM, attenuator, 400 cps oscillator, and power supply. The r-f carrier may be modulated from the internal oscillator or from an external source. Minimum leakage and stray fields, high reading accuracy of the frequency dial, low cable standing wave errors. Light weight, sturdy construction. **Clough-Brengle Co., Dept. TT, 6014 Broadway, Chicago 40, Ill.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-23)

RESISTORS

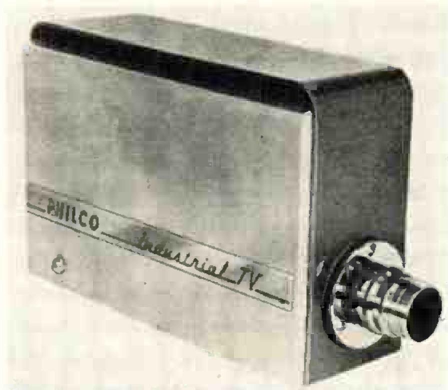
A new line of variable resistors for all color TV applications includes ¾ in. to 2½ in. diameter controls with wattages from 2/10 w. to 4 w. Control types are carbon and wirewound with and without an attached switch. Mountings are conventional bushing, twist ear, and snap-in bracket for printed circuits. Terminal styles are for conventional soldering, printed circuits, and



wire wrap. Terminal styles make possible endless combinations of tandems with both single and dual shafts. **Chicago Telephone Supply Corp., 1142 W. Beardsley Ave., Elkhart, Ind.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-21)

INDUSTRIAL TV

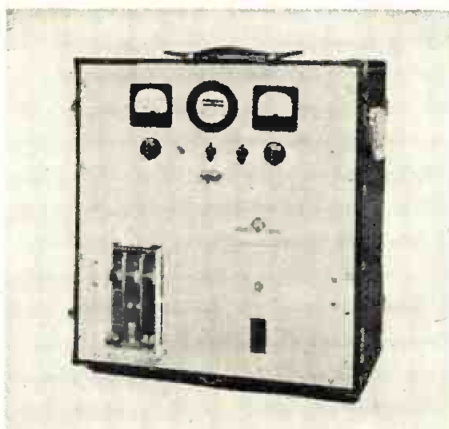
Industrial TV system is designed for industry, utilities and transportation companies for remote supervision of manufacturing processes, materials handling and plant protection. It features



a small camera, camera monitor and camera control, and provides for operation at extremely low light levels. Unitized construction is employed. The system operates on commercial TV standards and utilizes a professional video monitor for high resolution. **Philco Corp., Government and Industrial Div., Philadelphia 44, Penna.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-31)

POWER SUPPLY

The Model V1B multi-purpose 500 w. electronic power supply furnishes 117 v., 60 cps ac. with sufficient capacity to operate recorders, turntables, and other synchronously-driven equipment. To furnish an absolute 60 cps, the unit employs a standard frequency accurate to 1/10,000 parts. To furnish either fixed or continuously variable output frequencies to change recorded pitch or



motor speeds, a built-in oscillator controls output from 35 to 90 cps. Under full load, distortion is slightly more than 5%. **Stancil-Hoffman, 921 N. Highland Ave., Hollywood 38, Calif.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-26)

www.americanradiohistory.com

for the Electronic Industries

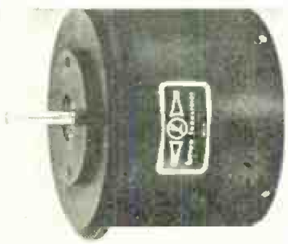
COMPARATOR BRIDGE

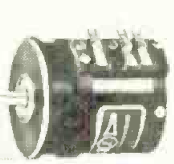
Model 50 comparator bridge is a precision voltage source and a precision comparator of voltages in the range —100 v to +100 v. A precision 10-turn potentiometer with dial allows the out-

put voltage to be set equal to an external voltage. Accuracy within 0.1% is obtained by direct reading on the dial. A special circuit provides sliding-meter sensitivity on the null indicator so that a coarse-fine null balance may be obtained with ±½ μa without range switching. Can be used for analog computer work. Will supply power up to 10 ma from —100 to +100 v with a max. internal impedance of 5,000 ohms. **Donner Scientific Co., 2829 7th St., Berkeley 10, Calif.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-15)

POTENTIOMETERS

The series MA-20-10 ten-turn potentiometer is made with standard independent linearities ranging from ±0.5% to ±0.02. Linearities as high as ±0.01% are available on special order. Case diam. is 1.820 in. Resistances offered are from 1 k to 100 k ohms. The series MA-30-10 ten-turn potentiometer is also made with standard linearities ranging from ±0.5% to ±0.01%. Linearities as high as ±0.005% are available on special

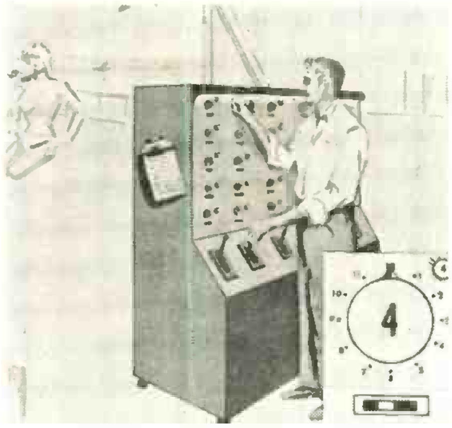




order. Case diam. is 3.000 in. Resistance range, 2 k to 300 k ohms. Fifteen-turn models are available with 3-in. diam. cases. **Litton Industries, Components Div., 336 N. Foothill Rd., Beverly Hills, Calif.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-16)

PORTABLE CONTROL PANEL

A portable control panel for TV lights in studios, movie sets, theaters, auditoriums, etc., the "Trol-Lite," consists of 6 dimmer units with a master mechanical interlock. Each dimmer circuit



is connected to 30 switches which control one light. It is possible to switch any light connected to any of the dimmers, and the operator can by-pass dimmers in use to reach the dimmer indicated by his lighting cue. Numerically marked pilot lights indicate which circuit is in use. Each dimmer is capable of handling up to 55 kva, or a total 330 kva for the entire system. **Eastern Precision Resistor Corp., 130-11 90th Ave., Richmond Hill 18, N. Y.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-18)

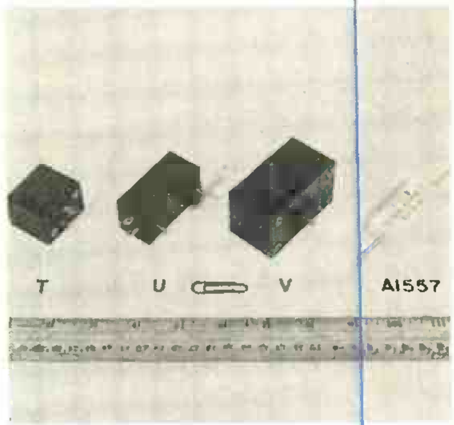
TRANSISTORS

Types 2N34, 2N36, 2N43, and 2N65 pnp junction transistors are hermetically sealed under vacuum to insure long life under most severe ambient conditions. Common emitter current gain (β), min. measured at 6v collector voltage, 1 ma collector current, 1 kc, at 25° C., 40, 45, 33, 50 db respectively. the units are available in JAN type miniature and subminiature cases. Low noise allows dependable operation at low levels. Up to 150 mw power dissipation with emitter connected to outer case. Uniformly low collector cut-off current and high common emitter current gain. **Transitron Electronic Corp., Dept. TT, 403 Main St., Melrose 76, Mass.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-17)

MORE TECHNICAL INFORMATION describing the new products presented here may be obtained by writing on company letterhead to New Products Editor, TELE-TECH & ELECTRONIC INDUSTRIES, 480 Lexington Ave., New York 17, N.Y., listing numbers given at end of each item of interest. Please mention title of position held.

DELAY LINES

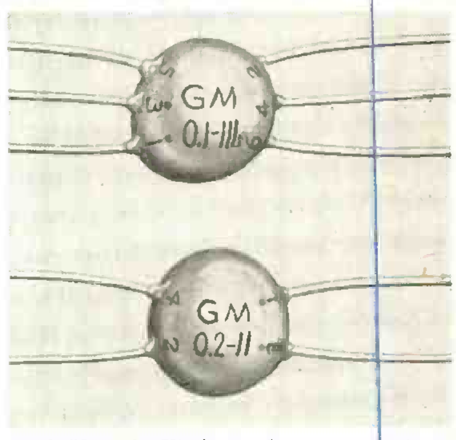
Three new series of military-type delay lines, designated T, U, and V, cover the same general ranges of impedance and delay time, but differ basically in complexity, or number of



sections, and hence, in the ratio of delay time to rise time. The T series offers a line of good rise time, the U series is better, and the rise time of the V series is excellent. The T series is smallest, the V series the largest. The lines are completely encapsulated in special thermally stable resin. All have means for bolting the lines firmly to a panel or chassis. All have solder lugs. **The Jacobs Instrument Co., Bethesda 14, Md.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-20)

PULSE TRANSFORMERS

The new GM series of toroidal steel core pulse transformers produce rectangular pulses with durations of 0.05, 0.10, 0.20, 0.50, 1.0, 2.0 μsec when used with the Gudeman standard blocking oscillator circuit. Units are available with 2 or 3 windings. Resin impregnated and encapsulated, they are impervious to moisture. Features: 1 to 1 turn ratio; ⅜ x ⅜ x 2⅜ in. size; ½ to 2 grams weight. Units are tested to



2,000 VRMS. Withstand repeated thermal shock cycles from 135° C. to —70° C. Surpass MIL-T-27, Grade 1, Class A test specifications. **Gudeman Co., 9200 Exposition Blvd., Los Angeles, Calif.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-14)

www.americanradiohistory.com

N. L. Straub; A. D. Schratt

LANCASTER
WGAL-TV; 8; 24 S. Queen St.; C, N, D; 316; 1000; J. E. Mathiot; Clair R. McCollough

NEW CASTLE
WKST-TV; 45; Cathedral Building; D; 17.8; 370; Don L. Dout; Arthur W. Graham

PHILADELPHIA
WCAU-TV; 10; City Line & Monument Rd.; C; 316; 1000; John C. Leitch; Donald W. Thornburgh
WFIL-TV; 6; 400 N. Broad St.; D, A; 100; 645; Henry E. Rhea; Roger W. Clipp
WPTZ; 3; 1600 Architects Building; N; 100; 749; R. J. Bowley; R. V. Tooke

PITTSBURGH
WDTV; 2; 1 Gateway Center; D, N, C, A; 100; 808; Raymond W. Rodgers; Harold C. Lund
WENS; 16; 700 Ivory Ave.; A, C, N; 200; 870; James E. Hurley; Larry H. Israel
WQED; 13 (NCE); 4337 5th Ave.; None; 26.03; 800; E. C. Horstman; William A. Wood.

READING
WEEU-TV; 33; 433 Penn St.; N, A; 167; 1036; Robert Guldin; Thomas E. Martin
WHUM-TV; 61; Skyline Studios, Skyline Dr.; C; 260; 1784; Louis E. Littlejohn; Humboldt J. Greig

SCRANTON
WARM-TV; 16; 333 Madison Ave.; A; 191; 1220; Roswell J. Parker; William M. Dawson
WGBI-TV; 22; 1000 Wyoming Ave.; C; 215.5; 1163; K. R. Cooke; R. E. McDowell
WTVU; 73; Wyoming Ave. & Spruce St.; None; 12.8; 1200; Patrick Napolitano; James H. Crowley

WILKES-BARRE
WBRE-TV; 28; 62 S. Franklin; N; 225; 1220; Charles Sakotski, Sr.; David M. Baltimore
WILK-TV; 34; 88 N. Franklin St.; A, D; 192; 1090; Theodore S. French; Thomas P. Shelburne

YORK
WNOW-TV; 49; P.O. Box 306; D; 20; 680; Glenn W. Winter; Lowell Williams
WSBA-TV; 43; Queen St. Extended Hill; A; 20; 550; Llewellyn Jones; C. L. Doty

RHODE ISLAND

PROVIDENCE
WJAR-TV; 10; 176 Weybosset St.; N, A, D; 226; 611; Thomas C. Prior; Norman Gittleson
WNET; 16; P.O. Box 1533; A, C, D; 20; 473; Herbert F. Evans; Abraham Belilove

SOUTH CAROLINA

ANDERSON
WAIM-TV; 40; 1 Martin St.; C; 16.8; 482; John Willis; G. P. Warnock

CHARLESTON
WCSC-TV; 5; 485 East Bay; C, A; 100; 525; Wilbur R. Albee; John M. Rivers
WUSN-TV; 2; East of Cooper River Bridge; N, D; 100; 850; Walter Nelson; J. Drayton Hastie

COLUMBIA
WCOS-TV; 25; Cornell Arms Apt.; A; 15.7; 650; Robert Lambert; Charles W. Pittman
WIS-TV; 10; 1111 Bull St.; N; 269; 640; Herbert Eidson, Jr.; Charles A. Batson
WNOK-TV; 67; 1811 Maine St.; C, D; 93.5; 629; Donald E. Willoughby; H. M. McElveen, Jr.

FLORENCE
WBTW; 8; Black Creek Rd.; C, A; 316; 827; Emil A. Sellars; J. William Quinn

GREENVILLE
WFBC-TV; 4; Rutherford St.; N; 100; 1204; W. E. Garrison; B. T. Whitmire
WGVL; 23; P.O. Box 2344; A, D; 17; 1142; Harley F. Reynolds; Ben K. McKinnon

SOUTH DAKOTA

SIOUX FALLS
KELO-TV; 11; 8th & Philips Ave.; N; 55; 583; Lester C. Froke; Evans Nord

TENNESSEE

CHATTANOOGA
WDEF-TV; 12; Volunteer Building; N, C, A, D; 105.2; 994; B. C. Baker; Harold Anderson

JOHNSON CITY
WJHL-TV; 11; 145 W. Main St.; C, N, A, D; 58.78; 720; O. K. Garland; W. Hanes Lancaster, Jr.

KNOXVILLE
WATE; 6; 612 S. Gay St.; N, A; 8; 994; Fred Andrews; W. H. Linebaugh
WTSK-TV; 26; P.O. Box 1388; C, D; 21.9; 487; Joseph E. Broyles; Harold B. Rothrock

MEMPHIS
WHBQ-TV; 13; 1381 Madison Ave.; C; 316; 1013; W. M. Roy; John Cleghorn
WMCT; 5; 169 Madison Ave.; N, A, D; 100; 1013; E. C. Frase, Jr.; H. W. Slavick

NASHVILLE
WSIX-TV; 8; Nashville Trust Building; A, D; 316; 1374; Charles R. Duke; Shelton Weaver
WSM-TV; 4; 301 7th Ave., N.; N, D; 100; 680; Aaron Shelton; John H. De Witt, Jr.

OLD HICKORY
WLAC-TV; 5; 159 4th Ave., N., Nashville; C; 100; 1367; Ralph L. Hucaby; T. B. Baker, Jr.

TEXAS

ABILENE
KRBC-TV; 9; 4510 S. 14th St.; A, D, N; 29.5; 772; W. E. Kessel; Howard Barrett

AMARILLO
KFDA-TV; 10; Broadway at Cherry Ave.; C, A; 56.5; 550; B. W. Spiller; Stan Wilson
KGNC-TV; 4; 2000 N. Polk St.; N, D; 100; 787; W. H. Torrey; Noel E. Thompson

AUSTIN
KTBC-TV; 7; P.O. Box 717; C, N, A, D; 100; 740; Ben Hearn; J. C. Kellam

BEAUMONT
KBMT; 31; P.O. Box 1192; A, N, D; 224; 460; Frank R. Leins; John Rossiter

CORPUS CHRISTI
KVDO-TV; 22; P.O. Box 2223; N; 20; 326; Nestor Cuesta; L. W. Smith

DALLAS
KRLD-TV; 4; Herald Square; C; 100; 465; B. B. Honeycutt; Roy M. Flynn
WFAA-TV; 8; 3000 Hines Blvd.; N, A, D; 274; 350; William C. Ellis; Ralph W. Nimmons

EL PASO
KROD-TV; 4; P.O. Box 1799; C, A, D; 56.3; 1585; Edward P. Talbott; Val Lawrence
KTSM-TV; 9; 801 N. Oregon St.; N; 58.7; 500; K. J. Walton; Karl O. Wyler

FORT WORTH
WBAP-TV; 5; 3900 Barnett; N, A; 100; 1072; R. G. Stinson; George Cranston

GALVESTON
KGUL-TV; 11; 11 Video Lane; C, A, D; 235; 550; W. R. Sloat; Paul E. Taft

HARLINGEN
KGBT-TV; 4; P.O. Box 711; C, A, D; 13; 435; Al Beck; Troy McDaniel

HOUSTON
KPRC-TV; 2; P.O. Box 1234; N, A; 100; 686; Paul Huhndorff; Jack Harris
KTRK-TV; 13; 4513 Cullen Blvd.; A, D; 316; 958; T. L. Hiner; Willard E. Walbridge
KUHT; 8 (NCE); 3801 Cullen Blvd.; None; 48; 700; James Byrd; John C. Schwarzwalder

LONGVIEW
KTVE; 32; P.O. Box 2029; None; 20; 300; William Dixon; Barre Monigold

LUBBOCK
KCBD-TV; 11; 5600 Ave. A; N, A; 100; 757; Frank Lee; Joe H. Bryant
KDUB-TV; 13; 7400 College; C, D; 35; 833; R. N. Starnes; W. D. Rogers

MIDLAND
KMID-TV; 2; Midland Air Terminal; N, C, A, D; 26.3; 500; Bill Buford; S. A. Grayson

SAN ANGELO
KTXL-TV; 8; 1015 E. 28th St.; C, D, N, A; 27.5; 420; Robert Benson; J. Harley Hubbard

SAN ANTONIO
KENS-TV; 5; Transit Tower; C, A, D; 100; 450; William J. Jackson; Bill Michaels
WOAI-TV; 4; 1031 Navarro; N; 100; 480; Charles L. Jeffers; James M. Gaines

TEMPLE
KCEN-TV; 6; P.O. Box 188; N; 100; 830; W. O. Crusinberry; Harry Stone

TEXARKANA
KCMC-TV; 6; Summer Hill Rd.; C, A, D; 100; 380; Harvey Robertson; Walter M. Windsor

TYLER
KLTV; 7; State Highway 31; N, A; 100; 520; Hudson C. Collins; Marshall Pengra

WACO
KANG-TV; 34; 4811 Bosque Blvd.; A, D; 18.7; 500; James H. Smith; Bob H. Walker

WESLACO
KRGV-TV; 5; 311 Missouri Ave.; N; 28.8; 791; Lewis Hartwig; B. W. Ogle

WICHITA FALLS
KFDX-TV; 3; P.O. Box 2040; N, A; 60; 510; John Adams; Howard Fry
KWFT-TV; 6; Seymour Highway; C; 23.7; 495; Herbert T. Wiley; Kenyon Brown

UTAH

SALT LAKE CITY
KSL-TV; 5; 145 Social Hall Ave.; C, A, D; 28.3; 4400; Vincent E. Clayton; D. Lennox Murdoch
KTVT; 4; 130 Social Hall Ave.; N; 30; 3083; Alan Gundersan; G. Bennett Larsan
KUTV; 2; 179 Motor Ave.; A; 45.71; 3185; —; Frank C. Carmen

VERMONT

MONTPELIER
WMVT; 3; 50 Barrett, Burlington; C, N, A, D; 18.3; 2730; James Tierney; Stuart T. Martin

VIRGINIA

DANVILLE
WBTM-TV; 24; 710 Grove St.; A; 22.5; 650; Lyle C. Motley; Edward G. Gardner

HAMPTON
WVEC-TV; 15; 10 Seldon Arcade, Norfolk; N; 220; 510; William C. King, Jr.; Thomas P. Chisman

HARRISONBURG
WSVA-TV; 3; Rawley Pike; C, A, N, D; 8.3; 2130; Warren L. Braun; Frederick L. Allman

LYNCHBURG
WLVA-TV; 13; 925 Church St.; C, A, D; 28.2; 2100; John T. Orth; Phillip P. Allen

NEWPORT NEWS
WACH-TV; 33; 114 24th St.; None; 20.9; 352; John Brigman; Hal Seville

NORFOLK
WTAR-TV; 3; 720 Boush St.; C, A, D; 100; 1039; Richard L. Lindell; Campbell Arnoux

RICHMOND
WTVR; 6; 3301 W. Broad St.; N; 100; 844; James W. Kyle; Wilbur M. Havens

ROANOKE
WSLS-TV; 10; Shenandoah Building; N, A, C; 296; 1976; Phil Briggs; James H. Moore

WASHINGTON

BELLINGHAM
KVOS-TV; 12; 1321 Commercial; D; 33; 550; Ernest E. Harper; Rogan Jones

SEATTLE
KING-TV; 5; 320 Aurora Ave.; A; 100; 17; R. A. Ferguson; Otto P. Brandt
KOMO-TV; 4; 100 4th Ave., N.; N; 100; 810; F. J. Brott; W. W. Warren

SPOKANE
KHQ-TV; 6; Radio Central Building; N, A; 100; 826; Al Sparling; R. O. Dunning
KREM-TV; 2; S. 4103 Regal; A; 100; 837; Hommer W. Mead; Robert H. Temple
KXLY-TV; 4; W. 315 Sprague Ave.; C, D; 49; 3070; Dave Green; George Morgan

TACOMA
KTVW; 13; 914½ Broadway; None; 100; 784; Charles R. Morris; J. Fernhead
KTNT-TV; 11; 1701 S. 11th; C, D; 316; 803; Max H. Bice; L. H. Higgins

YAKIMA
KIMA-TV; 29; P.O. Box 702; C, N, A, D; 10.7; 980; J. Barry Watkinson; Thomas C. Bostic

WEST VIRGINIA

CHARLESTON
WCHS-TV; 8; 1111 Virginia St., E.; C, D, A; 316; 666; William E. Dixon; John T. Gelder
WKNA-TV; 49; 804 Kanawha Blvd.; A; 22.5; 390; A. J. Ginkel; Charles H. High

FAIRMONT
WJPB-TV; 35; TV-Radio Centre Building; N, A, D; 25; 325; Joseph Sterloskie; R. M. Drummond

HUNTINGTON
WSAZ-TV; 3; 201 9th St.; N, A; 100; 559; J. P. Clay; L. H. Rogers

PARKERSBURG
WTAP; 15; 121 W. 7th St.; A, D; 19.5; 570; George W. DeBlieux; T. E. Eiland

WHEELING
WTRF-TV; 7; 1329 Market St.; N, A; 316; 591; Howard L. Doubenmeyer, Jr.; Robert W. Ferguson

WISCONSIN

EAU CLAIRE
WEAU-TV; 13; 2415 S. Hastings Way; N, A, D; 57.5; 430; T. O. Jorgenson; H. S. Hyett

GREEN BAY
WBAY-TV; 2; 115 S. Jefferson St.; C, D, A; 100; 861; Wally Stangel; Burke Farquhar

LA CROSSE
WKBT; 8; 141 S. 6th St.; N, C, D; 100; 810; Al Leeman; Howard Dahl

MADISON
WHA-TV; 21 (NCE); Radio Hall, University of Wisconsin; None; 1; 233; J. H. Stiehl; William G. Harley
WKOW-TV; 27; Gilbert Rd.; C; 17; 690; Cloren Smith; Clark Hogan
WMTV; 33; W. Beltline Highway; N, A, D; 17; 650; L. Stanley Sadler; Morton J. Wagner

(Continued on page 122)

 (For TV Stations Coming on the Air see February 1955 issue of TELE-TECH)

www.americanradiohistory.com

2+2=4 Everytime

☆ "...each component reproduced must be identical to the original . . . the same, every one, every time."

CINCH IS PRODUCING PRECISION PARTS FOR AUTOMATION PROJECTS

. . . exactingly made components for the exacting requirements of mechanical assembly.

- CINCH parts are made automatically and therefore are made with precision metal and insulation components. These automatically assembled parts assure the uniformity and quality mandatory for use in AUTOMATION in the end users equipment.
- CINCH will design a new or re-design parts within the category of their manufacture to fit your particular plans.
- CINCH will also assist in the introduction in the assembly of CINCH's specially designed component in your radio and TV equipment.

CINCH components available at leading electronic jobbers — *everywhere.*

Centrally located plants at Chicago, Shelbyville, Indiana and St. Louis.

Cinch ELECTRONIC COMPONENTS

CONSULT CINCH

CINCH MANUFACTURING CORPORATION

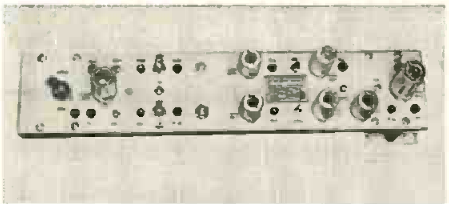
1026 South Homan Ave., Chicago 24, Illinois

Subsidiary of United-Carr Fastener Corporation, Cambridge, Mass.

www.americanradiohistory.com

New Electronic Products

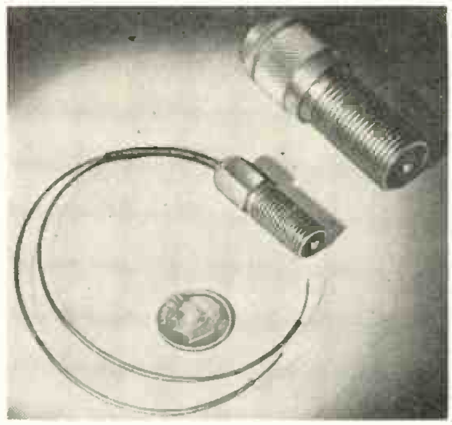
AUTOMATIC CONTROL



The Model 617-BR automatic balance control eliminates drift problems in colorplexers. A circuit locks the entire color broadcasting equipment in perfect balance within 20 seconds after it is turned on. Balance, thereafter, is held to better than 2%. But warm-up time is unnecessary. The need for stand-by personnel to reset balance is eliminated. Generally, colorplexers require at least two hours of warm-up time and must be rebalanced several times a day during normal operation as unbalance causes color receivers to "see" the wrong colors. **Telechrome, Inc., 88 Merrick Rd., Amityville, New York.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-27)

MAGNETIC PICKUP

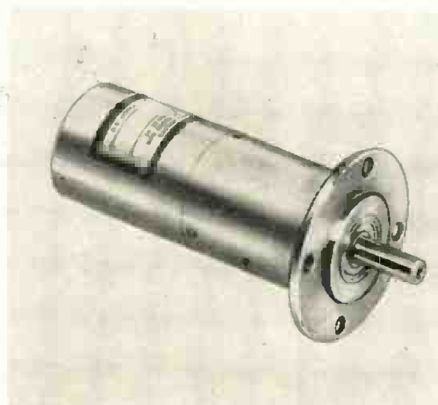
The Model 3015 miniature magnetic pick up, designed as a companion to the standard 3010 A pickup, generates electrical voltage when excited by steel or iron moving into its magnetic field.



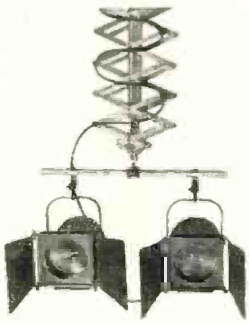
The new model affords the same ratio of output to speed characteristic of the 3010 A with an output to within 20% of the latter. All parts are mounted in a threaded, stainless steel body and supplied with 61in. connecting leads. Overall dimensions: $1\frac{9}{32}$ x $\frac{3}{8}$ in. hex with $\frac{3}{8}$ in. x 24 NF thread. Resonant frequency, 60 kc. Impedance, 300 ohms at 1,000 CPS. **Electro Products Laboratories, Inc., 4501 N. Ravenswood Ave., Chicago 40, Ill.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-29)

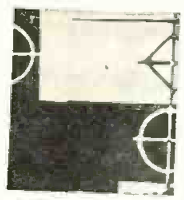
MOTOR

A subminiature aircraft-quality, planetary-gear, reduced motor has been developed that measures $\frac{7}{8}$" dia. and weighs 5 oz. Overall length varies from $2\frac{1}{2}$" to $3\frac{11}{64}$" depending on speed reduction ratios. Nineteen different standard reduction ratios are available. Units can be furnished with speed governors, though the feature necessarily increases



overall length. Standard or custom made mounting flanges can be supplied. Separate radio noise filters are also available. Units meet all applicable military specifications. **Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, O.**—TELE-TECH & ELECTRONIC INDUSTRIES. (Ask for 1-30)



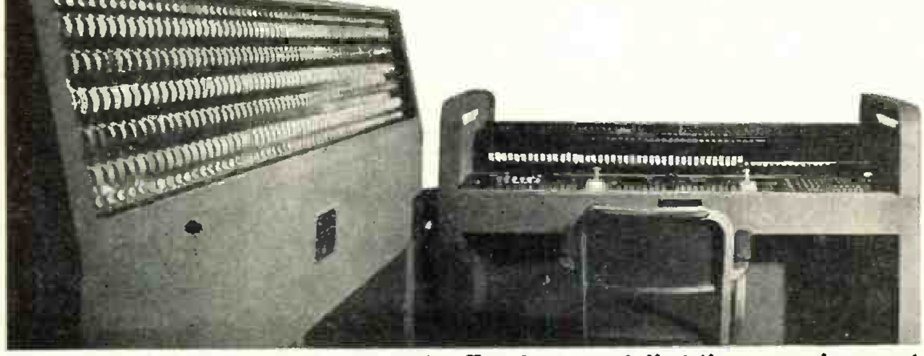


NBC chooses Century again!

*Recently, WRCA-TV in its first
all-color studio in New York
installed the C-I Board,
Century's all-electronic light system.
Now, KRCA-TV elects Century
to furnish all of its lighting equipment
and C-I electronic dimmer and switchboard
(the largest in the world)
for its first all-color T-V studio
located in Burbank, California.*

Century Lighting, Inc.
521 West 43rd Street
New York 36, N. Y.

1820-40 Berkeley Street
Santa Monica, Calif.



Century lighting equipment is Engineered lighting equipment

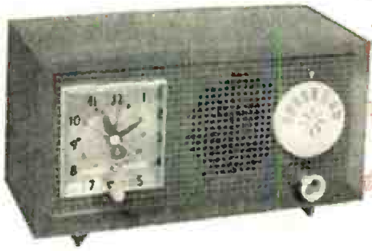
www.americanradiohistory.com

...here's new might for miniatures

Dur-Mica DM15

World's Smallest Mica Capacitor

The First Miniature Dipped Mica Capacitors with Parallel Leads.



(Shown Actual Size)

NOW! Also available . . .

El Menco Dur-Mica DM20

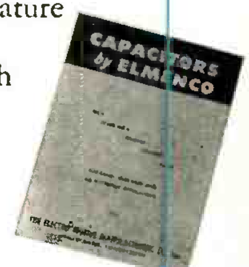
1 to 3900 mmf. at 500vDCw

1 to 5100 mmf. at 300vDCw

El-Menco Dur-Mica

IDEAL FOR PRINTED CIRCUITS. Meets all Humidity, Temperature and Electrical Requirements of MIL-C-5 Specifications. El Menco's Dur-Mica DM15 establishes a *"new dimension"* in capacitor performance with ranges from 1 to 390 mmf. at 500vDCw and 1 to 510 mmf. at 300vDCw. A new, tougher phenolic casing provides temperature co-efficient and stability equal to or better than characteristic F in all but the lowest capacity values . . . efficient operation at temperatures as high as 125°C. El Menco's Dur-Mica DM15 can be used in a variety of transistor circuits and other miniature electronic equipment in military and civilian applications.

Sells for Less than the famous El Menco CM-15 — Provides Economy of Size with Maximum Performance and Widest Application.



test El Menco "Dur-Micas" for yourself!

Write for free samples and catalog on your firm's letterhead.

El-Menco Capacitors

THE ELECTRO MOTIVE MFG. CO., INC.

WILLIMANTIC CONNECTICUT

molded mica · mica trimmer

tubular paper · ceramic

Jobbers and distributors write to Arco Electronics, Inc., 103 Lafayette St., New York, N. Y.

For product information, use inquiry card on last page.

www.americanradiohistory.com

WASHINGTON

News Letter

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

ONE-THIRD—Around one-third of the total electronics industry sales in 1955 will come from production for the nation's armed services, according to forecasts of the budget for the Department of Defense. It is estimated that military expenditures will amount to between $2.7 and $2.8 billions for communications and electronics equipment which is close to one-third of the projected sales for 1955 of $9.5 billions for the industry. The Eisenhower Administration is expected to recommend to the new Congress expenditures of $34 billion for the armed services and of this the Air Force will have an allocation of around $16 billion so that the preponderance of the electronics defense production will be for aviation electronics, air warning radar, and many other classified weapons purposes.

NEW TV METHODS—Expansion of television through home-subscription TV and satellite stations are "headache" problems now before the FCC and decisions on both methods of expanding television coverage will not be forthcoming from the Commission for several months in this new year, in all probability. Zenith Radio Corp. presented its proposal for commercial operation of subscription TV with a request for immediate authorization by the FCC without hearings, but there was no question that the Commission felt it had to give considerable study to the plan. VHF satellite TV stations are to be determined on a case-by-case basis by the FCC with the majority of commissioners holding that satellites should not be restricted only to UHF television.

PRIVATE TV RELAYS—Supported by leading electronics manufacturers like DuMont, Motorola, Philco, Raytheon and Dage Electronics, a large array of television stations representing all sections of the country, supported by the NARTB, have advocated that the FCC make permanent its proposed rules forbidding TV stations to build their own connecting facilities on an interim basis until the telephone companies install their own connections. Hearings are in all probability scheduled to be staged on this controversial issue. Television stations and the manufacturers, together with NARTB, contended that TV stations could build their own intercity links for one-quarter to one-half the cost of common carrier or telephone facilities. The American Telephone & Telegraph Co. stressed that stations generally tended to underestimate costs in planning privately built relays and such intercity connections mean wasteful duplication of facilities.

EUROPEAN ELECTRONICS—Western European nations are now making encouraging progress in electronics, Dr. E. Maurice Deloraine, Technical Director of the International Telephone & Telegraph Corp. and world-known leader in communications-electronics research, recently told a Washington audience. Handicapped by the wartime occupation, continental European nations were unable to maintain technical contact with the United States like Great Britain so they have had to rebuild and reorganize their electronics industry and laboratories, he cited. Today most European countries are on the same quality level and now are able to produce for NATO intricate and exacting military equipments. A handicap to the expansion of television in Europe is the use of four different standards, he pointed out.

INDUSTRIAL RADIO—The FCC's concept of the limited use of radio facilities within metropolitan areas will seriously hamper the development of manufacturers' and special industrial radio services in exceptions to the FCC's proposed special industrial radio service rules. The National Association of Manufacturers' Committee on Manufacturers Radio Use and the Special Industrial Radio Service Association emphasized limitation of radio facilities in metropolitan areas should be abandoned or revised because it is completely unrealistic and unworkable. Both organizations asked for oral argument on their exceptions.

PRIVATE SYSTEMS—Vigorous opposition to the plan of the Bell System of lease-maintenance arrangements for radio facilities for industrial users has been voiced by the American Petroleum Institute's central committee on radio facilities and will undoubtedly be supported by other similar organizations in the industrial and mobile radio communications field. The FCC has instituted a survey of the lease-maintenance arrangements of the telephone companies.

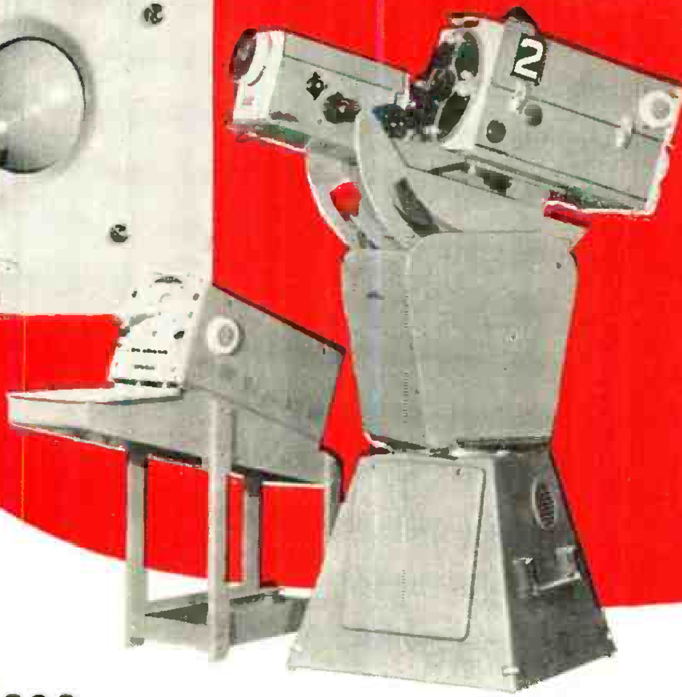
MICROWAVE—The petroleum industry's review of microwave facilities, undertaken upon request from the FCC to provide the Commission with basic information to be used in the drafting of regular microwave rules, has been completed and was submitted to the Commission. The project was headed by Dr. William M. Rust, Chairman of the American Petroleum Institute's Central Committee on Radio Facilities, who is with the Humble Oil & Refining Co. Dr. Rust also expects to ask the Commission for a joint meeting some time in January with representatives of the Radio-Electronics-Television Manufacturers Association, which is conducting a similar study.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

www.americanradiohistory.com

The REVOLUTIONARY NEW GPL PYE REMOTE CONTROL CAMERA



one hand does the work of many...

USE the new GPL one-hand camera in studio or field

Remote control pedestal can be operated from points 1,000 feet away from control center. Full pan, tilt, zoom, focus and iris. Set up and leave unattended for sports, conventions, parades, civic affairs.

Here is the new one-hand camera that makes possible one-camera shows with all the quality of two chains, yet *is operated by one hand from the control room.*

It's an image orthicon camera mounted on the remote control pan and tilt pedestal developed exclusively by GPL PYE. Added is the GPL-Watson Vari-Focus lens, with zoom in or out controlled by two buttons on the pan-tilt stick.

With one hand an operator can pan and tilt to follow action . . . can zoom in or out for extreme close-up or full stage shots. The same operator may handle audio, film or slide control, or switching.

No operator is needed on the studio floor. If you want protection, a stand-by chain can be kept hot with a capped lens in place. Open lenses can be brought instantly into action by remote control of the turret. This is a feature of GPL PYE cameras alone—all have remote control of focus, lens change and iris.

Ask For Cost Figures: GPL has worked out complete cost figures of what this camera can save you in operating expenses, interest, amortization and maintenance. Savings more than equal cost of added features, including the 3″ to 30″ lens (fully color corrected) and the pan and tilt pedestal. The camera puts money in your pocket the first month of operation.

Phone, wire or write for these figures . . . see how this new development can be used in your station operations.

Write, wire or phone for information on complete television station equipment

GPL

General Precision Laboratory

INCORPORATED

PLEASANTVILLE NEW YORK

Regional Offices: Chicago • Atlanta • Dallas • Glendale, California

For product information, use inquiry card on last page.

www.americanradiohistory.com

New Products

RADIANT OVEN for continuous production soldering announced by Electrical Industries, 44 Summer Ave., Newark 4, N. J., has three 1,100 w. "Chromalox" far-infrared heaters. Gives a density of 40 w./sq. in. Conveyor driven by ¼ in. h.p. motor. (Ask for A-1-11)

BOBBINLESS PRECISION RESISTORS. A new line of flat, rectangular, modular-constructed, bobbinless, non-inductive precision wire resistors has been announced by Monson Mfg. Corp., 6059 W. Belmont Ave., Chicago 34, Ill. (Ask for A-1-12)

TV PACKAGE, primarily for TV broadcasting, is comprised of the Types 325 TV line selector and 327 cathode ray oscillograph recently developed by Allen B. DuMont Laboratories, Inc., Instr. Div., 760 Bloomfield Ave., Clifton, N. J. (Ask for A-1-13)

TOOL, Y10Q-1 "Hytool," has recently been developed by Burndy Engineering Co., Inc., Norwalk, Conn., for installing compression-type lugs, links, and ferrules. Used either as a portable or bench-mounted tool. (Ask for A-1-14)

LEADER AND TIMING TAPE to be spliced at both ends of a magnetic recording tape to save threading wear and tear has been added to the line of Reeves Soundcraft Corp., 10 East 52nd St., New York, N. Y. 150 ft. roll comes in a dispenser pack. (Ask for A-1-15)

SELF-COOLED SERVO, Series 5100-2237, made by John Oster Mfg. Co., Avionic Div., Racine, Wis., weighs only 3.188 lbs. but pulls as much as 1/15th h.p. at 6,000 rpm. Has 22 oz./in. stall torque. (Ask for A-1-16)

SYNCHROS, size 15 series, announced by Clifton Precision Products Co., Inc., Marple at Broadway, Clifton Heights, Pa., have 1.437 in. max diam. and 1.640 in. max overall length. Av. wt. 4.7 oz. (Ask for A-1-17)

COAXIAL SWITCH. A new 5-position unit, Model 550, by Barker & Williamson, Inc., 237 Fairfield Ave., Upper Darby, Pa., is equipped with 6 S0239 type connectors that enable selection of any of five 52 or 75 ohm lines. (Ask for A-1-18)

PUSH BUTTON SWITCH HANDLES. The B1000 series, made by Hetherington, Inc., Sharon Hill, Pa., are rated for resistive loads at 5 amps, or inductive loads of 3 amps at 115 v ac or dc. Snap-action mechanism greatly reduces arcing and wear. (Ask for A-1-19)

RESISTORS. Eight "P" Type encapsulated resistors extend the range and ratings of such units available at Shallcross Mfg. Co., Collingdale, Pa. The line now has wattage ratings from 0.50 to 2.75; max. resistance rating 0.05 to 15 megohms. (Ask for A-1-20)

SHIFT REGISTERS. A new line of magnetic shift registers and assemblies, custom engineered by Sprague Electric Co., 233 Marshall St., North Adams, Mass., are designed to fit the specific requirements of each application. (Ask for A-1-25)

METER CALIBRATOR. A voltage and current meter calibrator, announced by Kay Lab, 1090 Morena Blvd., San Diego 10, Calif., employs the Kay Lab dc power supply circuitry. Gives output voltage or current in small steps. Stability, 0.01%. Accuracy 0.05%. (Ask for A-1-26)

VOLTAGE DIVIDER, Model 8350, announced by Shallcross Mfg. Co., Collingdale, Pa., uses the Kelvin-Varley circuit and offers total resistances of 100, 1,000, 10,000 and 100,000 ohms with up to 6 dials for the latter two. (Ask for A-1-27)

"CTI," by Arnoux Corp., 1357 S. Hawthorne Blvd., Hawthorne, Calif., is a compact temperature measuring, indicating and warning system for industrial, airborne, and laboratory use. Dial markings from 50 to 120%. (Ask for A-1-28)

MORE TECHNICAL INFORMATION describing the new products presented here may be obtained by writing on company letterhead to New Products Editor, TELE-TECH & ELECTRONIC INDUSTRIES, 480 Lexington Ave., New York 17, N.Y., listing numbers given at end of each item of interest. Please mention title of position held.

www.americanradiohistory.com

if you need to

stop electricity

for a precise interval

it'll pay you to look into

Adlake

mercury relays

Adlake relays require no maintenance whatever...are quiet and chatterless...free from explosion hazard...dust, dirt, moisture and temperature changes can't affect their operation. Mercury-to-mercury contact gives ideal snap action, with no burning, pitting or sticking. Time delay characteristics are fixed and non-adjustable.

The Adams & Westlake Company
Established 1857
ELKHART, INDIANA • New York • Chicago

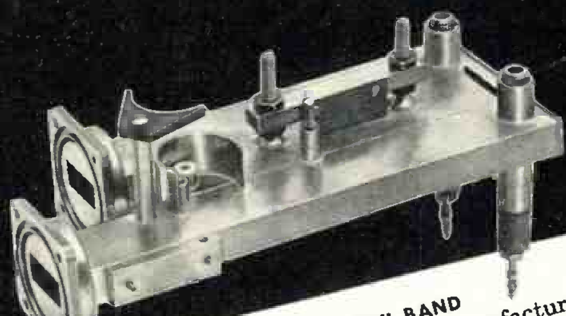
the *original* and largest manufacturers of mercury plunger-type relays

www.americanradiohistory.com

DICO

MICROWAVE COMPONENTS

DICO designs and manufactures custom and standard Co-axial Line and Waveguide components. These are produced under highest quality control standards, a typical example being . . .



WAVEGUIDE MIXER ASSEMBLY, "X" BAND
This particular mixer assembly, manufactured to exacting customer's drawings, is typical of DICO'S custom products.

Send for catalog 953

DIAMOND MICROWAVE CORPORATION
7 North Avenue, Wakefield, Mass.

3 FIELDS 1 instrument

NUCLEONICS
Laboratory Instrumentation

Color Television
Color Channels and Test Work

Digital Computers
Development laboratory use.

Less than 1 CPS to 10 MC/S
Variable Impedance Input
Variable Impedance Output
Low Compression and Overshoot

Model 120
Laboratory Video Amplifier

AEL AMERICAN ELECTRONIC LABORATORIES, INC.
641 Arch street Phila. 6, Penna.

New Product Briefs

(*Continued from page 88*)

POTENTIOMETER. Ace Electronics Associates, 125-129 Rogers Ave., Somerville 44, Mass., have announced a new subminiature precision wire-wound potentiometer to the trade under the trade name, "Acepot." Resistances, 200 to 50,000 ohms. (Ask for A-1-47)

OSCILLOSCOPE developed by the Electronic Tube Corp., 1200 E. Mermaid Lane, Philadelphia 18, Pa., the FT-11, employs a 5 in. flat-face CRT of the electrostatic focus and deflection type. Accelerating potential 2,000 v. (Ask for A-1-48)

PATTERN RECORDER, Model 121, continuously records antenna patterns in rectangular coordinates. Will measure an input signal with an amplitude span of less than 10 mv accurately to better than 0.5% full scale, made by Scientific Associates, 580 Virginia Ave., N. E. Atlanta, Ga. (Ask for A-1-49)

CRYSTAL CONVERTERS, Model MM-101, made by Mohawk Electronic Research Laboratories, Inc., RD 4, Box 126-A, Amsterdam, N. Y., are constructed on the modular principle of using plug-in r-f sections to cover the VHF spectrum 28 to 300 MC. (Ask for A-1-50)

SAMPLING SWITCH, high speed, for hub, hanger, pedestal, or flange mounting, by General Devices, Inc., P.O. Box 253, Princeton, N. J., has these typical specifications: 60 contacts, 30 channels, 1 pole. Sampling rates, to R.P.S. (Ask for A-1-39)

TELEPHONE RELAYS, (Type A) introduced by Kurman Electric Co., 35-18 37th St., Long Island City, N. Y., for applications requiring opening and closing time to 14 individual circuits, has coil resistance to 63,000 ohms. Maximum coil dissipation is 10 w. (Ask for A-1-40)

TUBE SOCKETS, Models M-730 and M-930, 7 and 9 pin, respectively, made by Livingston Electronic Corp., Livingston, N. J., extend only 5/16 in. above and less than 3/8 in. below chassis, including solder-type terminals. (Ask for A-1-42)

STABILIZING AMPLIFIER (TA-7B) offered by RCA Engineering Products Div., Camden, N. J., for correcting video signals for hum, low frequency distortion, operates with equal efficiency with monochrome signals. (Ask for A-1-41)

CBS Licenses RCA to Make Color TV Tubes

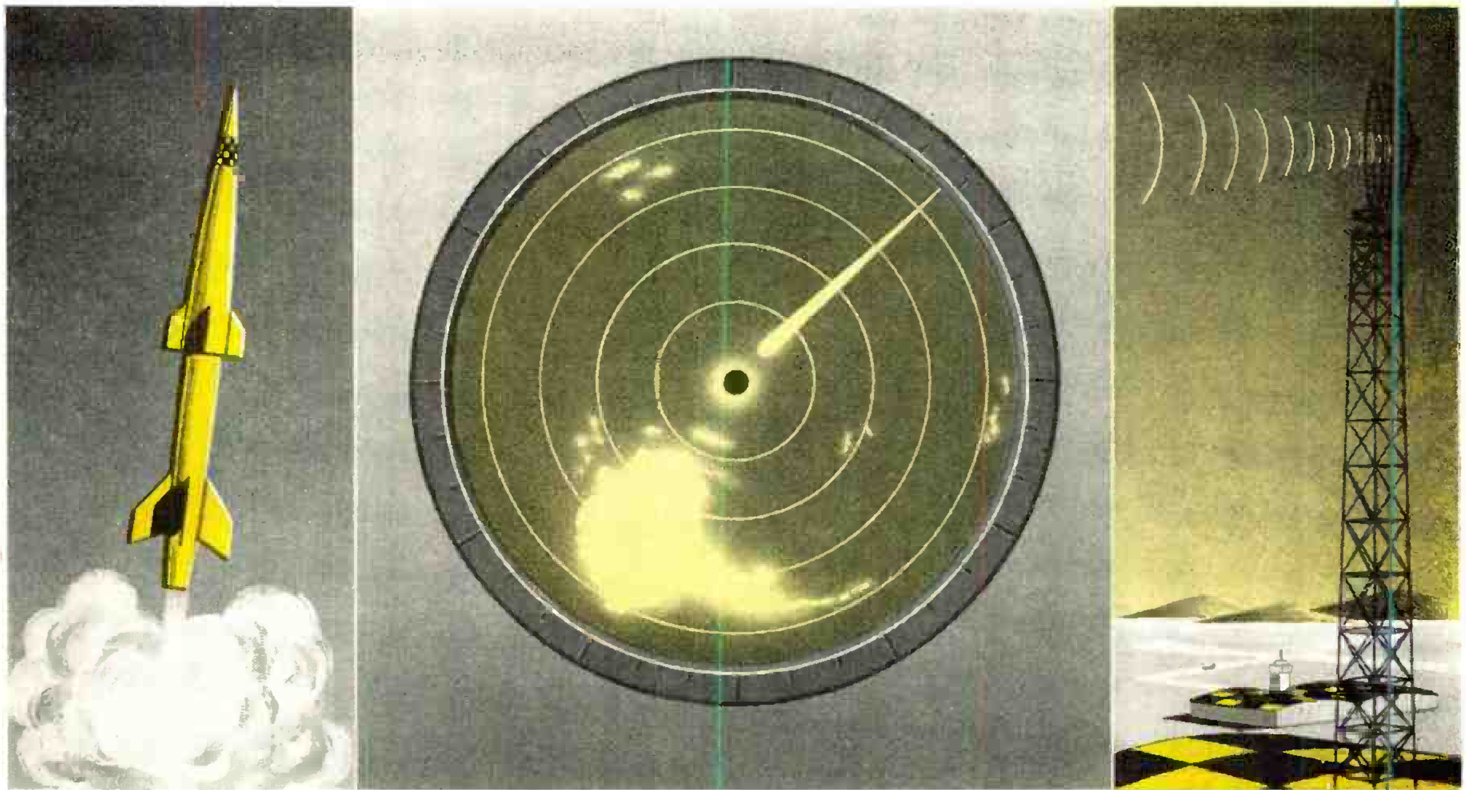
CBS has licensed RCA to manufacture direct-view color TV picture tubes of the curved-screen mask type. Charles F. Stromeyer, Pres. of CBS-Hytron, signed the licensing agreement under U. S. Patent No. 2,690,518 for CBS. E. C. Anderson, Exec. Vice Pres. of RCA, signed for Radio Corp. of America.

The license grants RCA the right to use the original patent as well as other CBS patents that may issue from pending applications and future inventions for direct-view color TV picture tubes during the 5-year term of the agreement.

RCA Semiconductor Dept.

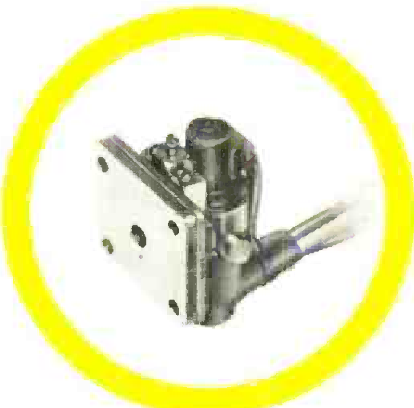
Establishment of a separate Semi-Conductor Operations Dept., devoted exclusively to engineering and manufacturing transistors and other semi-conductor electron devices, has been announced by Douglas Y. Smith, Vice-Pres. and Gen. Mgr., RCA Tube Div. Dr. Alan M. Glover has been appointed manager of the new department, which will have its headquarters at Harrison, N. J.

www.americanradiohistory.com



FOR ALL Ku-BAND APPLICATIONS SPECIFY THE FINEST KLYSTRON...

VARIAN'S NEW VA-94



TYPICAL OPERATION

Frequency	*16.5 kmc*
Resonator Voltage	*300 v*
Resonator Current	*38 ma*
Reflector Voltage	*– 150 v*
Power Output (VSWR < 1.1)	*40 mw*
Electronic Tuning	*65 mc*

Varian now offers the most advanced reflex klystron ever developed for airborne radar local oscillator and beacon service. *The VA-94* provides a minimum power output of 20 mw throughout its range of 16 to 17 kmc . . . to give you absolutely reliable operation at any altitude without pressurization.

Exclusive Varian features include a unique brazed-on external tuning cavity . . . to assure you of excellent frequency stability, extremely low microphonics, slow tuning rate and long tuning life. Its single screw tuner adapts easily to motor tuning. The VA-94 weighs only four ounces and mates directly with standard waveguide flanges.

FOR EXPERIMENTAL APPLICATIONS . . . SPECIFY THE VERSATILE NEW VA-92. Varian's VA-92 meets all reflex oscillator requirements in the frequency range 14 to 17.5 kmc . . . is especially suitable for signal generators and laboratory testing. It gives you the ease of tuning, ruggedness and reliable performance that has made Varian klystrons the first choice among microwave engineers. Special features include linear reflector voltage tracking, wide tuning range and high altitude operation without pressurization.

FOR OTHER K-BAND APPLICATIONS . . . SPECIFY V-39, V-40 AND VA-96.

FOR COMPLETE SPECIFICATIONS and technical data on the outstanding new VA-94, and other Varian klystrons, contact our Application Engineering Department.

IN KLYSTRONS, THE MARK OF LEADERSHIP IS

VARIAN associates
PALO ALTO 10, CALIFORNIA

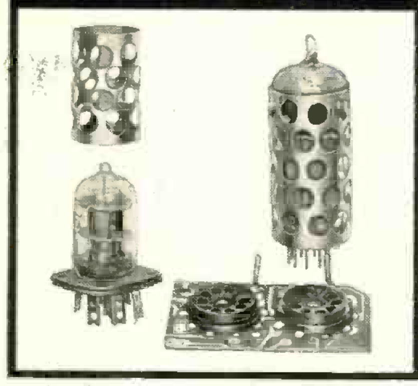
Representatives in all principal cities

For product information, use inquiry card on last page.

www.americanradiohistory.com

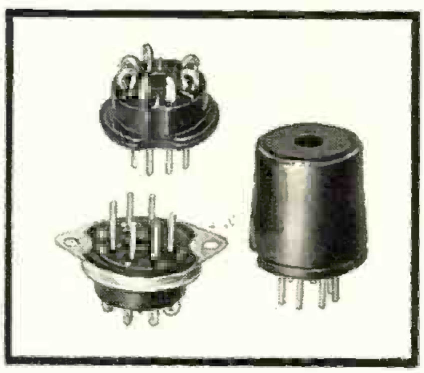
NEW

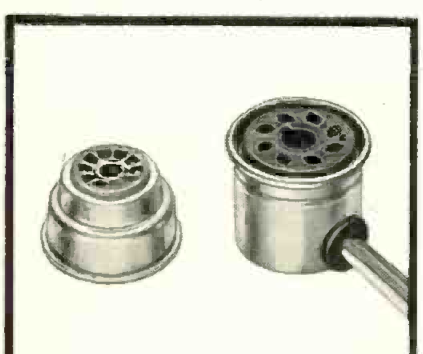
TUBE ACCESSORIES and ELECTRONIC HARDWARE



"Ventilatar" shields not only improve "hot" tube performance by dissipating heat but are the mast economical shields in Methode's extensive line. Easily handled and compression fitted to ground terminals on Methode laminated or printed circuit sockets, shields are available in lengths of 1-11/16" or 2-1/16" with one standard diameter which fits either seven or nine pin tubes. Available with tin or black oxide finish.

Molded phenolic plugs, with seven pins, 45° apart on .375" centers, mate with economical standard miniature sockets. Designed to save space and competitive in price with bulky wafer pin plates, these units are ideal for base assemblies on plug-in components or quick-disconnect harness assemblies. Plugs are available with or without vinyl caps or mounting saddles. General purpose or mica phenolic insulators with cadmium plated brass pins are standard.





For high voltage tubes these corona caps and socket combinations for both octal and novol sizes feature generously rolled outer surfaces. Assemblies are designed for screw mounting to condenser studs or stand offs and are available with general purpose black or low loss mica phenolic insulators. Noval caps available with 1-5/16" or 1-1/2" major rim diameter. Octal units have insulating fibre liners.

Newly designed laminated tube sockets for dip solder attachment to printed wiring panels supplements Methode's earlier development of molded snap in printed circuit sockets. Individual terminal hole punching permits printing of jumper and cross over connections directly on circuit panel. Springlike tabs permit amazingly strong terminal dip solder connections.

BRAND NEW CATALOG AVAILABLE ON REQUEST

METHODE Manufacturing Corp.
2021 West Churchill Street • Chicago 47, Illinois

Geared to produce Plastic and Metal Electronic Components

Power Supply

(*Continued from page 71*)

signed. The capacitance reduction is accomplished by inserting an air gap between the core and the one or more secondary windings of the power transformer, and by compactly mounting the entire secondary circuit on an insulated chassis. Typical capacitance values obtained with this design range from 8 to 18 μμf and are comparable to the stray shunting capacitances of equivalent batteries. With moderately low driving impedance, this amount of capacitance has no appreciable effect at frequencies below several megacycles.

To reduce magnetic leakage resulting from the isolating air gap in the transformer, and thereby improve the voltage regulation, a split primary winding is usually employed, one-half on each side of the secondary winding. The voltage regulation is further improved in a 200-volt 20-ma model of the supply by use of electronic stablization; in this model the output voltage varies approximately 1% from no load to full load, and over a reasonable range of line voltages.

An added advantage of the MBS low-capacitance power supply over batteries is that the output voltage of the former can be varied easily and continuously. This is accomplished conventionally, either by an internal potentiometer in the case of the electronically regulated model or, with the other models, by an external variable-voltage transformer.

The special power supply is particularly useful in the laboratory as a means for easily determining the proper operating voltages for experimental circuits. In addition to the direct-coupling application, for which it is uniquely suited, it may also be used in circuits in which one terminal is grounded, though it offers no advantages when used in such conventional applications.

Servo To Sell Recorder

Servo Corp. of America, New Hyde Park, N.Y. has been licensed by Haller Raymond & Brown, Inc., State College, Pa., to make and sell the radar recorder-reproducer system developed by Haller, Raymond & Brown under the name of Rafax. Servo is the exclusive domestic and overseas commercial sales rep for the system which simultaneously records the air-ground voice, radar video, and directional information from aircraft in airport traffic control areas through the medium of a standard tape recorder. For details see July 1954 TELE-TECH & ELECTRONIC INDUSTRIES, page 70.

NOW! For your most important electronic control applications

RUGGED

Completely ruggedized tubes developed especially for the Armed Forces to operate under conditions of severe shock and mechanical vibration.

RELIABLE

Sylvania premium performance tubes offer high reliability for applications in electronic computors and guided missiles.

SYLVANIA GAS TUBES

To MEET your electronic control equipment needs, whether military or commercial, Sylvania offers a wide selection of gas tubes engineered to meet the most rigid specifications. These include tubes for commercial use in applications where reliable performance is required under difficult conditions of shock and vibration. Some Sylvania gas tubes have been especially designed to meet MIL-E-1 specifications.

Whatever your needs, you can select any Sylvania gas tube with confidence that it is manufactured under the same standards of quality and dependability which recommend their use in vital military equipment.

Sylvania's complete line offers you dependable tube types for your most important control functions.

A SYLVANIA TYPE FOR EVERY NEED

Type	Application
0A2	voltage regulator
0A4G	relay and grid controlled rectifier
0B2	voltage regulator
0B3	voltage regulator
0C3	voltage regulator
0D3	voltaae regulator
1B59/R1130B	glow modulator diode
1D21/SN4	strobotron
2D21	relay and grid controlled rectifier
2D21W	relay and grid controlled rectifier
R4330	strobotron
S413	strobotron
SA309	strobotron
1237	full-wave rectifier
20A5	trigger tube
5643	relay tube
5644	voltage regulator
5651	voltage reference
5823	relay, rectifier
6D4	relay, relaxation osc. noise generator
6308	voltage reference
6483	trigger tube

Send for new bulletin for complete data on Sylvania Gas Tubes.

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC. • 1740 BROADWAY, NEW YORK 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., St. Catherine Street, Montreal, P. Q.

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

Sylvania Electric Products Inc.
1740 Broadway, New York 19, N. Y.
Please send Technical Data on Sylvania Gas Tubes.

Name ______________________

Company ______________________

Address ______________________

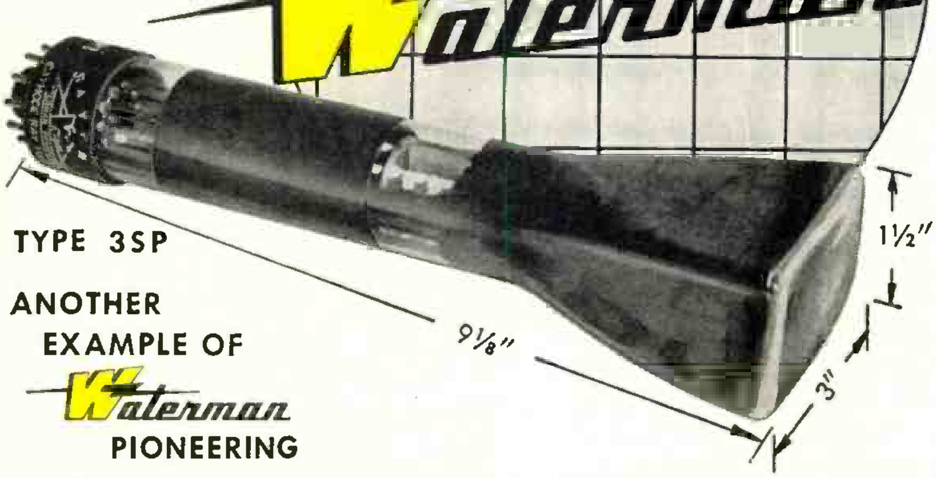
City ____________ Zone ____ State ____________

For product information, use inquiry card on last page.

www.americanradiohistory.com

RAYONIC CATHODE RAY TUBES

by Waterman



TYPE 3SP

ANOTHER EXAMPLE OF Waterman PIONEERING

The introduction of the 3SP type Waterman RAYONIC cathode ray tube has been received with great enthusiasm. Its unique applications have more than justified enthusiasm. From a mechanical standpoint alone, this acceptance has been based upon the fact that two 3SP cathode ray tubes occupy the same space as a single 3 inch round tube—a feature which makes the tube an outstanding performer in multi-trace work. As many as ten tubes have been mounted across a standard relay rack panel without crowding. The low deflection factors of the 3SP have still further widened its use in single cathode ray tube video devices. The choice of screen is optional and available in P1, P2, P7 and P11 phosphors. The 3SP1 is available with JAN stamping. Let the 3SP type Waterman RAYONIC cathode ray tubes add their new concept of compactness to your own equipment.

TECHNICAL DATA The basic properties of the cathode ray tube that concern the designer or the user are: deflection sensitivity, unit line brightness, line width, static voltage requirements and physical size. A comparison between cathode ray tubes manufactured by Waterman Products Company is shown in the table below. These tubes are available in P1, P2, P7 and P11 phosphors. 3JP1, 3JP7, 3SP1 and 3XP1 are available as JAN tubes.

TUBE	PHYSICAL DATA			STATIC VOLTAGE			DEFLECTION*		LIGHT OUTPUT**
	Face	Length	Base	A3	A2	A2 Max.	Vert	Hor	
3JP1	3"	10"	Med Diheptal	3000	1500	2000	111	150	352
3MP1	3"	8"	Sm Duodecal		750	2500	99	104	33
3RP1	3"	9⅛"	Sm Duodecal		1000	2750	61	86	44
3SP1	1.5x3"	9⅛"	Sm Duodecal		1000	2750	61	86	44
3XP1	1.5x3"	8⅞"	Loctal		2000	2750	33	80	218

*Deflection in volts per inch.
**Light output of an element of a raster line (one mm long and not exceeding .65mm in width) in microlumens.

All heaters 6.3 V AC, .6 AMP.

WATERMAN PRODUCTS CO., INC.
PHILADELPHIA 25, PA. CABLE ADDRESS: POKETSCOPE

MEMO... Write for details today!

WATERMAN PRODUCTS INCLUDE
3JP1, 3JP7, 3SP1, 3XP1 JAN RAYONIC® Cathode Ray Tubes
3JP—3MP—3RP—3SP—3XP RAYONIC CATHODE RAY TUBES
Available in P1, P2, P7, and P11 Phosphors
POCKETSCOPES® PULSESCOPES® RAKSCOPES®
And Other Associated Equipment

WATERMAN PRODUCTS

Military Contract Awards

Electronic products, dollar value, and names of manufacturing contractors receiving awards as reported by U.S. Dept. of Commerce.

Headset Assy—114,812—Permoflux Corp., 4900 W. Grand Ave., Chicago, Ill.
Amplifier—191,480—General Electric Co., 1405 Locust St., Philadelphia 2, Pa.
Charger, battery—96,780—The Electric Products Co., 1725 Clarkstone Rd., Cleveland 12, Ohio.
Battery, submarine—619,200—The Electric Storage Battery Co., Philadelphia, Pa.
Transformers—139,206—Jefferson Electric Co., Bellwood, Ill.
Electrodes, welding—36,778—Arcos Corp., 1500 S. 50th St., Philadelphia 43, Pa.
Electrodes, welding—31,993—Air Reduction Co., Inc., 60 E. 42nd St., New York 17, N. Y.
Cable, power—34,264—American Steel & Wire Div., United States Steel Corp., Suburban Sta. Bldg., Philadelphia, Pa.
Transmitters, syncro control—61,031—Ketay Instrument Corp., 555 Broadway, N. Y.
Panels, generator control—29,578—Westinghouse Electric Corp., Dayton, Ohio.
Actuator Assy—34,291—Airesearch Mfg. Co., Div. Garrett Corp., Los Angeles, Calif.
Switch assy, control stick—250,187—Guardian Elec. Mfg. Co., Chicago, Ill.
Beam Guidance Control System—146,055—Eclipse-Pioneer Div., Bendix Aviation, Teterboro, N. J.
Radar Set—1,766,620—The Hallicrafters Co., Chicago, Ill.
Autopilot Systems—3,001,682—Lear Inc., Grand Rapids, Mich.
Batteries, replenishment — 250,928 — Reading Batteries, Inc., Reading, Pa.
Radiosonde Adapter System—29,814—Barth Engineering and Mfg. Co., Milldale, Conn.
Keyer, frequency—271,164—Northern Radio Co., Inc., 143-145 West 22nd St., New York 11, N.Y.
Spare Parts, signal generator—32,292—Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.
Keyer and Control—32,447—Grimes Mfg. Co., 515 N. Russell St., Urbana, Ohio.
Power Units — 35,153 — Minneapolis-Honeywell Regulator Co., 2600 Ridgway Rd., Minneapolis 13, Minn.
Tube, electron—71,425—Radio Corp. of America, RCA Victor Div., Camden, N.J.
Tube, electron—61,102—Taylor Tubes Inc., 2312 Wabash Ave., Chicago, Ill.
Tube, electron—33,600—United Electronic Co., 41 Spring St., Newark, N.J.
Tube, electron—39,565—Radio Corp. of America, Tube Div., 415 S. 5th St., Harrison, N.J.
Tube, electron—35,200—Sylvania Electric Products, Inc., 1740 Broadway, New York, N.Y.
Tube, electron—61,600—Sylvania Electric Products, Inc., 1740 Broadway, New York, N.Y.
Tube, electron—74,608—Raytheon Mfg. Co., 55 Chapel St., Newton, Mass.
Potentiometer—34,572—Emmerson Electric Mfg. Co., St. Louis 21, Mo.
Kits—41,025—Sperry Gyroscope Co., Great Neck, L.I., New York.
Motor Generator—561,971—Kurz and Root Co., Appleton, Wis.
Screen, X-Ray protective—35,609—Fabco Metal Products, 827 East Linden, Linden, N.J.
Video Recording System—25,850—General Precision Laboratory, Inc., 63 Bedford Rd., Pleasantville, N.Y.
Motor Generator—374,815—Leach Corp., Los Angeles 58, Calif.
Transformer—30,200—Hughes Tool Co., Culver City, Calif.
Indicator, tachometer—245,169—General Electric, W. Lynn, Mass.
Tube, electron—2,066,467—Raytheon Mfg. Co., Waltham, Mass.
Receiver, transmitter—422,315—Collins Radio Co., Cedar Rapids, Ia.

(Continued on page 96)

ANNOUNCING ANOTHER NEW AMPEX

but this time it's a superb amplifier-speaker

It's a 25 pound portable amplifier-speaker that matches the Ampex 600 tape recorder in appearance **and in quality, too!** The new Ampex 620 has FLAT ACOUSTIC RESPONSE from 60 to 10,000 cycles. This would be a great achievement in a speaker of any size, but in a 25-pound portable it's truly exceptional — in the Ampex tradition.

A quality demonstrator to sell broadcast time
Program samples or auditions can now be demonstrated with a new impact and clarity that will make prospective time buyers sit up and take notice. The Ampex 620 can be carried anywhere. It has ample power for a group hearing in office, conference room or small auditorium.

A speaker to monitor with greater sensitivity
The Ampex 620 is an extra sensitive monitoring unit usable anywhere inside the studio and outside with portable recorders as well. It will give operating personnel a much better indication of recording and broadcast quality than the usual monitor speaker. This can help forestall criticism from the growing percentage of your audience who listen through high quality amplifiers and speakers.

AMPEX 620 PORTABLE AMPLIFIER-SPEAKER
Connects with your studio console — or reproduces directly from tape recorders, turntables or pre-amplified microphones. The Ampex 620 is a perfectly integrated design including a 10-watt amplifier, loudspeaker, reciprocal network, level control, equalization control and acoustically correct enclosure. By standard test procedures **in air** it has low distortion and an acoustic response curve that is essentially flat from 65 to 10,000 cycles. Price is $149.50 complete.

AMPEX 600 PORTABLE TAPE RECORDER
Like the great Ampex studio tape recorders the 600 is the best of its kind. It weighs only 28 pounds, yet the Ampex 600 can serve every broadcast station need. For auditions and demonstrations it is the perfect sound source for the Ampex 620 amplifier-speaker. Prices: $498 unmounted, $545 in portable case.

For full description and specifications write Dept. U-1977

Signature of Perfection in Sound

AMPEX CORPORATION

934 CHARTER STREET
REDWOOD CITY, CALIF.

Distributors in principal cities (see classified section of your telephone directory under "Recording Equipment.")
Distributed in Canada by Canadian General Electric Company.

For product information, use inquiry card on last page.

www.americanradiohistory.com

FOR TRANSFORMER SKILL

"Making transformers" some say, "is easy. Just wind coils for stock voltages . . . dip or pot them . . . and you're in business."

That may be true for some who produce *stock* transformers. But it hardly accounts for the electronic manufacturers who more and more come to Airdesign seeking easy solutions to tough problems. For Airdesign has come to be the source for quality transformers made to answer design problems or to meet the industry's most stringent specifications.

Long experience and skill of Airdesign's people alone account for this ability to make all kinds of transformers up to 5KVA in large quantity to lab sample quality. This is the difference in transformer production—this is Airdesign. Try Airdesign on your next transformer order and see.

AIRDESIGN, INC.
ELECTRONIC COMPONENTS
241 Fairfield Ave., Upper Darby, Pa.

SEND IN THIS COUPON FOR NEW BROCHURE ON INDUSTRIAL & MILITARY TYPE TRANSFORMERS

Gentlemen:
Send me the latest copy of your literature describing Airdesign Transformers.

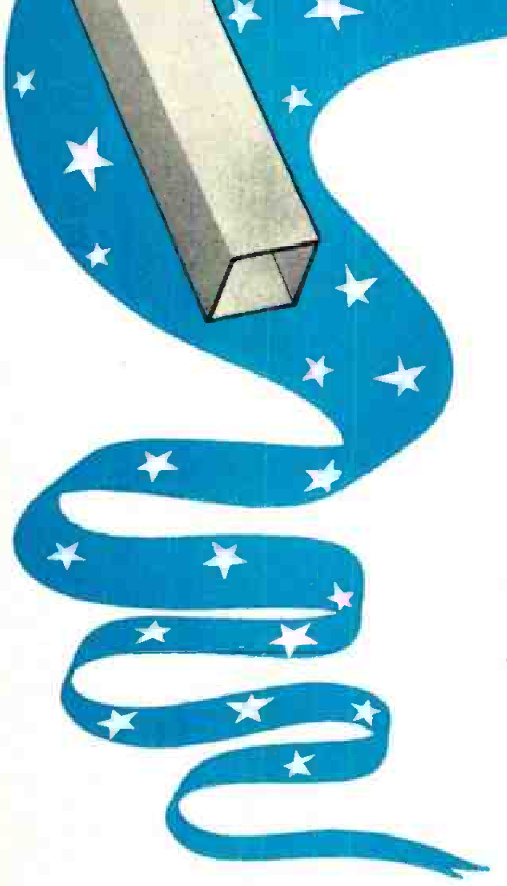
Name__________
Title__________
Company__________
City__________Zone____State____

Military Contract Awards

(*Continued from page 94*)

Sub Assys, switch drive—32,900—Bendix Aviation Corp., E. Joppa Rd., Towson 4, Md.
Kits, modification — 126,328 — Sperry Corp., Sperry Gyroscope Co., Div., Great Neck, L.I., N.Y.
Repair Parts, gyro compass—74,406—Sperry Corp., Sperry Gyroscope Div., Great Neck, L.I., N.Y.
Test Sets, radar—134,606, Radiation, Inc., Melbourne, Fla.
Tube, electron—29,400—Allen B. Du Mont Lab., 750 Bloomfield Ave., Clifton, N.J.
Servo Motor—70,000—Keytay Mfg. Corp., New York, N.Y.
Tube, electron—84,171—Sylvania Products, Inc., 1740 Broadway, N.Y.
Tube, electron—197,346—Radio Corp. of America, RCA Victor Div., Harrison, N.J.
Training Set, "Radiac"—40,426—Taffet Radio and Television Co., 2530 Belmont Ave., Bronx 58, N.Y.
Exciter—41,300—The M. B. Mfg. Co., Inc., 1060 State St., New Haven 11, Conn.
Circuit Breaker—36.248—I. T. E. Circuit Breaker Co., Philadelphia, Pa.
Motor Generator—87,676—Cline Electric Mfg. Co., Chicago, Ill.
Switchboards—382,848—Walker Electrical Co., Inc., Atlanta, Ga.
Switchboards—93,512—Electric Service Engineering Co.
Power Supply, "Teletype" — 97,165 — Teletype Corp., Chicago, Ill.
Tubes, electron—57,541—Varian Associates, Palo Alto, Calif.
Sonar Domes, rubber—298,017—The B. F. Goodrich Co., Akron, Ohio.
Antennas — 657,963 — Bendix Aviation Corp., Radio Div., Towson, Md.
Operator, motor and gear drive—96,015—Piezo Mfg. Corp., Staten Island, N.Y.
Cable, electric—10,248—W. A. Leiser and Co., 1219 Race St., Philadelphia, Pa.
Cable Assys—250,000—Powertone Corp., 112 W. Liberty St., Milford, Mich.
Microphone Assys—55,068—Telephonics Corp., Park Ave., Huntington, L.I., N.Y.
Microphone Assys—64,495—Roanwell Corp., 662 Pacific St., Brooklyn 17, N.Y.
Actuators—69,001—The Cleveland Pneumatic Tool Co., 3781 E. 77th St., Cleveland, O.
Generators—40,606—Bendix Aviation Corp., Red Bank Div., Eatontown, N.J.
Wires—46,555—Boston Insulated Wire and Cable Co., 65 Bay St., Boston 25, Mass.
Amplifiers—148,848—Lear, Inc., 110 Ionia Ave., N.W., Grand Rapids, Mich.
Switching Units—36,669—The Arrow Hart and Hageman Electric Co., Hartford.
Tubes, electron—606,504—RCA Victor Corp., Camden, N.J.
Receptacles, connector—28,093—American Phenolic Corp., 1830 South 54th St., Chicago 50, Ill.
Transmitter—77,780—Keytay Mfg. Corp., 555 Broadway, New York, N.Y.
Converter-Amplifier—89,846—Espey Mfg., New York 21, N.Y.
Mounts, Torquer—684,575—Aeroflex Labs, Inc., Long Island City, N.Y.
Receiver, radio—59,245—The Hallicrafters Co., 4401 W. Fifth Ave., Chicago 24, Ill.
Tube, electron—43,762—Bomac Laboratories, Inc., Salem Rd., Beverly, Mass.
Tube, electron—444,515—Eitel-McCullough, Inc., 798 San Mateo Ave., San Bruno, Calif.
Film, radiographic—1,737,585—General Aniline and Film Corp., Ansco Div., Binghamton, N.Y.
Receivers, transistorized—26,835—Radio Corp. of America, Victor Div., Camden 2, N.J.
Tube, electron—79,852—Radio Corp. of America, RCA Victor, Div., Harrison, N.J.
Receiver, "Rawin"—936,333—Crosley Div., 2630 Milford Rd., Cincinnati, O.
Carcinatron—82,339—American Radio Co., Inc., 445 Park Ave., New York, N.Y.
Radio Beacon—63,789—Avion Instrument Corp., 299 State Highway No. 17, Paramus, N.J.

www.americanradiohistory.com



CLEVELITE*

LAMINATED PAPER BASE PHENOLIC TUBING

Outstanding for many years as the Top Performer, Clevelite is unmatched in its ability to meet unusual specifications.

Built-in Dimensional Stability, High Dielectric Strength, Low Moisture Absorption, Great Mechanical Strength, Excellent Machining Qualities and Low Power Factor make Clevelite Tubing outstanding.

Available in diameters, wall thicknesses and lengths as desired, for Collars, Bushings, Spacers, Cores and Coil Forms.

☆ ☆ ☆

Our new Torkrite internally threaded and embossed tubing affords better control of adjustments in coil forms using threaded cores.

Write for your copy of the latest Clevelite brochure.

WHY PAY MORE? For Good Quality . . . call CLEVELAND!

*Reg. U. S. Pat. Off.

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

PLANTS AND SALES OFFICES at Chicago, Detroit, Memphis, Plymouth, Wisc., 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, 604 CENTRAL AVE., EAST ORANGE, N. J.
NEW ENGLAND R. S. PETTIGREW & CO., 62 LA SALLE RD., WEST HARTFORD, CONN.
CHICAGO AREA PLASTIC TUBING SALES, 5215 N. RAVENSWOOD AVE., CHICAGO
WEST COAST IRV. M. COCHRANE CO., 408 S. ALVARADO ST., LOS ANGELES

Take advantage of our
Fast Dependable Delivery.

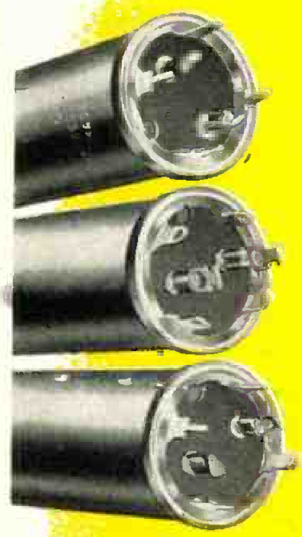
For product information, use inquiry card on last page.

www.americanradiohistory.com

LOOK for this *new terminal construction* if you want

SEALED

IMMERSION-PROOF 85-100° C. TWIST-PRONG ELECTROLYTICS



FUNCTION FITTED

Note the new cover design for Aerovox twist-prong electrolytic capacitors. It embodies several highly desirable features not found in conventional twist-prong units, such as:

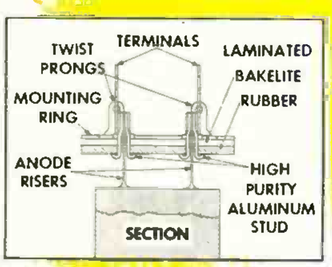
All-in-one phenolic disk and sealing rubber. Greater basic strength than with separate layers of phenolic and rubber heretofore used.

Lead connection through stud to terminal, produces excellent seal against moisture.

Design flexibility of terminal-stud construction allows greater size and shape variation of terminal ends. Especially desirable with "printed" wiring" circuitry. Greater dimensional uniformity.

Permits standardization of mounting. Completely interchangeable with all other types.

No internal contact between dissimilar materials—high purity aluminum throughout.



GET THE FACTS!

Let us give you the significant details, and then let us quote on your requirements for these superior twist-prong electrolytics.

AEROVOX capacitors

AEROVOX CORPORATION
NEW BEDFORD, MASS.

Hi-Q DIVISION OLEAN, N. Y.	CINEMA ENGINEERING CO. BURBANK, CALIF.	ACME ELECTRONICS, INC. MONROVIA, CALIF.

In Canada: AEROVOX CANADA LTD., Hamilton, Ont. JOBBER ADDRESS: 740 Belleville Ave., New Bedford, Mass.
Export: Ad. Auriema, Inc., 89 Broad St., New York, N. Y. • Cable: Auriema, N. Y.

News of MANUFACTURERS' REPS

Carter Parts Co. of Chicago, Ill. has appointed the following reps: **E. W. McGrade Co.**, Kansas City and St. Louis, Mo. to cover Iowa, Mo., Kans., Neb., southern Ill.; **Win W. Tompkins & Co.**, San Francisco and Palo Alto, Calif. to cover northern Calif., Nev. and Hawaii; **Ealy & Hastings**, N. Hollywood, Calif. to cover southern Calif. and Ariz.; **Burt C. Porter Co.**, Seattle, Wash., to cover Wash., Ore., Idaho, Mont., and Alaska; **Carl H. Schmidt Co.**, Detroit, Mich., to cover eastern Mich.; **Delzell-Maynard Sales Co.**, Dallas, Tex., to cover Tex., Okla., La. and Ark.

George P. Marron, with offices at 712 Norman Place, Westfield, N J., has become rep for Centralab Div. of Globe-Union Inc. in New York State except the metropolitan N.Y.C. area. For the southern Calif. area, including Arizona and southern Nev., the company has appointed **Walter S. Harmon Co.**, of 121 Robertson Blvd., Beverly Hills, Calif. to handle industrial and manufacturing accounts, and **Richard L. Stone**, 5864 Hollywood Blvd., Hollywood, Calif. to handle distributor accounts.

Al Engelman Co., with offices at 919 Palmetto St., Birmingham, Ala. and 3205 Crump Ave., Memphis, Tenn. will handle the C. P. Clare & Co. line of relays in Tenn., Ala., Miss. and n.w. Fla. In the territory of Colorado, Utah and Wyo., Clare will be represented by **Fred A. Pease**, Terminal Bldg., Stapleton Airfield, P.O. Box 1566, Denver, and the northeastern Okla. territory will be covered by **Maury E. Bettis Co.**, 5500 E. 51st St., Tulsa, Okla.

Budd-Stanley Co., Inc., microwave component mfr. of Long Island City, N.Y., have named **T. Louis Snitzer** of 5777 W. Pico Blvd., Los Angeles, Calif. exclusive southern Calif. and Arizona rep.

Weightman & Assoc., 1405 W. Magnolia Blvd., Burbank, Calif. have become west coast reps for Allies' Products, Inc. of Washington, D.C. Exclusive reps in the greater Chicago area will be **Hill-Gray**, 41½ Harrison St., Oak Park, Ill., and the Ohio territory will be covered by **J. M. Landfear Co.**, 12429 Cedar Rd., Cleveland 6, Ohio.

William Blinoff has been appointed sales engineering rep for Automatic Manufacturing Corp., miniature transformer manufacturer of Newark, N. J. He represents the firm in Ohio, Indiana and Michigan.

Arthur H. Lynch & Assoc., P. O. Box 466, Fort Myers, Fla., have been named manufacturer's rep for Electronic Instr. Div. of Burroughs Corp. in Florida.

NOW! the new *Gray telop III*

Eliminates extra manpower requirements

opaque and transparency projector

REMOTE OR LOCAL CONTROL
CHECK THESE NEW FEATURES

- Completely automatic . . . utilizing features contained in the now famous Telop and Telojector . . . Slides change by push button control.
- Sequence of up to 50 slides can be handled at one loading . . . additional pre-loaded slide holders easily inserted in unit.
- Remote control of lap dissolves . . . superposition of two slides . . . and slide changes.
- Shutter type dimming permits fades without variation of color temperature . . . opaque copy cooled by heat filters and adequate blowers . . . assembly movable on base which permits easy focus of image.

SCREEN OUT HIGH PRODUCTION COSTS FOR LOCAL SPONSORS

Telop III by the elimination of extra manpower assures the production and projection of low-cost commercials that local sponsors can afford. It can be used with any TV camera including the new Vidicon camera. Telop III projects on single optical axis opaque cards, photographs, art work, transparent 3¼" x 4" glass slides, strip material, and 2" x 2" transparencies when Telojector is used with optical channel provided. Telop III eliminates costly film strips and expensive live talent.

WRITE FOR: Illustrated bulletin describing Telop III specifications. Your request will receive prompt response.

Telop III . . . interior view of automatic slide holder which accommodates 4" x 5" opaque slides . . . One lens . . . no registration problem . . . no keystoning.

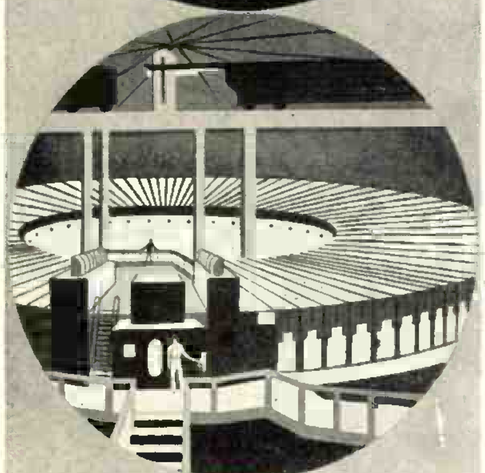
GRAY RESEARCH

AND DEVELOPMENT CO., Inc., Hilliard St., Manchester, Conn.
Division of the GRAY MANUFACTURING COMPANY
Originators of the Gray Telephone Pay Station and the Gray Audograph and PhonAudograph.

For product information, use inquiry card on last page.

www.americanradiohistory.com

THE *American* IDEA



"To find and follow the better way"... Gigantic offspring of the cyclotron, the Bevatron—world's greatest magnet—can send masses of protons hurtling around its 135'-diameter race track at almost the speed of light. "Idea", to penetrate deep into the atomic nucleus, where lie secrets of matter and energy.

With us, the "American Idea" is, by directed effort and applied know-how, to continue to lead in bringing you electronic products of the highest quality.

Complete line of "Full Vision" Microphones
D33 Broadcast
D-22 Public Address

Replacement Phonograph Cartridges

INSIST ON AMERICAN FOR QUALITY

Send for FREE Catalog 47

American microphone co.

370 South Fair Oaks Ave. • Pasadena, 1, Calif.

BULLETINS

Transformer Laminations

Two catalog pages on 1¾ in. E & I transformer laminations have been released by Tempel Manufacturing Co., Bryn Mawr at Damen, Chicago 26, Ill. Type T-175 RH features RETMA corner mounting holes. Type T-175 H has standard mounting holes. (Ask for B-1-17)

Torches and Tips

Catalog ADC 702B contains 36 pages that present illustrations, charts, and descriptions covering the complete line of torches and tips for oxyacetylene cutting and welding made by Air Reduction Sales Co., 60 E. 42nd St., New York 17. (Ask for B-1-18)

Color TV Station Equipment

"Station Planning for Color Television," released by Allen B. DuMont Laboratories, Inc., TV Transmitter Dept., 1000 Main Ave., Clifton, N. J. outlines four color TV complements as steps recommended by Du Mont for the conversion of monochrome TV operations to handle a color signal. A chart outlines each complement and explains what each will accomplish. (Ask for B-1-19)

Wave Analyzer

Bulletin 54-C, issued by The Davies Labortories, Inc., 4705 Queensbury Rd., Riverdale, Md., gives complete information covering a heterodyne type automatic wave analyzer that provides Fourier analysis of vibration and similar data. (Ask for B-1-20)

Probes

Bulletin No. 15, released by Flow Corp., 283 Concord Ave., Cambridge 38, Mass. presents detailed drawings and performance characteristics covering hot wire anemometer probes. (Ask for B-1-21)

"Plus Costs"

The National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill., makes available without charge, the booklet, "Plus Costs," published by the Small Business Program, that tells how accidents eat away profits. (Ask for B-1-22)

V-Belt Drive

Mailer V-1400-M39, "Trouble Saver" No. 1, one of five intended to help users of V-belt drive to analyze many of the causes of trouble, can be obtained by writing the Advertising and Sales Promotion Dept., Worthington Corp., Harrison, N. J. (Ask for B-1-23)

Impedance Bridge

A folder issued by Republic Engineering Co., Inc., Beltsville, Md., describes the vector impedance bridge Model 100-B, gives engineering specifications and a list of the measurements that can be made with the instrument. (Ask for B-1-24)

Instruments

Raymond Rosen Engineering Products, Inc., 32nd and Walnut Sts., Philadelphia, Pa., and 15,166 Ventura Blvd., Sherman Oaks, Calif., has released a number of bulletins covering various "RREP" instruments. Bulletin TSS-A-840 describes Type 840 FM transmitter; TIS-A-865, Type 865C r-f power amplifier; TSS-A-874, Type 874 variable reactance oscillator; TSS-A-949, Type 949 strain gage oscillator; TSS-A-957, Type 957 voltage controlled oscillator; TSS-A-960, Type 960 crystal controlled PM transmitter; TSS-A-CG, Types 885, 886, 869, 878, commutator-gating unit; TSS-A-DCG, Types 871, 910, 911, 884, 927 dynamotor-commutator-gating unit. TAI-A-PMT, covers a four w crystal controlled telemetering transmitter; TAI-A-UMA, covers a universal mounting assembly; and, TSS-A-DYN covers Types 870, 906, and 906A dynamotor units. (Ask for B-1-25)

TRANSISTOR &
DIGITAL COMPUTER
TECHNIQUES

applied to the design, development and application of

AUTOMATIC RADAR DATA PROCESSING, TRANSMISSION AND CORRELATION IN LARGE GROUND NETWORKS

ENGINEERS & PHYSICISTS

Digital computers similar to the successful Hughes airborne fire control computers are being applied by the Ground Systems Department to the information processing and computing functions of large ground radar weapons control systems.

The application of digital and transistor techniques to the problems of large ground radar networks has created new positions at all levels in the Ground Systems Department. Engineers and physicists with experience in the fields listed, or with exceptional ability, are invited to consider joining us.

fields include

TRANSISTOR CIRCUITS
DIGITAL COMPUTING NETS
MAGNETIC DRUM AND CORE MEMORY
LOGICAL DESIGN
PROGRAMMING

VERY HIGH POWER MODULATORS AND TRANSMITTERS

INPUT AND OUTPUT DEVICES
SPECIAL DISPLAYS
MICROWAVE CIRCUITS

Scientific and Engineering Staff

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

Relocation of applicant must not cause disruption of an urgent military project.

www.americanradiohistory.com

Wafers

Aircraft-Marine Products, Inc., 2100 Paxton St., Harrisburg, Pa., announce the availability of their catalog covering a new line of "Capitron" wafer capacitors. Gives descriptions and special design factors, etc. Specify Series 935,000. (Ask for B-1-13)

Antennas and Accessories

Communication Products Company, Inc., Marlboro, N. J., have released Catalog No. 654, covering their line of coaxial antennas and accessories. Presents detailed drawings and technical data. (Ask for B-1-14)

"Laboratory Standards"

"Laboratory Standards," a 59-page catalog issued by Measurements Corp., Boonton, N. J., describes and illustrates the company's facilities, and presents complete technical information covering its various types of generators, meters, attenuators, calibrators, etc. (Ask for B-1-15)

Resistors

The new precision wire wound resistor catalog, prepared by The Daven Company, 191 Central Ave., Newark, N. J., is a guide to basic data for the application and design engineer. In addition to all Daven resistor types, it contains previously unpublished wire wound resistor information and JAN, MIL and other Government ratings. Also, it presents new charts and data on various types of hermetically sealed, encapsulated, and subminiature units. (Ask for B-1-12)

Dials

Ackerman Engravers, 458 Broadway, New York 13, N. Y., have announced the availability of their free 44-page "Standard Dial Catalog" that presents details on precision dials, dial rings, vernier crow-foot pointers, back rings and back plates. (Ask for B-1-11)

Insulation

Product Bulletin No. 750G, released by Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6, Ill. contains complete technical data, descriptions, photos, etc. on "Varslot" varnished cambric-paper insulation. (Ask for B-1-16)

Capacitors and Components

A pocket-size digest of the latest in capacitor and component developments from the plants of the Aerovox Corp., New Bedford, Mass. has been released. (Ask for B-1-30)

Phone Jacks

A new catalog sheet, released by Carter Parts Co., 213 W. Institute Pl., Chicago 10, Ill., covers 21 types of "IMP" miniature phone jacks. Includes mounting dimensions, circuit diagrams, and descriptions. (Ask for B-1-26)

Background Music

A colorful 12-page brochure describing the new background music service of Magnecord, Inc., 1101 S. Kilbourn Ave., Chicago 24, Ill., presents its advantages and how it is sold. (Ask for B-1-27)

Power Supplies

A catalog of regulated and unregulated power supplies for industrial and laboratory use is available at Lambda Electronics Corp., 103-02 Northern Blvd., Corona 60, N. Y. Covers 35 models. (Ask for B-1-28)

Transformers

CT-554, a new transformer catalog, has just been published that lists the full line of "Sealed-in-Steel" transformers made by Chicago Standard Transformer Corp., 3501 Addison St., Chicago 18, Ill. Thirty-two page book describes over 500 stock units. (Ask for B-1-29)

OBTAIN THESE BULLETINS

described here by writing on company letterhead to Bulletins Editor, TELE-TECH & ELECTRONIC INDUSTRIES, 480 Lexington Ave., New York 17, N.Y., listing numbers given at end of each item of interest. Please mention title of position held.

KLEINS

TO SPEED YOUR PRODUCTION

NEW SMALL PATTERNS

Ask to see the complete new line.

You just can't beat Klein pliers for smooth, easy operation—for steady dependability whatever your production job. That's because Kleins are quality made of finest tool steel, precision fitted—individually tested. Handles fit the hand to perfection—knives shear through toughest wire with ease.

And now the Klein plier selection is bigger than ever—in standard size patterns—in new compact patterns specially designed for intricate wiring and cutting in confined space. Available with or without a flexible steel leaf spring.

ASK YOUR SUPPLIER
Foreign Distributor:
International Standard Electric Corp.,
New York

Write for your free copy of the Klein Pocket Tool Guide. Contains information on all types of Klein Quality Pliers.

Mathias KLEIN & Sons
Established 1857
Chicago, Ill., U.S.A.
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

For product information, use inquiry card on last page.

www.americanradiohistory.com

Sell the industry's top buyers

before . . . during . . . and after the

1955 IRE SHOW

Kingsbridge Armory—Waldorf Astoria Hotel

Again this year Kingsbridge Armory, New York City, March 21-24, is the meeting place of electronic manufacturers, radio, television and electronic engineers from the world over . . . where the industry will unfold a "spectacular" featuring new products, equipment, techniques and engineering developments. This is where manufacturers put their best foot forward to reach and sell the industry's key buyers who will plan and place millions of dollars worth of orders during and after the IRE exposition.

TELE-TECH pre-selects and packages your audience for effective advertising and sales in the electronic market

Year after year the March and April issues of TELE-TECH are an unbeatable team when it comes to scoring with its 27,000 regular readers. Each year the key engineers and executives in every branch of the industry look to the editorial and advertising pages of these issues for vital, up-to-the-minute IRE show news, *and,* news about your products. TELE-TECH goes direct to these men with predetermined buying power in the expanding $6.5 billion electronic market.

MARCH Pre-IRE Issue

- contains the IRE National Convention Preview.
- includes the convention program—technical paper topics, symposia and their locations, and other important events at the show.
- previews equipment to be displayed during the show.
- enables you to announce your booth number, products to be exhibited, and invite attendance to your exhibit.
- out a full month before the show.
  permits those attending show to plan their schedule.

APRIL IRE ISSUE

- lists IRE show exhibits.
- describes new products being exhibited and gives booth numbers of exhibit.
- includes a master map of exhibit locations.
- geared for special and last-minute announcements timed for the show's opening.
- out simultaneously with the show.
- gives regular monthly coverage of the industry.

Get triple IMPACT! . . . before, during and after the IRE SHOW

CALDWELL-CLEMENTS, Inc. 480 Lexington Ave., New York 17, N.Y.

TELEPHONE: PLaza 9-7880

www.americanradiohistory.com

. . . with TWO key salesmen . . .

MARCH Pre-IRE and APRIL IRE issues of

TELE-TECH & Electronic Industries

Tie your sales story to these timely issues

Plan to make the MARCH Pre-IRE and APRIL IRE issues your "advance men." Your advertisement in these issues wi l single out the biggest buyers in the electronic industry and attract them to your exhibit. And if you aren't exhibiting, let TELE-TECH represent you at the Show. You can put your products on display at Show time, influence buyers everywhere to inquire about your line by placing your most effective advertisement in the March and April issues.

Special advantages for your advertisements

- March Pre-IRE issue out a month before the show.
- April IRE issue available at Show time.
- Increased circulation of 27,000—includes coverage of ALL TV-electronic manufacturers; ALL TV-FM-AM Broadcast Stations; ALL Armed Forces Research and Procurement groups; ALL consulting Engineers and Major Operators in Microwave, Mobile and other systems.
- Largest circulation in Manufacturing and Communications—21,116, at the lowest cost per thousand—in the market's two main buying power divisions.
- Special editorial features condition the advertising.
- After-Show reading gives ads extra long sales life.
- TELE-TECH is a three year winner of readership surveys directed to Chief Engineers.

AN UNBEATABLE TEAM

MARCH Pre-IRE ISSUE

APRIL IRE ISSUE

Put your money where your market is!

MARCH Pre-IRE and APRIL IRE Issues of

TELE-TECH
& ELECTRONIC INDUSTRIES

Closing date . . . 1st of preceding month

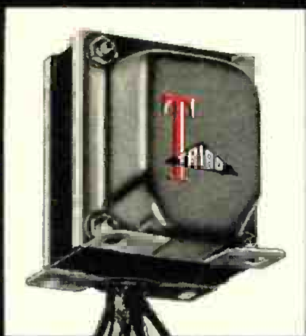
CHICAGO—
201 North Wells Street

CALIFORNIA—Chris Dunkle & Associates
Los Angeles 5—3257 W. 6th St. DUnkirk 7-6149

www.americanradiohistory.com

TRIAD INSTRUMENT TRANSFORMERS

for REGULATED POWER SUPPLIES



AVAILABLE FROM STOCK

Triad Transformers ESPECIALLY DESIGNED for regulated supplies employ multiple static shields, isolated filament windings, special values of high voltage, and low flux density, to insure optimum performance.

Type No.	List Price	Plate Supply AC Volts	Plate Supply DC Ma.	Filament Windings Volts and Amperes	
R-70A	$11.25	880 C.T.	75	6.3V.-.6A. 6.3V.-.3A.	6.3V.-.9A. 6.3V.-3A.
R-26A	21.50	880-720 C.T.	200	6.3 C.T.-8A. 6.3V.-1A.	6.3V.-3A. 5V.-3A.
R-28A	32.50	1250 C.T.	300	6.3 C.T.-8A. 6.3V.-3A.	6.3V.-3A. 5V.-6A.
R-46A	33.00	1250 C.T. 130 (Bias)	350 50	5V.-4A.	6.3V-5A 6.3V.-1A. 6.3V.-1A.
R-46A will supply 550 V. D.C. using 2 5R4G rectifier tubes, choke input. Will also supply 130 V. for bias using Selenium rectifier.					
R-27A	45.00	1500 C.T.	400	5V.-6A.	6.3V.-3A 6.3V.-8A.

Write for catalog TR-54J

TRIAD TRANSFORMER CORP.

4055 Redwood Ave., Venice, Calif.

Starved Amplifiers

(*Continued from page 70*)

checked in an emission type tube tester and were found to indicate 'good' on exactly the same portion of the meter scale. The next test was that of mutual conductance, this quantity being measured on a Hickok Model 533P standard dynamic tube tester. In this respect, a difference in readings was obtained and it was found that a definite correlation pattern resulted, as can be seen from Table I, showing the results for both 6SG7 and 6AG5 tubes.

Examination of the data shows that in all cases, as the mutual conductance of the tube as measured under normal operating conditions is increased, the quiescent plate current under starved conditions of tube operation is decreased for a given plate voltage. This is of interest in that a given set of curves for starved operation can be adapted (qualitatively speaking) to other tubes of the same type or possibly even of different types (provided the normal operating conditions are similar) by a simple measurement of the mutual conductance on a reliable, standard tube tester. We thus have a method of circumventing the "critical" aspect of starved circuit design, since matching of tube g_m's under normal operating conditions is equivalent to matching them under actual conditions of starved operation.

The magnitude of the space current in a pentode is determined almost entirely by the control grid and screen grid potentials. The plate potential determines only what fraction of space current is trans-

COMPUTER AGREEMENT

F. W. Godsey (l), Manager of Westinghouse Baltimore Div., discusses new agreement with Dr. Dean E. Wooldridge, President of Ramo-Wooldridge Corp., to develop computers for aircraft, military controls, science and business

FOR PRINTED CIRCUITS

PRINTED CIRCUITRY

FLUXES

3 NON-ACTIVATED AND 4 ACTIVATED FLUXES

A TRUSTED NAME IN

ALPHA ®

ELECTRONIC INDUSTRY

PRINTED CIRCUITRY

SOLDERS

5 BAR SOLDERS FOR DIP SOLDERING

SOLDER PLATE, GOLD, SILVER AND COPPER SYSTEMS

The facilities of a modern, well equipped metallurgical laboratory, competent research staff and field engineers are available to help you solve printed circuitry problems.

write for informative literature

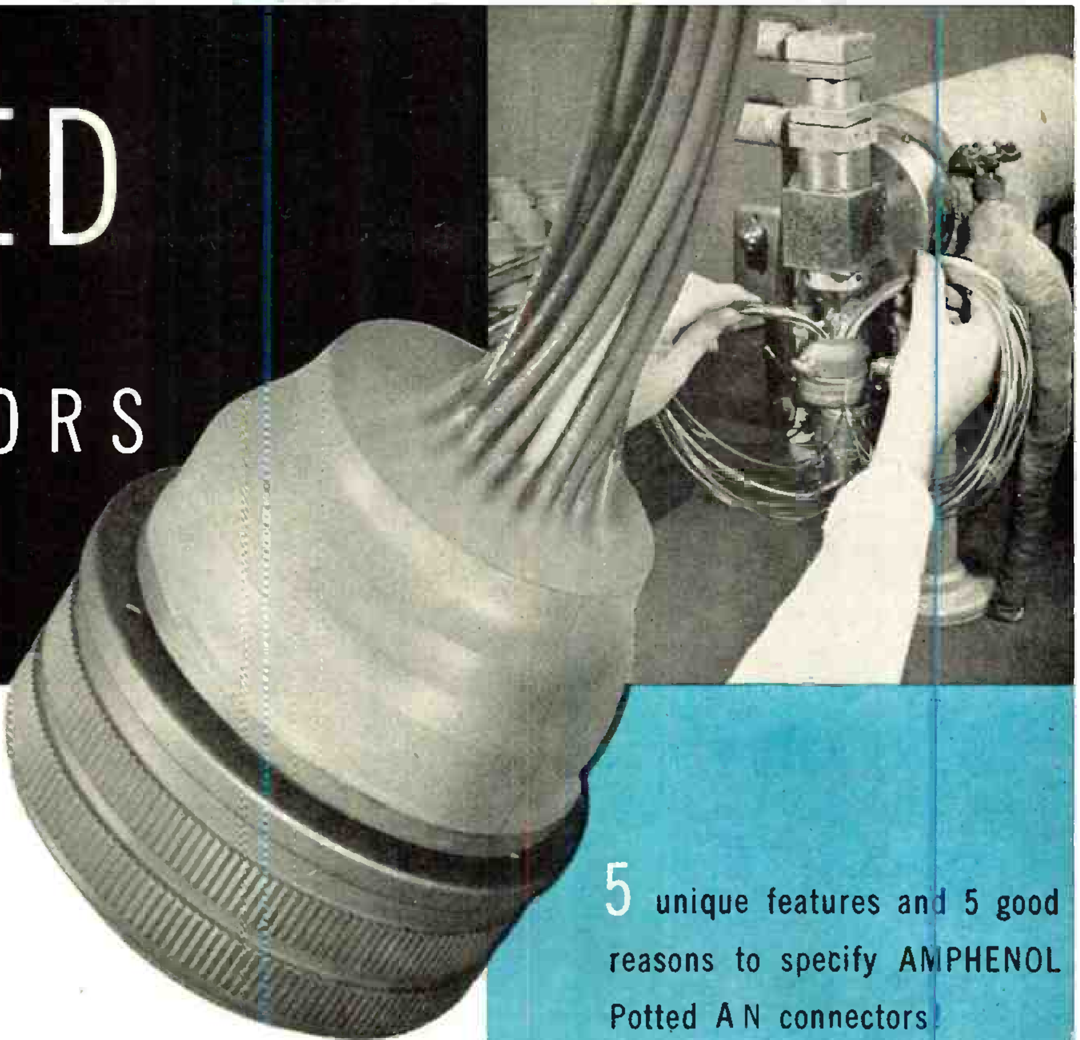
ALPHA METALS, INC.

58 Water St., Jersey City 4, N. J.

HEnderson 4-6778

www.americanradiohistory.com

POTTED A·N CONNECTORS



gain greater electrical reliability with moisture-proof AMPHENOL Potted AN Connectors

At right are listed the outstanding features of AMPHENOL Potted AN connectors. What is Potting and how can it offer these advantages to AN users? Potting simply replaces the usual backshells of any AN3106, AN3101 and AN3100 plug with a hemispherically shaped synthetic rubber sealant. It completely encloses the contact terminals in an AN cable assembly with a rugged moisture-proof housing.

The primary achievement of AMPHENOL Potting is an *electrically reliable moisture-proof* connector—but its other advantages are almost as desirable and open the possibilities of the use of Potted ANs in applications where moisture-proofing is not important. For not only is the Potted AN completely resistant to salt water but also to stronger fluids such as fuel oil and gasoline. Elimination of the usual backshell and cable-clamping components reduces both the size and the weight of an AN connector—and weight reduction is all important to engineers in every field of electronics today. Potting also provides a resilient mass at the wire terminals of the connector which not only isolates each individual contact and its wire lead in a sealed resilient chamber but permits the AN assembly to withstand severe vibration and to operate efficiently under unusual conditions. And, finally, if these were not enough reasons for specifying AMPHENOL Potted AN connectors, a Potted connector is not only more efficient, lighter in weight and smaller, but costs far less than so-called mechanically sealed connectors which are dependent upon auxiliary parts for moisture sealing!

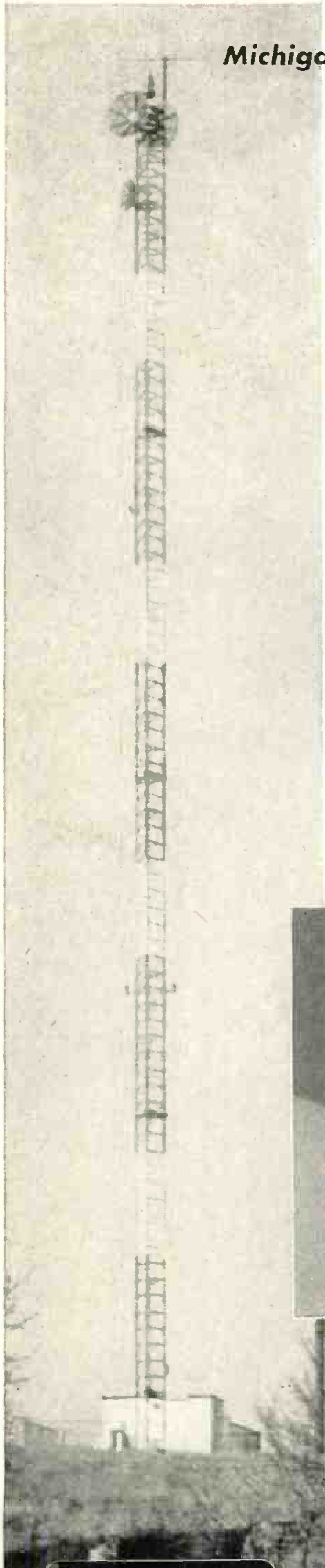
5 unique features and 5 good reasons to specify AMPHENOL Potted AN connectors!

1. New efficient moisture-proof design
2. Greater electrical reliability in all kinds of weather
3. Weight-saving, space-saving construction
4. Ability to withstand severe vibration.
5. Lower cost than standard or mechanically "sealed" connectors

REQUEST BULLETIN 2555
Full details on Potting of AN connectors

1830 South 54th Avenue, Chicago 50, Illinois
AMERICAN PHENOLIC CORPORATION AMPHENOL

www.americanradiohistory.com



Michigan-Wisconsin Pipeline Company

Assures power for repeater stations with ONAN Standby Electric Plants

Microwave radio handles communications for the Michigan-Wisconsin pipeline which carries natural gas from Texas fields throughout Wisconsin and Michigan.

Of the 60 repeater stations in the system, 53 are unattended and are equipped with Onan Standby Electric Plants and Onan Automatic Line Transfer Controls. When commercial power is interrupted, the Onan plants start automatically and supply power for operating microwave equipment.

Most of the Onan units are Model 305CK electric plants of 3,500-watt capacity. This model, together with the Onan 5 and 10KW "CW" electric plants have built-in advantages for microwave standby service. They are air-cooled, extremely compact, and dependable.

If you have a problem in standby power, write our sales engineers. Onan builds electric plants for every need . . . from 400 to 75,000 watts.

Onan Model 305CK shown installed in the repeater station at Waukesha, Wisconsin. Bottled gas is used for fuel.

NEW AUTOMATIC MICROWAVE LINE TRANSFER CONTROL

This new control facilitates testing of all control components as well as the engine generator set. Momentary contact switch transfers load from commercial power to the generating plant with only 1/10th second interruption. Generator can be exercised by itself if desired. Control incorporates time-delay starting, stopping. Voltage sensitive relays, both on the commercial line and on generator output, assure correct voltage before transferring load.

Onan ELECTRIC PLANTS

Write for literature and specifications

D. W. ONAN & SONS INC.

3509 University Ave. S. E. • Minneapolis 14, Minnesota

Starved Amplifiers

(*Continued from page 104*)

mitted to the plate. It does, of course, have a second order influence upon the plate current, with the result that I_b rises slowly as the plate voltage is increased. Thus, as can be seen by referring to the plate characteristics, all of the curves are similar in shape and differ only in scale. The space current (see Fig. 8) is even more constant with plate voltage than is the plate current. The only departure from near constancy occurs near zero plate voltage. Here the space current increases by about 20-to-40% as the plate voltage is increased to about half of the screen grid potential. This increase in space current occurs because there is a change in the space-charge conditions around the screen grid as the condition of reflection of electrons from the plate changes to one of transmission.

Although not proven here, use can be made of the fact that the suppressor grid is able to control the fraction of the current transmitted past the plane of the screen grid that goes on to the plate. When the suppressor is at a low potential relative to the plate and the screen grid, as it usually is, it can sort out the electrons having a large component of energy directed toward the plate from those which, because of deflection on passing close to a screen grid wire, have a lower component of plate directed energy. The plate voltage is moderately sensitive to suppressor grid voltage and the suppressor is readily capable of completely cutting off the flow of plate current.

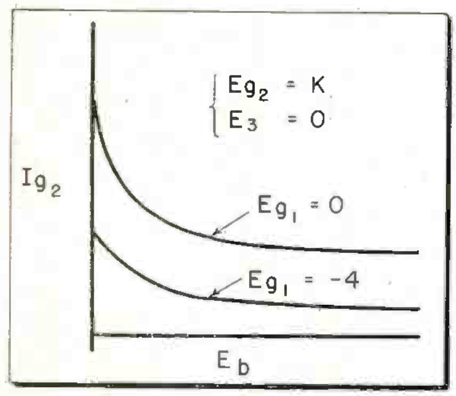


Fig. 8: Space current—plate voltage curves

The use of a positive suppressor potential will give considerable sharpness to the shoulder of the plate characteristics. An important fact to note in connection with this is that for negative suppressor voltages, the plate resistance decreases with increasingly negative applied voltages. This is evident from an in-

www.americanradiohistory.com

spection of the plate characteristics (Fig. 9). The reverse effect is true to some extent, and hence slightly positive suppressor voltages offer additional possibilities for obtaining a higher gain per stage.

Another fact worth mentioning at this point in conjunction with the tube characteristics is the rather high control grid current flow which presents additional problems and must be considered in the design of a starved stage.

Design Considerations

Performance to be expected from a given design must be viewed with caution due to the considerable differences between tube types, the critical nature of the operating voltages where maximum gain is desirable, and the low operating currents involved. An approximate design may be carried out on paper, the final adjustments being made by trimming up or adjusting the screen voltage of the unit after construction

TABLE I

6SG7

mutual cond.	plate current
3180 μmho	50 μa
3100	77
2910	90
2870	180
2840	330

6AG5

mutual cond.	plate current
4080 μmho	30 μa
4000	33
3930	116
3700	200
3360	410

has been completed. Certain items must be kept in mind while determining component values and circuit voltages and a typical design procedure would be somewhat as follows assuming the proper characteristics for the tube type selected are available (if a stage gain not in excess of one thousand is desired, the graphs included in this report may be utilized as a first approximation. These curves were obtained from a type 6SG7 tube with a normal mutual conductance of 3150):

1. From the μ vs I_b curve, select a quiescent plate current which lies slightly to the right of the highest peak. (If a lower stage gain may be tolerated, select a plate current such that the μ of the tube remains approximately constant as I_b is varied slightly to either side of the quiescent point.)

2. Determine g_m of the tube for the plate current selected above by referring to the g_m vs I_b curve.

3. Choose a suitable load resistor

VLF

. . . Very Low Frequencies

RADIO INTERFERENCE and FIELD INTENSITY* measuring equipment

Stoddart NM-10A • 14kc to 250kc

Commercial Equivalent of AN/URM-6B

VERSATILITY...The NM-10A is designed to meet the most exacting laboratory standards for the precise measurements, analysis and interpretation of VLF radiated and conducted radio-frequency signals and interference. Thoroughly portable, yet rugged, the NM-10A can be supplied with accessories to fulfill every conceivable laboratory and field requirement.

EXCELLENT SENSITIVITY...The NM-10A sensitivity ranges from one microvolt-per-meter to 100 microvolts-per-meter, depending upon whether rod or shielded loop antennas or line probe are used.

ACCURACY...Each equipment is "hand calibrated" in the Stoddart Test Laboratories by competent engineers. This data is presented in simplified chart form.

DRIPPROOF...Sturdy dripproof construction allows long periods of operation in driving rain or snow without adverse effects.

FLEXIBLE POWER REQUIREMENTS...The ac power supply permits operation from either 105 to 125 volts or 210 to 250 volts ac, at any frequency between 50 cps and 1600 cps.

Stoddart RI-FI* Meters cover the frequency range 14kc to 1000mc

HF NM-20B, 150kc to 25mc
Commercial Equivalent of AN/PRM-1A. Self-contained batteries. A.C. supply optional. Includes standard broadcast band, radio range, WWV, and communications frequencies. Has BFO.

VHF NM-30A. 20mc to 400mc
Commercial Equivalent of AN/URM-47.. Frequency range includes FM and TV bands.

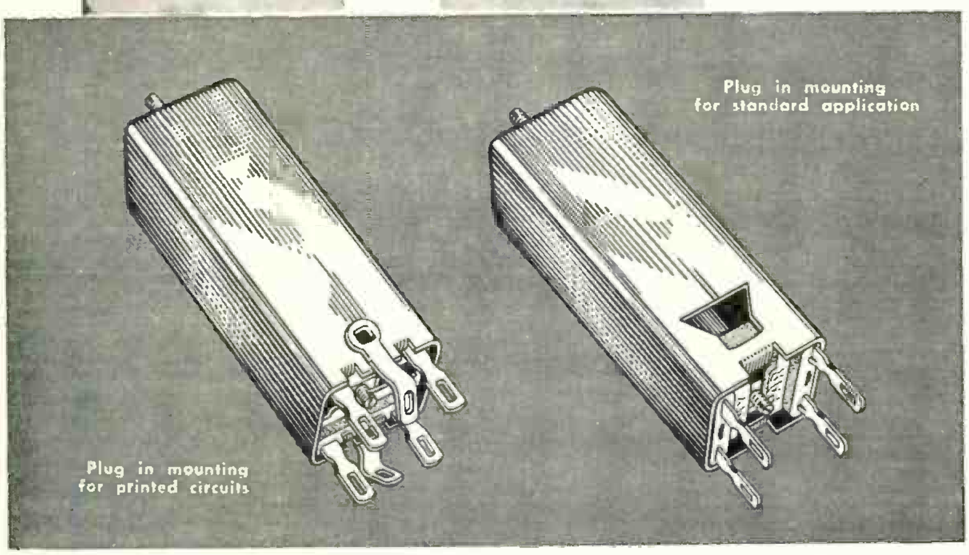
UHF NM-50A, 375mc to 1000mc
Commercial Equivalent of AN/URM-17. Frequency range includes Citizens band and UHF color TV band.

STODDART AIRCRAFT RADIO Co., Inc.
6644-G Santa Monica Blvd., Hollywood 38, California • Hollywood 4-9294

For product information, use inquiry card on last page.

www.americanradiohistory.com

another raypar first IF transformers for printed circuits



Compare these features . . .

- ✱ Wide range of impedances to cover all applications
- ✱ Excellent Stability & High Gain
- ✱ Micrometer core adjustment
- ✱ Compression moulded plastic base for auto radio and other high temperature applications
- ✱ Individually tested and visually aligned and preset before shipping

Send us your inquiries for delivery and quotations. Request our free catalog and engineering handbook.

RAYPAR incorporated

7800 WEST ADDISON STREET • CHICAGO 34, ILLINOIS

SERVING AMERICA'S LEADING RADIO & TV MANUFACTURERS

Starved Amplifiers

(*Continued from page* 107)

(usually from 3 to 20 Meg.) from a knowledge of the desired stage gain and the approximate relationship: $R_l = K/g_m$ (which is applicable when the plate resistance is high compared to the load resistance).

4. For a given plate supply, draw a load line on the plate characteristics, selecting two sets of values for

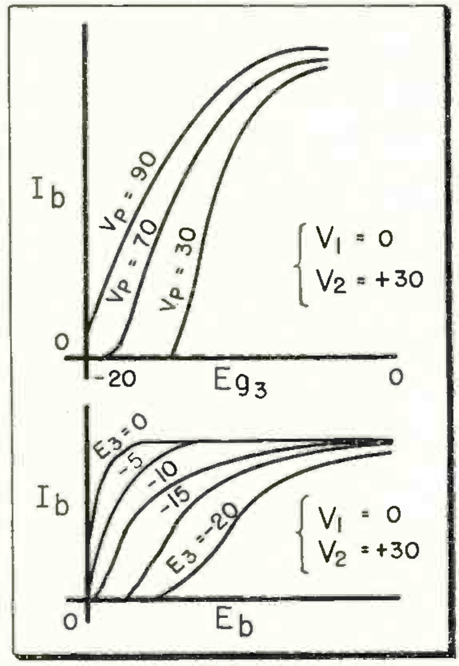


Fig. 9: Effect of change in plate resistance

end points such as: a) $I_0 = E_{bb}/R_1$, $E_b = 0$; b) $I' = 9E_{bb}/10R_2$; $E_b = E_{bb}/10$.

5. Knowing the plate current, locate the quiescent point on the graph and read off the bias voltage. At this point the plate current or load resistor may have to be revised if the bias is found to be too low (not negative enough).

6. A suitable method of biasing must now be selected. From the E_c vs I_c curve, note the grid current flow for the bias voltage determined above. If it is zero, the bias must be obtained by inserting a resistance in series with the cathode of the tube such that $R_k = E_c/(I_b+I_2)$. If a definite value of grid current flows, economy may warrant the utilization of the grid resistor as the biasing device (rather than employing a transformer input or low resistance grid leak and cathode biasing), and this resistor must be chosen such that $R_g = E_c/I_c$.

a) The advantages of cathode bias is that grid current flow, with its inherent distortion of the signal, can be eliminated. Select a high enough negative bias so that the grid current is zero for quiescent operating

www.americanradiohistory.com

conditions and for the range of grid swing in question (which is usually less than five millivolts). This assures a more stable design and less difficulty is encountered when tubes are replaced.

7. Design the following stage, preferably a cathode follower for minimum loading (the plate load of the starved stage acting as the grid leak for the cathode follower), to provide the desired screen voltage from a cathode divider. If this voltage source is made variable to a slight degree, any design errors can be compensated for in the completed circuit by making a slight adjustment at this point. This method of securing the screen grid voltage also provides for the necessary stabilization of the stage.

a) It will be found that the screen voltage influences the linearity of the stage to a large degree. When substantial plate swings are involved, the screen voltage must be adjusted with this fact in mind: optimum voltage being about 80% of the quiescent plate voltage.

Factors which should not be overlooked in this design include:

1. We are essentially trading bandwidth for gain, the frequency response of the stage decreasing with increasing plate load resistance (upper frequency limit is of the order of 2000 CPS for a 15 Meg. load). Another limitation imposed on the magnitude of the load resistor is that it cannot be made too high since it is the grid resistor of the following stage.

2. If desired, a compensating network consisting of a parallel R-C combination may be added in series

WCEMA AWARDS

Los Angeles Council WCEMA past chairmen received awards for their achievements in building the association's activity since its inception in 1943. L. to r. (front row) are Fred Falck, pres., Advance Electric & Relay Co.; L. S. Howard, pres., Triad Transformer Corp.; H. L. Hoffman, pres., Hoffman Radio Corp.; E. P. Gertsch, pres., Gertsch Prods. Inc., and 1954 president of WCEMA; James L. Fouch, gen. mgr., Cinema Engineering Co. Back row, H. P. Balderson, sales mgr., Thermador Electrical Mfg Co.; Ed F. Grigsby, sales mgr. Altec-Lansing Corp.; Leon B. Ungar, secy.-treas., Ungar Electric Tools, Inc.; and Dr. Howard D. Thomas, Jr., formerly of Packard-Bell Co.

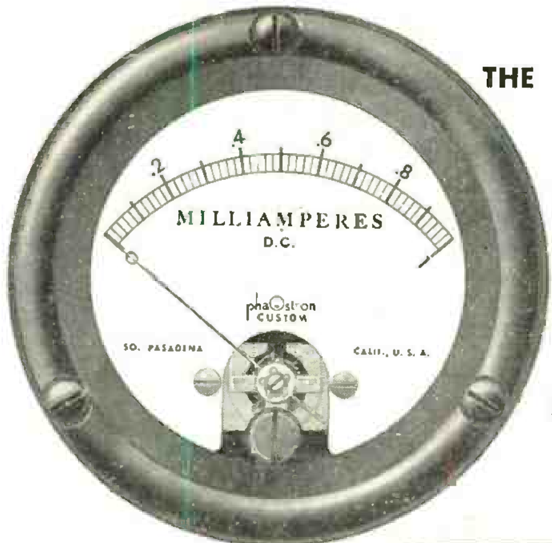
the KEY to your problem

phaostron

2½" and 3½" round or square

CUSTOM PANEL INSTRUMENTS

METAL-CASED TO INSURE THEIR CONTINUED INTEGRITY



THE RELIABILITY OF A METER AS AN INSTRUMENT DEPENDS ON ITS PERMANENT ACCURACY

PERMANENT ACCURACY is assured by the DRAWN STEEL CASE which shields the permanent magnetic assembly of the instrument against external magnetic fields.

phaostron TIME PROVEN MOVEMENTS

phaostron ANTI-MAGNETIC SHIELDING

phaostron 2% ACCURACY

phaostron INSULATED ZERO ADJUSTMENTS

Phaostron CUSTOM Panel Instruments offer highest quality at new low cost

phaostron PRICE — YOU CANNOT BUY BETTER

Inquiries are invited and catalog sheets are available on this *NEW CUSTOM LINE* which also includes 6" MIRROR SCALE INSTRUMENTS.

PHAOSTRON CO. • 151 PASADENA AVE. • SO. PASADENA, CALIF.

www.americanradiohistory.com

DECADE RESISTANCES & VOLTAGE DIVIDERS

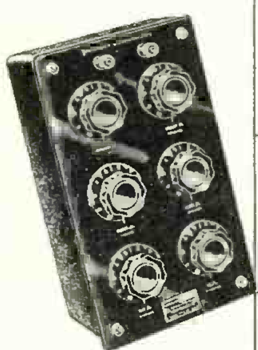
delivered from stock

Accuracy: 10 ohms and above: ±0.1%
1 ohm: ±0.25%
0.1 ohm: ±1%
0.01 ohm: ±5%

Temp. Coeff.: ±0.002% per degree C.
Maximum Load: ½-watt per step
Frequency Limit: Non-inductive to 20KC

DECADE RESISTANCE BOXES

Type	Dials	Ohm Steps	Total Resistance—Ohms	Price
817	3	0.01	11.1	$60.00
818	3	0.1	111	51.00
820	3	1	1,110	56.00
821	3	10	11,100	60.00
822	3	100	111,000	63.00
823	3	1,000	1,110,000	77.00
824	3	10,000	11,100,000	120.00
817-A	4	0.01	111.1	75.00
819	4	0.1	1,111	71.00
825	4	1	11,110	77.00
826	4	10	111,100	79.00
827	4	100	1,111,000	92.00
828	4	1,000	11,110,000	139.00
8285	5	0.1	11,111	94.00
829	5	1	111,110	101.00
830	5	10	1,111,100	113.00
831	5	100	11,111,000	155.00
817-C	6	0.01	11,111.1	105.00
8315	6	0.1	111,111	109.00
832	6	1	1,111,110	121.00
833	6	10	11,111,100	169.00

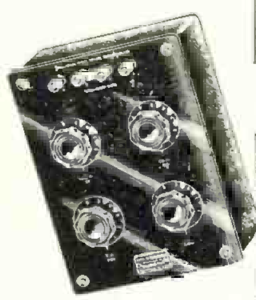


UNMOUNTED DECADE RESISTANCES

Type	Dials	Ohm Steps	Total Resistance—Ohms	Price
435	1	0.1	1	$12.00
436	1	1	10	13.25
437	1	10	100	13.25
438	1	100	1,000	15.00
439	1	1,000	10,000	16.00
440	1	10,000	100,000	18.50
441	1	100,000	1,000,000	32.50
442	1	1,000,000	10,000,000	60.00

DECADE VOLTAGE DIVIDERS (Potentiometers)

Type	Dials	Ohm Steps	Total Resistance—Ohms	Price
845	3	1	1,000	98.00
837	4	0.1	1,000	126.00
835	4	1	10,000	132.00
836	4	10	100,000	146.00



SHALLCROSS MANUFACTURING COMPANY

518 Pusey Ave., Collingdale, Pa.

Shallcross

Starved Amplifiers

(*Continued from page* 109)

with the grid of the starved stage to prevent positive grid operation and high frequency oscillations. If low frequency operation only is desired, a small bypass condenser (10 to 50 μμf) from the plate of the starved stage to ground will help improve the stability of the system.

3. In critical systems, an internal gain control may be desired to compensate for tube replacements. If high quality components are used in the networks which determine the operating potentials of the starved stage, little difficulty should be experienced with gain variations during the life of the tube.

4. With both internal and external feedback loops applied, reliability of circuit operation is quite good. It is not possible, however, to cancel drift due to variation in filament potential with inverse feedback. A regulated filament supply or auxiliary tube cancelling circuit must be employed for this purpose where extremely high gain and critical circuitry warrant its use. For oxide coated cathodes, a 10% increase in heater voltage is the same as a cathode-potential decrease of about 0.1 v.

5. In cascading stages for high gain, it must be remembered that the ultimate gain attainable is limited by the inherent noise of the system as well as problems of instability. As will be shown in the following section, the equivalent noise voltage is higher for starved operation than for normal operation of the same tube.

Tube Noise

Random noise similar in character to that produced in a resistor is generated in tubes as a result of irregularities in electron flow. The equivalent grid resistance R_{eq} representing the noise of a negative-grid pentode amplifier is given approximately by the relations:

$$R_{eq} = \frac{I_b}{I_b + I_2}\left(\frac{2.5}{g_m} + \frac{20\,I_2}{g_m^2}\right) = \frac{2.5}{g_m}\left(\frac{I_b}{I_s}\right)\left[1 + 8\frac{I_2}{g_m}\right]$$

Using the latter relationship, the relative noise for normal vs. starved operation of a type 6SG7 pentode can be computed as:

Normal operation:

$E_{bb} = 250$ v $\quad I_b = 11.8$ ma
$E_2 = 125$ v $\quad I_2 = 4.4$ ma
$g_m = 4700$ μmho $\quad I_s = 16.2$ ma

$$R_{eq} = \frac{2.5}{4700 \times 10^{-6}}\left(\frac{11.8}{16.2}\right) \times$$

www.americanradiohistory.com

$$\left[1 + 8\left(\frac{4.4 \times 10^3}{4700}\right)\right] = 3300 \text{ ohms}$$

Starved operation:

$E_b = 50$ v	$I_b = 29.3\ \mu A$
$E_2 = 5$ v	$I_2 = 6.0\ \mu A$
$g_m = 125\ \mu$mho	$I_s = 35.3\ \mu A$

$$R_{eg} = \frac{2.5}{125 \times 10^{-6}}\left(\frac{29.3}{35.3}\right) \times$$

$$\left[1 + 8\left(\frac{6 \times 10^{-6}}{125 \times 10^{-6}}\right)\right] = 22{,}960 \text{ ohms}$$

The equivalent resistance calculated for normal operation corresponds to a noise voltage of 0.53 μvolt, whereas that for starved operation is equivalent to a noise voltage of 1.4 μvolt. The latter operating condition thus increases the noise by a factor of approximately three.

1. Preamplifier for use with low gain amplifiers and magnetic direct writing oscillographs (current models have a frequency response relatively flat from 0-100 CPS and are ideally suited for use in the medical field for the measurement of brain, heart and nerve potentials in the μv range).
2. Amplifier for use with magnetic penmotor.
3. Transient recorder amplifier for low frequency phenomena.
4. Operational amplifiers.
5. Photocell amplifiers.
6. Direct-coupled servoamplifiers.
7. Direct-coupled vacuum tube millivoltmeters and microammeters.

Much more utilization of this circuit has been made than is indicated at first glance through manufacturer's literature. Closer investigation reveals that many firms are not only aware of, but are actually employing, starved amplifier circuits and are keeping the secrets of the success of their products from outsiders.

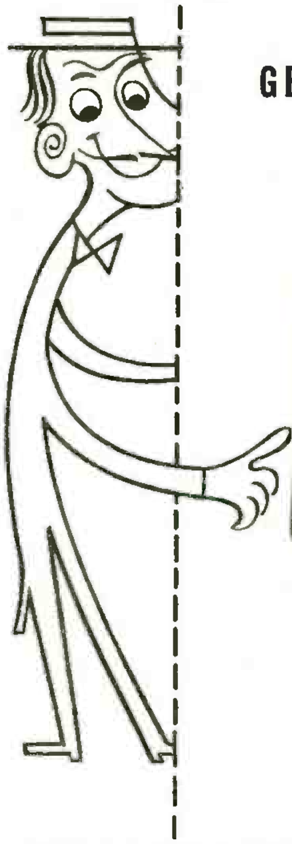
TEN-YEAR AWARD

The first ten-year service award in the history of Ampex Corp. was presented to Alexander M. Poniatoff, founder and president, by George I. Long, executive vice-president and general manager, at the company's 10th anniversary dinner.

NEW *improved lightweight model!*

CANOGA Wobbulator

SWEPT FREQUENCY SIGNAL GENERATOR with OSCILLOSCOPE



Here is a new improved functional design of the well-known Canoga Model 705 Wobbulator Signal Generator. Smaller in size and lighter in weight, it features a wider bandwidth, a greater frequency range, and an all-electronic sweep circuit. It is ideal for use in manufacturing, servicing, or testing receiving equipment such as video, RF, IF, and distributed amplifiers.

As an example of the Wobbulator's new functional design, the housing is an aerated structure with tapered sides allowing ample passage of cooling air throughout the unit, even when placed alongside other equipment.

These, and other features of the new Wobbulator, are positive proof of Canoga Corporation's superior electronic engineering and design.

FREQUENCY RANGE... 2.0 to 1000 mcs. Continuous single knob tuning with calibrated dial.

FREQUENCY SWEEP ... Any bandwidth of 100 mcs. or smaller.

AMPLITUDE VARIATION ... Less than 0.01 db/mc.

OUTPUT VOLTAGE ... 0.1 volts across 50 ohm resistive load.

ATTENUATOR ... The output level is continuously adjustable by means of a wave guide beyond cut-off attenuator calibrated in 1 db divisions.

DISPLAY ... 5″ CRT

SENSITIVITY ... Detector for built-in amplifier and CRT presentation has a sensitivity approx. 60 db below 0.1 volt; gain and bandwidth measurements can be accomplished on circuits having a loss as great as 60 db.

POWER SUPPLY ... Self-contained, all DC voltages regulated. Input 105-125 volts, 50-400 cps, approx. 100 watts.

SIZE ... 12″x 13″x 17″.

WEIGHT ... Approx. 50 lbs.

PRICE ... $1500.00

Write today for complete detailed information

CANOGA CORPORATION

Radar Systems, Antennas, Receivers, Test Equipment

5955 SEPULVEDA BLVD. · VAN NUYS, CALIFORNIA

www.americanradiohistory.com

A
BRIGHT FUTURE
IN
ORIGINAL RESEARCH
FOR
ELECTRONIC ENGINEERS
PHYSICISTS *and*
MECHANICAL ENGINEERS
WITH
SYLVANIA

It is not surprising that many contributions and advances in the field of electronics have been made by Sylvania engineers. Our company has always placed heavy emphasis on original research, development and product design, offering engineers wide latitude for exploration and creative expression.

As a result, growth opportunities for engineers are virtually unlimited, as Sylvania aggressively advances in its growth tradition.

To aid our engineers in their progress, Sylvania also provides financial support for advanced education, as well as liberal insurance, pension and medical programs.

The following **PERMANENT POSITIONS** are now open at:

BOSTON & BUFFALO ENGINEERING LABORATORIES

Section Heads, Engineers-in-Charge, Senior Engineers, Engineering Specialists and Junior Engineers for Research, Design, Development and Product Design on complex subminiaturized airborne electronic equipment and computers, experienced in:

Pulse Techniques
Electro-Mechanisms
Microwave Techniques
Microwave Applications
Circuit Design
Equipment Specifications
F. M. Techniques
Miniaturization
Servo Mechanisms
Transistors
Heat Transfer
Shock & Vibration
Technical Writing
Analytical Problems
Antenna Design
Applied Physics
Systems Development & Testing
Component Selection
Component Analysis & Testing
Component Specifications
Digital Computer Circuits & Systems
Mechanical Design

Please forward complete resume to:
MR. CHARLES KEPPLE
SYLVANIA
ELECTRIC PRODUCTS INC.
175 Great Arrow Avenue, Buffalo, New York

Guyed Towers

(Continued from page 74)

rial, being the function of two components: the elasticity and structural adjustment of the cable. The latter component can be appreciably decreased by a prestressing operation, which consists of repeated tensioning of the cable to about 40 to 45% of its breaking strength. Care should be taken in coiling the cable after this operation, i.e. the diameter of loops should not be smaller than the one recommended by the cable manufacturer. Information on physical properties of various types of cable may be obtained from a Manufacturer's Handbook.

Recapitulating the above derived results, we now have the following rules governing the behavior of a suspended guy wire:

1. With reference to Fig. 2, the full length of the cable between points A and B is:

$$l_o = \left(\frac{s_o}{\sin\beta} + \frac{w_g^2 \sin\beta\, s_o^3}{24\, P_o^2} + \frac{l_o P_o}{AE}\right) \quad (9)$$

2. The tangent of the angle formed between the tension force P_o and its horizontal component P_o is:

$$tg(\beta_g) = \left(\frac{w_g\, s_o}{2\, P_o \sin\beta} + ctg\beta\right) \quad (3)$$

3. The relation between forces P_o and P_o^1 is:

$$P_o = (P_o^1 \cos\beta_g) \quad (4)$$

The above equations refer to a system of coordinates shown in Fig. 2 and are chosen as the fundamental geometrics for all further calculations.

In figuring the guy stresses, an immediate complication arises due to the fact that the specific load w_g of the cable is not the only force acting on the cable. The wind pressure on a guy per unit length may often sur-

WDTV TO WESTINGHOUSE

Agreement for Westinghouse to purchase DuMont's channel 2 TV station in Pittsburgh, WDTV, is signed by Dr. Allen B. DuMont, president of DuMont Labs. Seated at left is Chris J. Witting, president of Westinghouse Broadcasting Co. Standing are (l) Westinghouse vice president E. V. Huggins and Ted Bergmann, DuMont TV network director

www.americanradiohistory.com

pass its unit weight. For all practical purposes, the wind direction must necessarily be assumed to act horizontally. As it will be seen below, nearly all types of loadings may be adequately dealt with, but in practice, we should be guarded against hair splitting and time consuming calculations.

Accuracy

The legitimate accuracy in stress analyses lies within 10% of the actual. It is the duty then of a stress analyst to estimate the various factors and suppress those the effect of which on the equilibrium system as a whole is relatively insignificant.

Needless to say, that cumulative factors and/or factors influencing inductively the behavior of elastic systems should never be dropped. More on this subject may be found elsewhere below.

With the assumption that the wind acts horizontally, the resultant force acting on the cable is:

$$w_r = \sqrt{w_w^2 + w_g^2}$$

Here, w_w is the wind pressure per unit length of the cable and w_g as before represents the weight of the cable. This resultant force (w_r) is no longer a vertical one, and, in addition, it may not lie in the vertical guy wire plane. As a consequence, when wind is present, the above derived equations (3, 4 & 9) cannot be applied directly. The action of wind on two opposing guys immediately segregates them into windward and leeward stays. In order to approach the problem systematically, we shall consider the same in two steps; the first one is the 2-dimensional case when the wind acts in the plane of two opposite guys, and the second one represents the 3-dimensional analysis of 3 or more tower guys, with the wind acting at any desired angle.

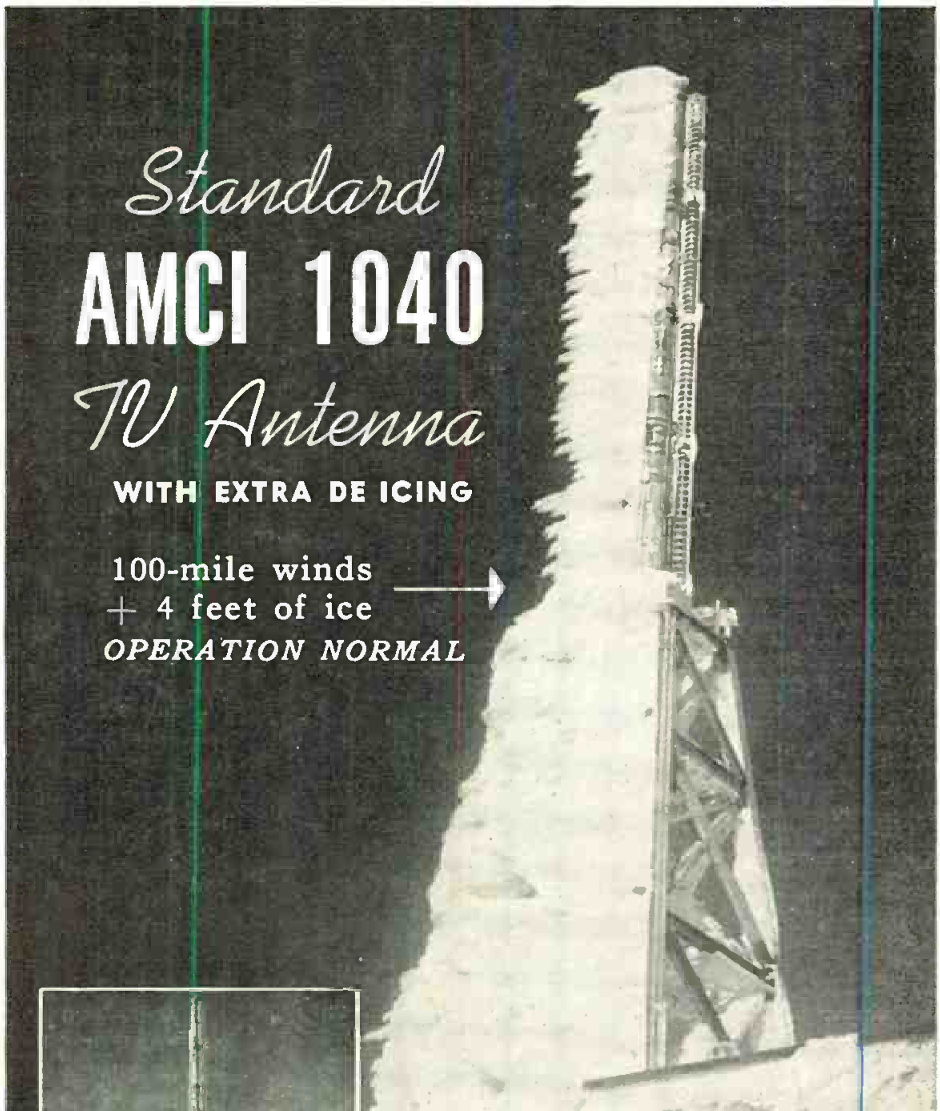
Opposite Guy Wires

We will now take the case of the tower supported by two opposite guy wires lying in one plane parallel to the wind direction. This case is illustrated in Fig. 3.

Let us assume that tower BO is held vertically at no wind conditions by two symmetrically opposed guys —BD and BA.

Both guys have an initial tension of P'_0 lbs., and each of them is l_0 ft. long. The angle which they form with the vertical is $\beta°$.

Next, let us assume that wind of force P lbs./sq. ft., on flat surface, is acting in the direction shown in Fig. 3. The wind pressure on the tower produces horizontal force W which



Chosen for use in "the world's worst weather" — atop New Hampshire's Mount Washington — the AMCI Type 1040 Antenna handles severe ice storm and high winds for Station WMTW (TV) Channel 8 with no decrease in transmitting efficiency.

With ice accumulating at a rate of 4½ inches per hour and winds averaging better than 100 miles per hour on Sept. 22-23, a combination of solid and rime ice built up to the 4-foot thicknesses shown above. Yet the deicers, operating at 1/16 power, kept the antenna clear and allowed normal operation and normal reflectometer readings throughout the storm.

And this antenna successfully withstood hurricanes Carol and Edna, in which wind velocities exceeded 140 miles per hour.

AMCI transmitting antennas available for full- or stand-by service on channels 7 through 13. *Write for bulletin T-913.*

ANTENNA SYSTEMS — COMPONENTS — AIR NAVIGATION AIDS — INSTRUMENTS

AMCI **ALFORD** *Manufacturing Co. Inc.* 299 ATLANTIC AVE., BOSTON MASS.

For product information, use Inquiry card on last page.

www.americanradiohistory.com

Guyed Towers

(*Continued from page* 113)

must be counterbalanced by means of stays; the initial tension in guy BD is thereby increased and the one in guy AB decreased. As a consequence, tower BO sways and its top moves over to point "C" causing a Δ deflection. The new position of the tower is reached at equilibrium, i.e. when all forces are in balance.

If the wind pressure acting normally on a FLAT surface is P lbs./sq. ft. the pressure on a cylindrical surface (like that of a round cable) according to RETMA standards is only (⅔ P) lbs. per sq. ft. of projected surface. A guy wire usually is not perpendicular to the wind direction, so that the wind pressure must be assumed to act on the projection of the cable to a plane normal to the direction of wind. As mentioned above, the resultant force w_r produced by the combined gravity and wind loadings does not act as a vertical force. Moreover, if the guy is not lying in a plane parallel to wind direction, the resultant force w_r will form an azimuth angle θ with it.

$$\gamma_w = (\beta + \varphi) \text{ and } \gamma_L = (\beta - \varphi)$$

Here φ is the angle between w_g and w_r so that

$$\text{Cos}(\varphi) = \frac{w_g}{w_r};\ \sin(\varphi) = \frac{w_w}{w_r};\ \text{and } \text{tg}(\varphi) = \frac{w_w}{w_g};$$

Eqs. 3, 4, 6, 7 and 8 are based on the assumption that force acts perpendicularly to the abscissa of the coordinate system. It follows that if this resultant force does not act perpendicularly to the abscissa, the origin of the coordinate system must be moved in such a way as to have its ordinate parallel to w_r. The two points of the suspended cable, i.e. A and B must again lie on the ordinate and abscissa respectively of the new coordinate system.

Part Two will appear in the February issue.

Custom Printed Circuits

Beck's Inc., 298-300 E. 5th St., St. Paul 1, Minn. announces the availability of custom printed circuit facilities. Circuitry, slip rings and other components can now be made in any reasonable size, shape or work capacity for either high or low voltage use. The "Beck" process imbeds the circuitry within any usable combination of suitable materials such as fiberglass, phenolic resins, paper, nylon, mica etc. Only terminals required for external connections are exposed. Beck's Inc. is a principal supplier to General Mills.

www.americanradiohistory.com

INDUSTRY NEWS

Major General Edmond H. Leavey (Retired) has been elected president of International Standard Electric Corp., overseas mfg. subsidiary of I.T.&T.

E. K. Foster, vice president of Bendix Aviation Corp. has been named group executive in charge of Bendix Radio, TV, Broadcast Receiver, York and Cincinnati Divisions. **Howard Walker**, formerly plant manager of the York Div., has been made general manager. **Maurice W. Horrell**, director of engineering and asst. general mgr. of the Computer div. at Los Angeles has been named general manager.

Gen. Walter Bedell Smith has been elected to the Board of Directors of RCA.

George M. Hakim has joined Hoffman Radio Corp. of Los Angeles as Director of Advertising. Previous to this appointment he was Advertising Manager of DuMont television and with the Radio-TV Div. of Raytheon Mfg. Co. as Advertising Director.

G. M. Hakim

R. W. Cotton

Richards W. Cotton has been appointed Assistant to the President (**Joseph H. Quick**) of National Co., Malden, Mass.

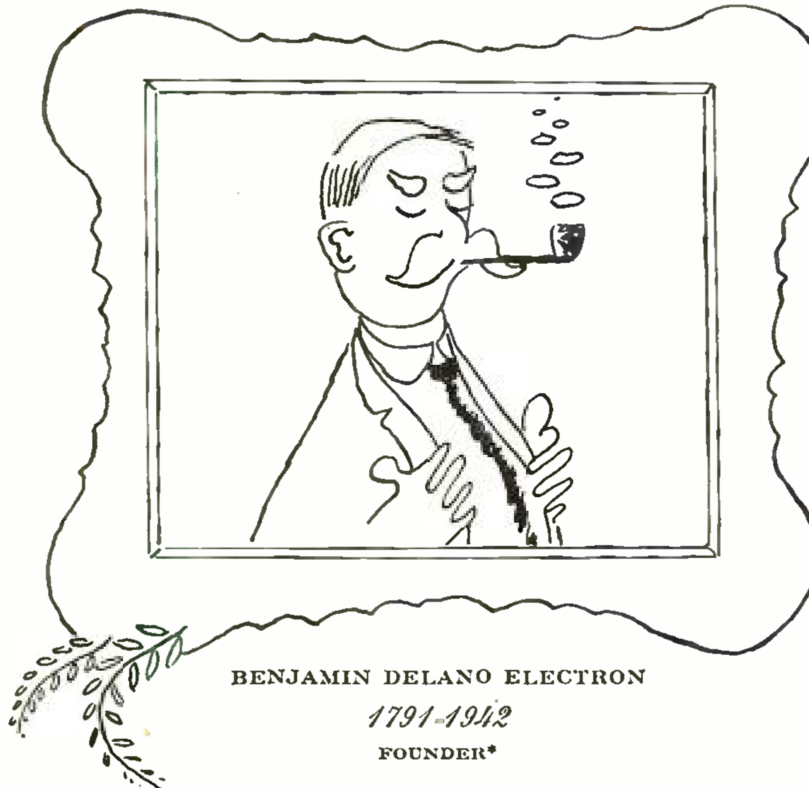
L. Arthur Hoyt has become Advertising Manager of the Cathode-ray Tube Div. of Allen B. DuMont Labs.

George Mena has been named district manager in the Southeast section of the U.S. for Belden Mfg. Co.

Ralph L. Power Advertising has moved to 11-300 E. Manzanita Mesa Rd., Littlerock, Calif., mailing address Star Route 1, Box 34.

Ward R. Schafer has been named West Coast Regional manager of the TV Broadcast Receiver div. of Bendix Aviation Corp., replacing **Bartley C. Furey** who is the new assistant sales manager of the division.

John D. Harper has become manager of Sales Promotion and Market Research for Stupakoff Ceramic & Mfg. Co. His former position as Sales Engineer in the New York State territory is occupied by **John Lazor.**



BENJAMIN DELANO ELECTRON

1791–1942

FOUNDER*

We take our share of pompous pride, shyly calling attention to our own contribution, in fatuously welcoming the Billenium. General Motors has built 50,000,000 self-propelled hydrocarbon energy converters, General-Whats-his-name has gotten his family of scientists to develop the prestige-pump. The BEV is dashing the modesty of the nucleus, and the lowly potato, long the friend of the TV-less, deepfreezeless proletariat, now coyly minces garbed in snobba-peel.

Our own bosom-swelling pride stems from our tradition of back-slapping familiarly with the greats of electricity and magnetism, whose august names are memorialized by the lower-case initial—joe volt, sam ampere, ed gauss, john henry, fred faraday—to us, each of these is a saint of science, their spirits blazoned on our banners boldly.

And now, in our humble way, we place on the altar of science at the epicenter of the Billenium our intellectual contribution for posterity. We are memorializing one of our staunchest researchers, who has reduced to hitherto unknown limits of accuracy, the measurement and observation of energy loss (or FRICTION), both magnetic and mechanical.

The New Unit is equal, for obvious reasons of national pride, to the friction overcome when the Battleship Missouri was pulled off the mud. As with the farad, in ordinary use, it is prefixed micro, or micro-micro, and for export to Europe, pica. It is the mccarthy (micromccarthy, micromicromccarthy, picamccarthy). M. K. S. and C. G. S. adherents may obtain metric conversions from Navy BuShips data on the big Mo. Absolute units are of course the abmccarthy and the statmccarthy.

Sensitive relays with good repeatability of operating characteristics never have more than 130 centimeter-micromicromccarthys (50 inch-micromicromccarthys) of pivot friction at all extremes of temperature. Sigma relays don't even have that much.

*THIS ISN'T OUR FOUNDER, BUT WE THINK HE SETS THE RIGHT TONE, AND IS MORE PICTURESQUE THAN OURS, WHO ISN'T EVEN DEAD YET!

SIGMA

SIGMA INSTRUMENTS, INC.
86 PEARL ST., BRAINTREE, BOSTON 85, MASS.

For product information, use inquiry card on last page.

www.americanradiohistory.com

More Engineers on A-N and civilian projects are proving—

It pays to specify

AMPERITE DELAY RELAYS and BALLAST REGULATORS

...they're finest ...cost less!

AMPERITE DELAY RELAY

STANDARD

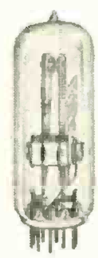
Thermostatic DELAY RELAYS

MOST COMPACT, HERMETICALLY SEALED

Provide delays ranging from 2 to 150 seconds.

- Actuated by a heater, they operate on A.C., D.C., or Pulsating Current.
- *Hermetically sealed.* Not affected by altitude, moisture, or other climate changes.
- Circuits: *SPST only* — normally open or normally closed.

Amperite Thermostatic Delay Relays are compensated for ambient temperature changes from —55° to +70°C. Heaters consume approximately 2 W. and may be operated continuously. The units are *most compact, rugged, explosion-proof, long-lived,* and — *inexpensive!*

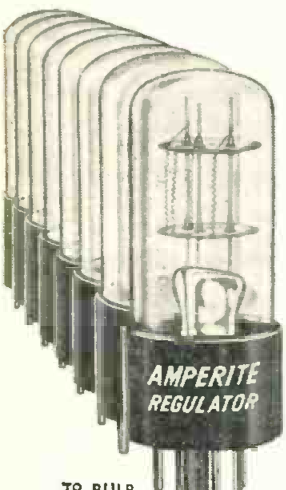


MINIATURE

TYPES: Standard Radio Octal, and 9-Pin Miniature.

PROBLEM? Send for Bulletin No. TR-81

Also — a new line of **Amperite Differential Relays** — may be used for *automatic overload, over-voltage, under-voltage* or *under-current protection.*

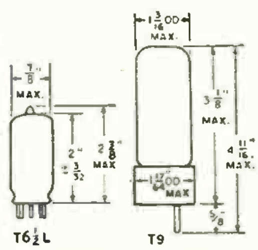


AMPERITE REGULATOR

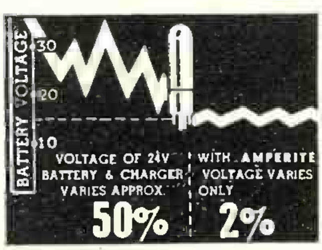
T9 BULB

BALLAST REGULATORS

- Amperite Regulators are designed to keep the current in a circuit ***automatically regulated*** at a definite value (for example, 0.5 amp).
- For currents of 60 ma. to 5 amps. *Operates on A.C., D.C., Pulsating Current.*
- Hermetically sealed, light, compact, and most inexpensive.



Amperite Regulators are the simplest, most effective method for obtaining ***automatic regulation*** of current or voltage. ***Hermetically sealed,*** they are not affected by changes in altitude, ambient temperature (—55° to +90°C), or humidity. Rugged; no moving parts; changed as easily as a radio tube.



AMPERITE

Write for 4-page Technical Bulletin No. AB-51

AMPERITE CO. Inc., 561 Broadway, New York 12, N. Y.

In Canada: Atlas Radio Corp., Ltd., 560 King St. W., Toronto 2B

PERSONAL

Dr. James M. Sharp has joined the Physics Dept. of Southwest Research Institute, San Antonio, Texas, as Supervisor of Special Projects. He was recently associated with atomic energy development programs at Sandia Corp. and the Air Force Special Weapons Center.

Mr. V. A. Woodell has been elected vice president in charge of manufacturing and **Mr. R. A. Jarboe** vice president in charge of engineering at Electra Mfg.

V. A. Woodell

R. A. Jarboe

Dr. LaVerne R. Philpott, has been appointed a coordinator in the Research Div. of New York University's College of Engineering. Dr. Philpott will direct and participate in air navigation and scientific photography studies.

John D. Moynihan has joined the Moduline Carrier Current Development Group of Sprague Electric Co. He was formerly electric utility engineer at Westinghouse Electric Corp.

Patrick E. Lannan has been appointed vice president of Designers for Industry, Inc., Cleveland, Ohio research and development firm.

P. E. Lannan

W. M. Thames

Col. W. Mack Thames has been named Chief of the Signal Plans and Operations Div. in the Office of the Chief Signal Officer, U. S. Army. Prior to this assignment he had been serving as Ass't Chief of the Engineering and Technical Div.

Ruben E. Carlson has been appointed to the position of Coordinator of High Fidelity Products with Fairchild Recording Equipment Co., Whitestone, N.Y.

www.americanradiohistory.com

Statistics

Electricity Generated in U.S.

Total Public supply in thousands of kilowatt-hours

1954	468,500,000
1953	442,000,000
1952	398,924,000
1951	370,234,364
1950	329,141,343

Note: Cost of electric power consumed by home TV receivers in 1953 was $300,000,000

Sound Recording—1954

4.5 billion feet of magnetic tape
Appr. cost $10 million
Tape Markets (Est.)
- 35% radio, TV, movies, commercial recording
- 35% home recording
- 15% industrial (computers, instrumentation etc.)
- 15% educational (schools, institutions)

1954 Commercial Electronic Sales

Estimated factory sales electronic products to commercial and industrial purchasers

Measuring Equipment	$120,000,000
Broadcast Equipment	65,000,000
X-ray Equipment	55,000,000
Control Equipment	55,000,000
Communications Equipment, Mobile, marine & aviation	50,000,000
Induction and dielectric heating	20,000,000
Microwave relays	15,000,000
Industrial TV	8,000,000

Color TV

(Continued from page 71)

bility (equivalent to direct view convergence stability) is achieved by using a regulating circuit to control focus current as high voltage changes occur.

Broad public acceptance of projection color TV appears to depend on further engineering refinements to improve performance and lower cost. It is believed that projection and direct view can exist side by side only until competitive factors decide which one will be most favored by viewers.

Ryder IRE President

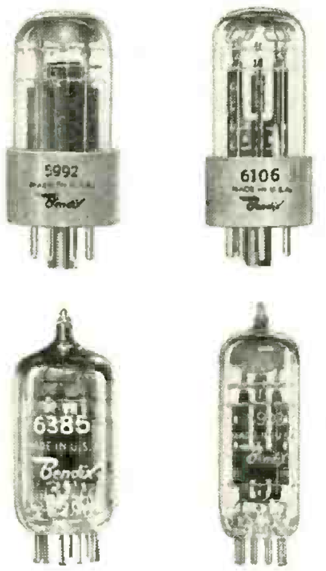
John D. Ryder, dean of the School of Engineering at Michigan State College, has been elected president of the Institute of Radio Engineers for 1955. He succeeds William R. Hewlett, vice-pres. of Hewlett-Packard Co.

Franz Tank, professor at the Swiss Institute of Technology, Zurich, will succeed Maurice J. H. Ponte, director of Compagnie Generale de Telegraphie Sans Fil, as IRE vice-pres. in recognition of the international Character of the IRE's membership and activities.

DEPEND ON

Bendix Red Bank

RELIABLE ELECTRON TUBES



With electronic controls taking over more and more operational functions in military and industrial applications, it is becoming increasingly important that the electron tubes used be dependable under extremely severe conditions. This applies particularly to installations in aircraft where tubes must operate reliably at high altitudes, while subjected to continuous vibration, varying voltages and frequent shock. Because of their advanced design and construction . . . born of never-ceasing research and special production skills . . . Bendix Red Bank Reliable Electron Tubes have the dependability necessary to meet these severe operating conditions. You can depend on our long, specialized experience to give you the right answer . . . for all types of regular as well as special-purpose tube applications. Tubes can be supplied to both commercial and military specifications. Call on us for full details.

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors, Voltage Regulators and Fractional D. C. Motors

DESIGNATION AND TYPE					TYPICAL OPERATING CONDITIONS		
Type	Proto-type	Bendix No.	Description	Base And Bulb	Heater Voltage	Plate Voltage Per Plate	M.A. Load
5838	6X5	TE-3	Full Wave Rectifier	Octal T-9	12.6	350.	70.
5839	6X5	TE-2	Full Wave Rectifier	Octal T-9	26.5	350.	70.
5852	6X5	TE-5	Full Wave Rectifier	Octal T-9	6.3	350.	70.
5993	6X4	TE-10	Full Wave Rectifier	9-Pin Miniature	6.3	350.	70.
6106	5Y3	TE-22	Full Wave Rectifier	Octal T-9	5.0	350.	100.

Type	Proto-type	Bendix No.	Description	Base And Bulb	Heater Voltage	Plate Voltage	Screen Voltage	Grid Voltage	Gm	Plate Current	Power Output
5992	6V6	TE-8	Beam Power Amplifier	Octal T-9	6.3	250.	250.	12.5	4000	45. MA	3.5 W
*6094	6AQ5 6005	TE-18	Beam Power Amplifier	9-Pin Miniature	6.3	250.	250.	12.5	4500	45. MA	3.5 W
6385	2C51 5670	TE-21	Double Triode	9-Pin Miniature	6.3	150.	—	—2.0	5000	8. MA	—

*Tube Manufactured with Hard (Nonex) Glass for High Temperature Operation (Max. Bulb Temp. 300°C)

Bendix Red Bank DIVISION OF Bendix AVIATION CORPORATION

EATONTOWN, N. J.

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif. • Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.
Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

For product information, use inquiry card on last page.

www.americanradiohistory.com

free

send for the
most widely used
Electronic Supply Guide

ALLIED'S
COMPLETE 308-PAGE
1955 CATALOG

your guide to the world's largest stocks of
ELECTRONIC SUPPLIES FOR INDUSTRY

We specialize in Electronic Equipment for Research, Development, Maintenance and Production Operations

Simplify and speed *all* your electronic supply purchases. Order from the world's largest stocks of electron tubes (all types), test instruments, audio equipment, electronic parts (transformers, capacitors, controls, etc.) and accessories—*everything* for industrial and communications application. Let our expert Industrial supply service save you time, effort and money. Send today for your FREE copy of the 1955 ALLIED Catalog—the *complete* up-to-date guide to the world's largest stocks of Electronic Supplies for Industrial and Broadcast use.

One complete dependable source for everything in electronics

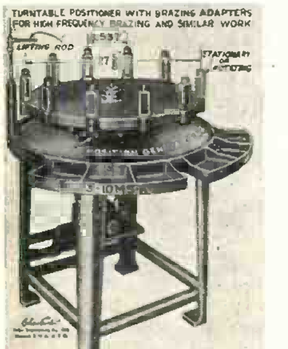
ALLIED RADIO
100 N. Western Ave., Dept. 18-A-5, Chicago 80, Ill.

Send for FREE CATALOG

INDEXING TURNTABLES OF EVERY DESCRIPTION

Eisler is considered a pioneer of indexing mechanisms. Has designed and built turntables for over 50 years. Indexing range from 1 to 400 RPM. Eisler indexing turntables have been adopted as standard for over 33 years by some of the largest firms in the U.S.A. Use Eisler Indexing machines as the basis and you can add parts for your own production. Hundreds of Eisler indexing machines are in daily use all over the world.

TURNTABLE POSITIONER WITH BRAZING ADAPTERS FOR HIGH FREQUENCY BRAZING AND SIMILAR WORK

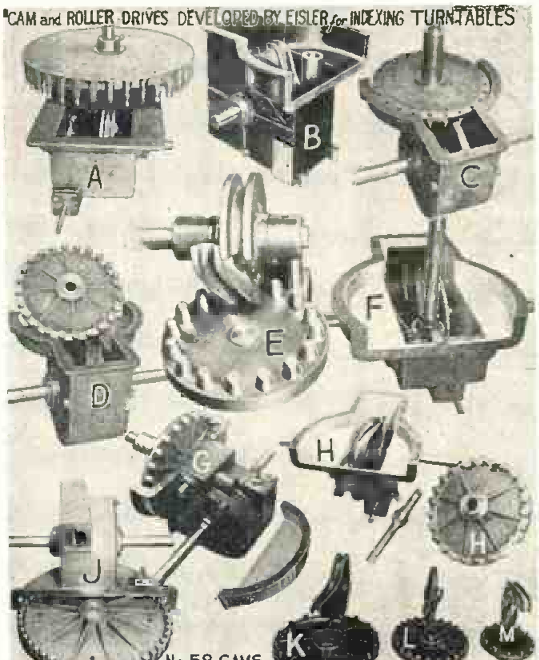


No. 23-10MS-A

CAMS

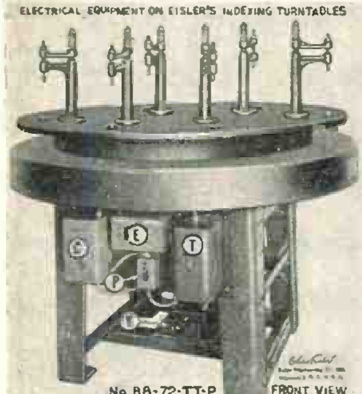
TILTING TURNTABLES AND POSITIONERS
A SPECIALIZED CAM MILLING
SERVICE, SPOT AND BUTT WELDING

"CAM and ROLLER DRIVES DEVELOPED BY EISLER for INDEXING TURNTABLES"



No. 58 CAMS

ELECTRICAL EQUIPMENT ON EISLER'S INDEXING TURNTABLES



No. 88-72-TT-P
FRONT VIEW

DR. CHAS. EISLER M.E. PRES.

World Famous for Over 33 Years
Chas Eisler M.E.

EISLER ENGINEERING CO., INC.
770 So. 13th St., NEWARK 3, N. J.

Series Strings

(*Continued from page* 67)

perature of the cathode may adversely affect the cathode emission and may quicken the development of leakage through deposits of material evaporated or sublimed from the cathode. A good general rule is that the maximum voltage across any heater, during warm-up, should not exceed 1½ times voltage rating.

The use of a fixed resistor (or even better, a non-linear resistance with a negative temperature coefficient) in series with a heater string is one of the most effective methods for reducing the warm-up unbalance. However, the addition of series resistance increases warm-up time and aggravates the voltage variations of the heaters with changing line voltage. Because of these conflicting effects the use of a series resistor for this purpose on 26 v. systems must be carefully considered.

Heater Cathode Voltage

Heater cathode voltage becomes a consideration on systems designed for use of supply voltages of 115 or higher, particularly where the voltage is alternating. In the design of such heater arrangements, it is important to consider the maximum heater-cathode rating of the tube. Heater-cathode voltage ratings are usually given in terms of peak voltages; the effective voltage, therefore, consists of the dc voltage plus the peak voltage including any signal voltages. If the heater cathode voltage is too high, the incidence of break down of heater-cathode insulation is certain to be aggravated. Although it can be said that the life of a tube used within its ratings will be satisfactory, the term "satisfactory" is a relative one. Tube operation will be appreciably more reliable if the heater-cathode voltage is minimized. Large alternating heater-cathode voltages can also be conducive to hum. It is advisable to place the tubes used in circuit stages susceptible to heater-cathode hum near the ground end of the ac string. Fig. 5 shows how the heater bias voltage can reduce the hum output.

Series-Parallel Operation

In the sections covering Steady State Conditions and Voltage Unbalance During Warm-up, all comments were based on simple series strings. In many military equipment, the number of tubes employed makes it practical to cross-tie the series string in order to operate in a series-parallel arrangement. Such operation will greatly reduce many of the detri-

www.americanradiohistory.com

mental features of the series string. Fig. 4 may be used as an example of paralleling of heaters. The heater currents on the tubes used for these tests were not as diverse as discussed previously, however, the results will be proportional. The greater the number of tubes series-parallel strings the more will the distribution of voltage approach that of conventional parallel operation.

In equipments using series heater strings, there are a number of ways in which one tube failure may bring about the failure of associated tubes. For example, a heater-cathode short in certain tubes in the heater string may bypass or ground portions of the string placing excessive heater voltages on the other tubes of the string.

Multiple failures may also result from an open heater or filament. In a complex arrangement in which two parallel heaters are used within a series string, a heater or filament failure in one of the parallel legs causes increased voltages on the heaters or filaments in the other leg. As an extreme example of this effect, an arrangement is shown in

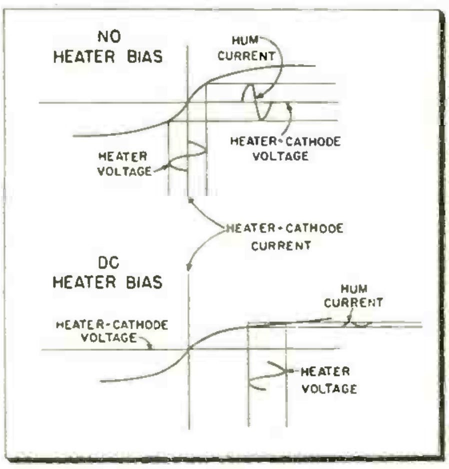


Fig. 5: Heater bias voltage reduces hum

Fig. 6, in which two parallel 150 ma heaters complete a string of 300 ma ampere heaters. If one of the 150 ma heaters opened the total current in the string would change only slightly, but the other 150 ma heater would experience more than four times its normal dissipation. Even if this tube did not fail immediately, it would almost surely fail when the equipment was allowed to cool off and then switched on again.

A similar problem arises when a resistance is placed in parallel with 450 ma heaters so that they may be fitted into 600 ma strings. Failure of one of the 450 ma heaters sends almost 600 ma through the shunt resistor which normally carries only 150, an increase in power by a factor approaching 16. There is a good

Requiring a panel area just 5/8" wide by 3/4" high (the longest models extend only 1-11/64" behind panel), these miniatures provide the ideal solution to compact design problems. Rugged, Johnson Miniature Air Variables will stand up under the most rigorous conditions, delivering peak performance throughout the VHF ranges. Soldered plate construction, oversize bearings, and heavily anchored stator supports provide extreme rigidity—torque is steady; rotor stays "put" where set. Bridge type stator terminal provides extremely low inductance path to BOTH stator supports. Silver plated rotor contacts for low noise level at high frequencies—all other metal parts nickel plated. DC-200 treated steatite end frames maintain high insulation resistance.

SINGLE SECTION

Cat. No.	Type No.	Cap. per Sec. Max	Cap. per Sec. Min.	Plates per Sec.	L	Net Price
160-102	5M11	5	1.5	5	49/64"	$0.95
160-104	9M11	8.7	1.8	9	13/16"	1.00
160-107	15M11	14.2	2.3	15	1"	1.15
160-110	20M11	19.6	2.7	21	1 11/64"	1.30
160-130	30M8	32	3	28	1 11/64"	1.35

BUTTERFLY

Cat. No.	Type No.	Cap. per Sec. Max.	Cap. per Sec. Min.	Plates per Sec.	L	Net Price
160-203	3MB11	3.1	1.5	5	45/64"	1.35
160-205	5MB11	5.1	1.8	9	13/16"	1.50
160-208	9MB11	8	2.2	15	1"	1.70
160-211	11MB11	10.8	2.7	21	1 11/64"	1.90

DIFFERENTIAL

Cat. No.	Type No.	Cap. per Sec. Max.	Cap. per Sec. Min.	Plates per Sec.	L	Net Price
160-303	6MA11	5.0	1.5	5	23/32"	1.40
160-305	9MA11	8.7	1.8	9	13/16"	1.55
160-308	15MA11	14.2	2.3	15	1"	1.75
160-311	19MA11	19.6	2.7	21	1 11/64"	2.00

SPECIALS—JOHNSON Miniature Air Variables are available in production quantities with the following features: 1. Locking bearing. 2. 180° stop. 3. Various shaft extensions. 4. High torque. We will be happy to furnish quotations on your special requirements. For complete information on standard Johnson components write for your copy of the new Johnson General Products Catalog 975.

E. F. JOHNSON COMPANY

2320 SECOND AVENUE SOUTHWEST • WASECA, MINNESOTA

CAPACITORS • INDUCTORS • SOCKETS • INSULATORS • PLUGS • JACKS • KNOBS • DIALS • PILOT LIGHTS

For product information, use inquiry card on last page.

www.americanradiohistory.com

new
non-slip lacing tape

GUDELACE - H*

rubber-coated nylon

FUNGUS-RESISTANT . . . FLAME-RESISTANT

This new braided nylon lacing tape has a unique rubber coating to prevent slipping. It is easy to handle, ties securely, speeds production because knots stay put!

Another Gudebrod development!

Write for complete information and a free trial supply today.

GUDEBROD BROS. SILK CO., INC.

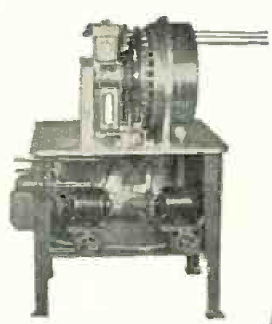
ELECTRONICS DIVISION
225 W. 34th Street, New York 1, N.Y.

EXECUTIVE OFFICES
12 S. 12th Street, Phila. 7, Pa.

*T.M.

plan your production with **KAHLE** machinery

built specifically for your operation



Industry leaders in electronics, glass, and allied fields have continuously keyed their operations to KAHLE Machines for over a quarter of a century. *Your* production rate, *your* specifications, *your* requirements—are "planned-in" KAHLE Machines.

Call KAHLE for "machines that think for you!"

Kahle
ENGINEERING COMPANY
1314 SEVENTH STREET
NORTH BERGEN, N. J

Series Strings

(*Continued from page* 119)

chance that the resistor will open and not be caught. Should this happen replacement of the defective tube could restore the equipment to operation, but the open current sharing resistor could cause greatly reduced life of the 450 ma tubes.

No assurance of the existence, or non-existence, of a property can be given unless a measure of that property is a requirement of the governing MIL-E-1 specification. Any circuit requiring properties not assured by the specification may be very difficult to maintain in the field where only replacement tubes procured to the specification requirements are available. Some of the more critical specification considerations for electron tubes used in series heater strings of military equipments follow:

1. The test point heater current tolerance must be smaller than presently permitted. This is a compromise method for controlling the center value resistance. It must be pointed out that the narrowing of limits has definite practical limitations since the percentage of tubes used in series heater strings is low as com-

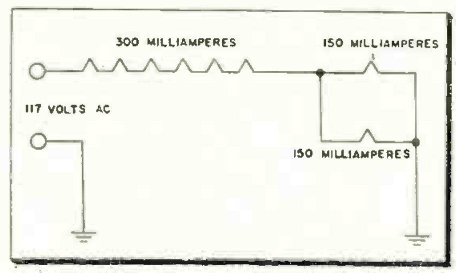


Fig. 6: Circuit designs using series-parallel combination illustrated are not reliable.

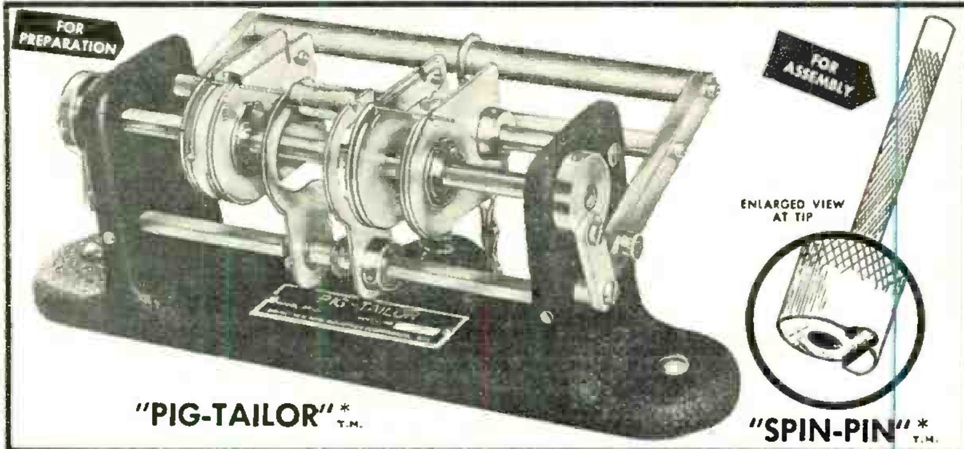
pared with those operated with individual heater voltage supply. Cross-tying for series parallel operation, shown in Fig. 1, will greatly relieve the current tolerance requirements.

2. Inclusion of acceptance limits for the lot average will help stabilize the results of series parallel operation and improve the general series string providing that the attribute limits and the actual dispersion of the individuals of the lot are compatible. Fig. 3 shows typical plots of heater current distributions for two high production types presently on MIL-STD-200. These data are for purposes of showing a typical single lot distribution and should not be considered as indicative of possible specification changes, many factors may influence the location of the average of heater current. Referring to Fig. 3, the limits for the average as established by the usual method,

www.americanradiohistory.com

"PIG-TAILORING"

. . . . *a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.*



The "PIG-TAILOR" plus "SPIN-PIN" — Accurately Measures, Cuts, Bends, Ejects and Assembles both leads simultaneously to individual lengths and shapes — 3 minute set-up — No accessories — Foot operated — 1 hour training time.

PIG-TAILORING provides:
1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits
6. Individual cut and bend lengths.
7. Better time/rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery.

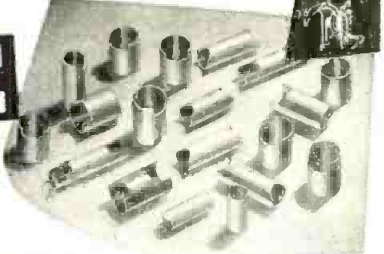
PIG-TAILORING eliminates:
1. Diagonal cutters.
2. Long-nose pliers.
3. Operator judgment.
4. 90% operator training time.
5. Broken components.
6. Broken leads.
7. Short circuits from clippings.
8. 65% chassis handling.
9. Excessive lead tautness.
10. Haphazard assembly methods.

* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. TT-1

BRUNO-NEW YORK INDUSTRIES CORPORATION
DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT
460 WEST 34th STREET • NEW YORK 1, N. Y.

To build a better *Flyback transformer start with a* RESINITE COIL FORM



Resinite flyback transformer coil forms are fabricated from select materials and resin impregnated by a special process to provide optimum dielectric characteristics.

In volume resistivity . . . low power factor . . . resistance to voltage break down . . . excellent thermal properties . . . and low moisture absorption . . . Resinite outperforms all other resinated products.

Resinite flyback transformer coils are available in any size or shape and are notched to your specification. Delivery is prompt in any quantity.

Request full information and samples.

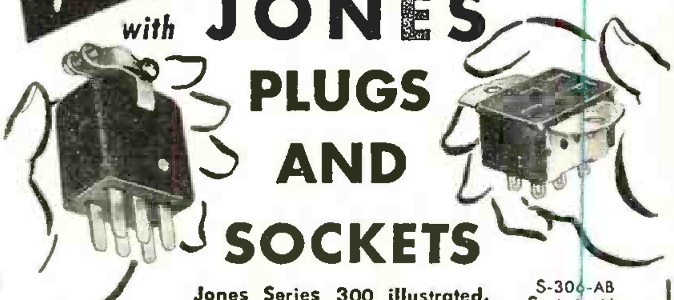
RESINITE CORPORATION

Sales Representatives in:

New England: Framingham, Mass., Framingham 7091
New York, New Jersey: Jersey City, New Jersey, Journal Square 4-3574
Upstate New York: Syracuse, N.Y., Syracuse 76-8056
Maryland: Baltimore, Maryland, Plaza 2-3211
Philadelphia: Philadelphia, Pa., Chestnut Hill 8-0282
Northern Ohio, Western Pennsylvania: Cleveland, Ohio, Atlantic 1-1060
Indiana, Southern Ohio: Logansport, Indiana, Logansport 2555
Missouri, Southern Illinois, Iowa: St. Louis, Missouri, Sterling 2318
California: Pasadena, California, Sycamore 8-3919
Canada: Montreal, Quebec, Canada, Walnut 2715

Division of **PRECISION PAPER TUBE COMPANY**
2035L W. CHARLESTON ST. • CHICAGO 47, ILLINOIS

INSURE *Proven Quality* with JONES PLUGS AND SOCKETS



P-306-CCT Plug, Cable Clamp in Cap.

Jones Series 300 illustrated. Small Plugs & Sockets for 1001 Uses. Cap or panel mounting.

S-306-AB Socket with Angle Brackets.

- Knife-switch socket contacts phosphor bronze, cadmium plated.
- Bar type Plug contacts brass, cadmium plated, with cross section of 5/32" by 3/64".
- Insulation molded bakelite.
- All Plugs and Sockets polarized.
- Metal Caps, with formed fibre linings.
- Made in two to 33 contacts.
- For 45 volts, 5 amperes. Efficient at much higher ratings where circuit characteristics permit.

Ask for Jones Catalog No. 20 showing complete line of Electrical Connecting Devices, Plugs, Sockets, Terminal Strips. Write or wire today.

HOWARD B. JONES DIVISION
CINCH MANUFACTURING CORPORATION
CHICAGO 24, ILLINOIS
SUBSIDIARY OF UNITED-CARR FASTENER CORP.

www.americanradiohistory.com

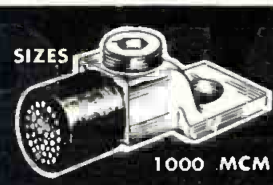
hot off the griddle!

ILSCO'S *New* CATALOG

• *for solving connector problems*

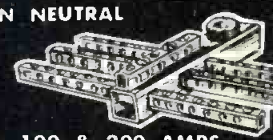
WRITE TODAY for your personal 80-page colorfully illustrated copy.

LO 7 SIZES



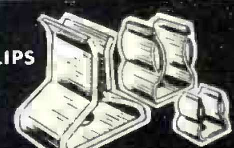
1000 MCM — 14

CAN NEUTRAL



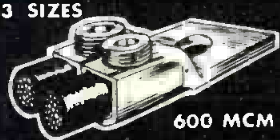
60, 100 & 200 AMPS.

FUSE CLIPS



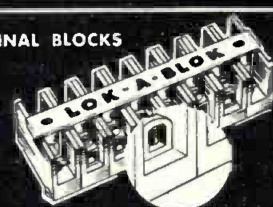
MANY SIZES AND TYPES

MU 3 SIZES



600 MCM — 6

TERMINAL BLOCKS



ILSCO 5742 MARIEMONT AVE., CINCINNATI 27, OHIO

Make your Ferrites with

HIGH PURITY MAPICO® RED FERRIC OXIDES for TOP performance

Purified synthetic products of reagent quality. Controlled particle size and shape contribute to effective control of packing and shrinkage. Our iron oxide production know-how can help you accomplish best results.

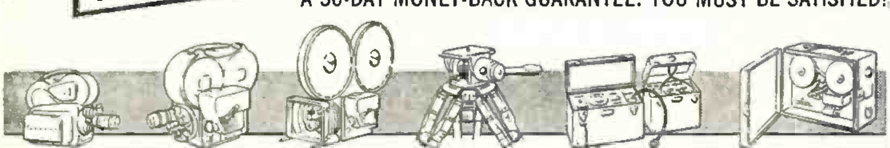
•

Manufactured by highly modern processes under rigid laboratory control. Clip this ad to your letterhead for a working sample.

COLUMBIAN CARBON COMPANY
MAPICO COLOR DIVISION
MANUFACTURER
BINNEY & SMITH INC., *Distributor*
380 MADISON AVENUE, NEW YORK 17, N.Y.

Auricon Hollywood

16mm SOUND-ON-FILM EQUIPMENT FOR TELEVISION NEWSREELS, TV FILM INSERTS AND KINESCOPE RECORDINGS...SOLD WITH A 30-DAY MONEY-BACK GUARANTEE. YOU MUST BE SATISFIED!



CINE-VOICE $695.00 | AURICON-PRO $1310.00 | SUPER 1200 $4652.15 | TRIPOD $325.00 | PORTABLE POWER UNIT $269.50 | SOUND RECORDER $1149.50

WRITE FOR FREE ILLUSTRATED INFORMATION

BERNDT-BACH, Inc.
6926 Romaine St., Hollywood 38, Calif.

MANUFACTURERS OF SOUND-ON-FILM RECORDING EQUIPMENT SINCE 1931

Series Strings

(*Continued from page* 120)

would be 169 ma and 181 ma. The effective attribute limit for an AQL of 0.65% for a distribution as shown would become 164 ma and 186 ma instead of 160 ma and 190 ma as presently specified for the type. The distribution is such that the end (attribute) limits will reject lots and tubes rapidly as these limits are approached. Consideration, then, should be given to the end limits if changes are deemed advisable.

3. Some assurance of maintaining warm-up time within certain limits will be required for the most satisfactory performances in series heater strings. When such limits are considered they must be the same for all tubes included in the heater string.

Television Stations

(*Continued from page* 82)

MARINETTE
WMBV-TV; 11; Radio-TV Park; N; 115; 526; Al Alexander; William R. Walker

MILWAUKEE
WCAN-TV; 25; 723 N. 3rd; C; 212; 620; Wally Wesley; Lou Poller
WOKY-TV; 19; 704 W. Wisconsin Ave.; D; 230; 410; Ralph E. Evans; Lee Bartell
WTMJ-TV; 4; 333 W. State St.; N, A, D; 100; 921; Phillip B. Laeser; W. J. Damm
WTVW; 12; 722 Empire Building; A, D; 316; 993; Lionel Wittenberg; Soren Munkohf

SUPERIOR
WDSM-TV; 6; 921 Tower Ave.; C, D; 100; 791; G. M. Baumann; Rodney Quick

WAUSAU
WSAU-TV; 7; 714 5th St.; C, N, A, D; 89.9; 423; Roland W. Richardt; George Frechette

WYOMING

CHEYENNE
KFBC-TV; 5; 2923 E. Lincolnway; C, A, N, D; 100; 618; Robert C. Pfonnenschmid; William C. Grove

ALASKA

ANCHORAGE
KFIA; 2; 3rd & F Sts.; A, C; 13; 138; George Roland; James C. Duncan
KTVA; 11; 4th & Denali; N, D; 3.22; 130; Jack M. Walden; August G. Hiebert

HAWAII

HONOLULU
KGMB-TV; 9; 1534 Kapiolani Blvd.; C; 104; 1770; Don Hunter; C. Richard Evans
KONA; 11; 206 Koula St.; N; 27.6; 337; Lawrence Trombly; John D. Keating
KULA-TV; 4; 1290 Ala Moana Blvd.; A, D; 26.3; 680; Ronald T. Miyahira; Jack Burnett

PUERTO RICO

SAN JUAN
WAPA-TV; 4; 357 Ponce De Leon Ave.; N, A, D; 56.2; 220; Jose Arzuaga; Delfin Fernandez
WKAQ-TV; 2; Box 5096, Puerta De Tierra Station, C; 100; 1271; Angel P. Del Valle; R. Degado Marquez

Utility Gets Microwave

Kentucky Utilities Co., Lexington, Ky., plans to modernize its communications system with a 160-mi. 7 station microwave system. The new system, made by Motorola, is scheduled for completion by mid-1955. It will use 15 channels and have an ultimate capacity of 24.

www.americanradiohistory.com

Letters

(*Continued from page 50*)

cifications. Salient points of this solution for equipment manufacturers are:

1. Your equipment designers should work with tube makerst in earliest stages. RTMA members will be glad to furnish type samples and their recommendations for your needs.
2. Explore all possibilities with tube makers' engineers before equipment designs are finalized and production begins. This will prevent serious difficulties later.
3. When it is determined that standard tubes will not give satisfactory performance, discuss the problem further with the tube manufacturer. There are two courses of action to solve the problem, either the circuit has to be modified or a new tube has to be considered to—AVOID SELECTIONS.

Coax Equations

Editors, TELE-TECH:

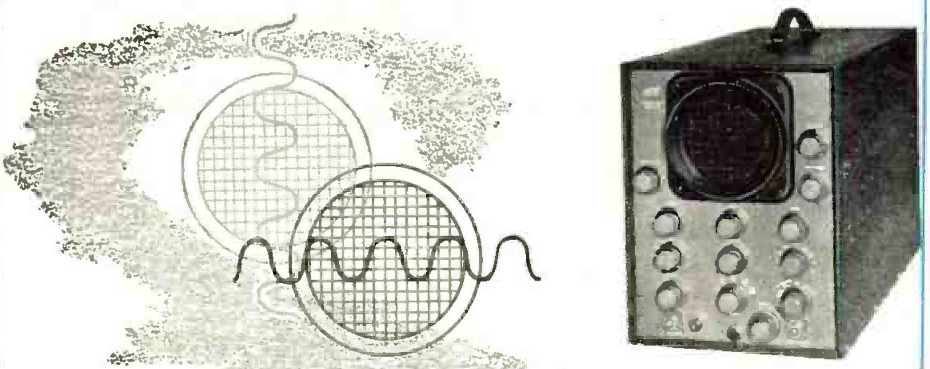
In my article entitled "Calculating the Impedance of Co-Axial Lines" appearing in the November issue there was an omission on my part. The symbol π was left out on page 92, column 2, line 16 and 20 which should read $\mu_0 = 4\pi \times 10^{-7}$ henry/meter in rationalized practical system and $\varepsilon_0 = \frac{1}{36}\pi \times 10^{-9}$ farad/meter in rationalized practical system.

Fortunately in the calculations the π term drops out. This error does not affect the calculations, but in the interests of accuracy the π term should have been included. I missed this symbol in proofreading the copy sent to you. Unfortunately the symbol is not contained on the typewriter used and an oversight resulted. Please forgive this oversight.

E. B. Herman
Haller, Raymond and Brown, Inc.
State College, Pa.

INDUSTRY-NAVY MEET

Industrial representatives confer with Naval personnel at the Electronic Supply Office, Great Lakes, in an effort to simplify the method used to provision Navy electronic equipments. (L. to R.) are: L. T. Bard, Chairman, Spare Parts Committee, RETMA, which is representative of the entire electronics industry; G. F. Wickham, Bureau of Supplies & Accounts, Navy Dept.,; F. S. LeRoy, RETMA; M. D. Cohen, ESO; W. C. Tayloe, Bureau of Ships, Navy Dept.; Cmdr. R. L. Watson, Supply Corps, USN, Bureau of Ships; Capt. F. F. Metzger, Supply Corps, USN, Commanding Officer of ESO; Cmdr. R. C. Sergeant, USN, ESO; H. H. Haber, Bureau of Ships; Lt. J. L. Midgett, USN, ESO; C. O. Granzin, ESO; L. F. Schropp and H. G. Beauregard, RETMA.



IDENTICAL AMPLIFICATION
for perfect performance

Precision measurement of phase shift is practically distortion free in the CROSBY Wideband Oscilloscope, Model 320. Identical horizontal and vertical amplifiers allow phase shift indication for frequencies up to 5 megacycles.

A deflection sensitivity of 35 millivolts RMS per inch, on both amplifiers, makes the Model 320 ideally suited for use in laboratories requiring accurate phase shift evaluation.

A general purpose, high-gain instrument . . . particularly adapted to color television measurements. An Oscilloscope designed by engineers for use by engineers.

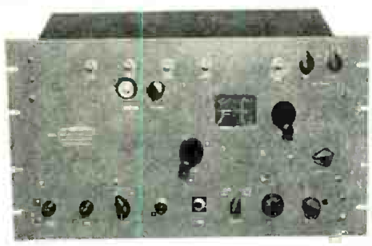
See Booth No. 481 IRE Show 1955

CROSBY

Write for literature

CROSBY LABORATORIES, Inc.
BOX 233 • HICKSVILLE, N. Y.

E-X-T-E-N-D THE RANGE OF
your frequency standard



vhf-uhf (20 to 1000 mc.)	*microwave* (500 to 12,500 mc.)
MODEL AM-1	MODEL FM-4
Measures and *generates* 20 to 1000 mc. Accuracy and stability as good as 1 part in 10^7 may be realized with proper driving source and auxiliary measuring equipment.	*Measures* and *generates* UHF through X bands. Extended frequency range possible. Requires 500-1000 mc. driving source. Contributes no error in accuracy and stability. When used with AM-1, accuracies of 1 part in 10^7 may be obtained.

For complete information and specifications contact your nearest Gertsch representative or

GERTSCH

GERTSCH PRODUCTS, INC.
11846 Mississippi Ave.
Los Angeles 25, Calif.

www.americanradiohistory.com

14 REASONS WHY VARIABLE TRIMMER JFD PISTON CAPACITORS ARE PREFERRED

1. Vernier Micrometer Adjustment
2. Ultra Linear Tuning
3. Freedom From Microphonics
4. No Tuning Backlash
5. Negligible Temperature Drift
6. High Dielectric Strength
7. Rugged Shock & Vibration Resistance
8. High Surface Resistivity
9. Wide Operating Temperature Range
10. Coaxial Tuning
11. Q Measurements Beyond 10,000
12. Precision Workmanship
13. Dust-proof Construction
14. Meet Strictest Military Demands

AIR EXPRESS DELIVERY ON STANDARD MODELS

MODEL	CAP. MMF	TEMP. COEFF. PPM PER °C	DIEL.	ROTOR ELECTRODE	TEMP. RANGE
VC 5	.5 to 5	approx. zero	Quartz	Invar	−55°C to +200°C
VC 11	1 to 10	approx. zero	Quartz	Invar	−55°C to +200°C
VC 12	10 to 20	approx. zero	Quartz	Invar	−55°C to +200°C
VC 1G	.5 to 8	+50 ± 100	Glass	Invar	−55°C to +125°C
VC 3G	.7 to 8	+600 ± 100	Glass	Brass	−55°C to +125°C
VC 4G	1 to 18	+600 ± 100	Glass	Brass	−55°C to +125°C
VC 11G	.7 to 12	+100 ± 50	Glass	Invar	−55°C to +125°C
VC 11GRB	.7 to 10	+750 ± 100	Glass	Brass	−55°C to +125°C
VC 11GRC	.7 to 10	+275 ± 100	Glass	Invar Brass Screw	−55°C to +125°C
VC 13G	1 to 10	+100 ± 50	Glass	Special Alloy	−55°C to +125°C

Other models available for ungrounded operation, larger ranges, fixed standards, etc.

Consult with JFD Engineers for piston capacitors designed to meet your specifications. Write today to be placed on the JFD Capacitor Bulletin mailing list.

JFD Electronics

JFD ELECTRONICS JFD MFG. CO., Inc., 1462-62nd STREET, BROOKLYN 19, N. Y.

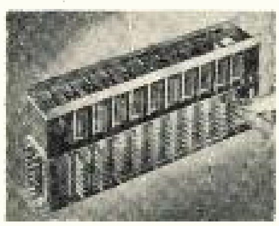
Cunningham ESTABLISHED 1838

crossbar

A truly superior switch for MASTER CONTROL AND MONITOR SWITCHING OF AUDIO & VIDEO CIRCUITS Also COMPUTERS • TELEMETERING TELEPHONY • DELAY LINES ETC.

Advantages

Extreme flexibility
Fast quiet switching
Crosstalk down 60 Db at 10 MC
Any group of setups may be held intact while setting up others
Provision for spot or remote control
Strapwiring eliminated
Excellent HF characteristics
Palladium contacts
Reduced cost
Compact design, small size
Low operating power—2.5 watts
Simple "package" installation



- Individual magnets at each cross-over.
- Maximum, six conductors per circuit.
- Life-tested to 100 million operations.

JAMES CUNNINGHAM, SON & CO., INC. Dept. T-1, Rochester, New York Tel: BAker 7240

HOLYOKE, MASS., HAS GOOD LABOR

There is an ample supply of both skilled and semi-skilled labor in Holyoke. Estimated population, 60,000.

A WONDERFUL PLANT
FOR SALE or LEASE AT OPPORTUNITY PRICES

125,000 sq. ft.—5 floors 315 x 80—light on all sides—high ceilings—low power rates—overnight shipments to major eastern cities.

STANDARD GREETINGS INC., HOLYOKE, MASS.

Tel. Holyoke 2-3263 or 5606

Transistor Parameters

(*Continued from page 65*)

rameters of the transistor may change with temperature even if the operating point remains constant.

We shall, in the following, discuss first the change in static characteristics and then the change in small signal performance for constant operating point.

Change with Temperature

Fig. 9 shows, for two different temperatures, the static output char-

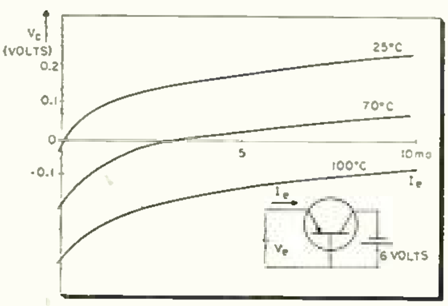


Fig. 10: Input-temperature characteristics

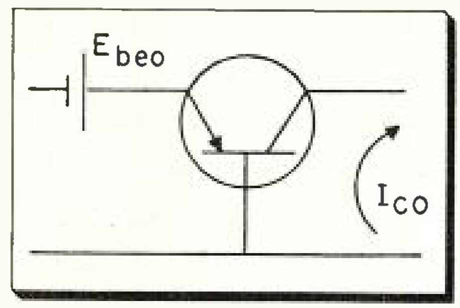


Fig. 11: Transistor equivalent circuit

acteristics with the emitter current as parameter. It may be seen that these curves are shifted in the direction of increased collector current by an amount I_{co} as the temperature increases. Since I_{co} is the collector current with open emitter we call it collector-diode current. This current increases exponentially with the temperature T:

$$I_{co} = I_{co}' e^{c(T-T_1)}$$

where I_{co}' is the diode back current at the temperature T_1. Typical values for the constant c are between 0.06 and 0.08 per degree C.

Fig. 10 shows, for three different temperatures, the input characteristics of the grounded base stage for constant collector current. It may be seen that the characteristics are shifted in the direction of decreased voltage by a constant amount ΔV. This amount is approximately:

$$\Delta V = -K_1 (T-T_1) \cong -\frac{c}{39} (T-T_1)$$

where c is the constant that was used in Eq. 4.

www.americanradiohistory.com

We can therefore represent the variation of the static characteristics with temperature, by adding a current generator and a voltage source to the transistor (Fig. 11).

Three of the six elements of the small signal equivalent circuits may change with temperature: g_c', g'_{co}

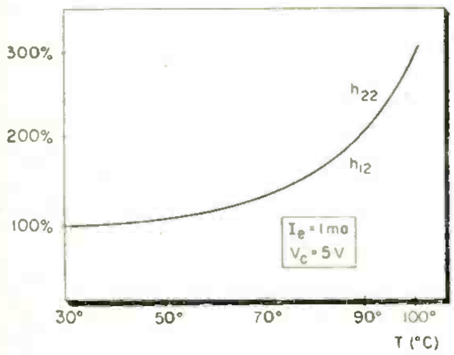


Fig. 12: Increase of h_{22} with temperature

and α'. Because of an increase in g'_{co} (the leakage conductance) h_{22} will increase with temperature for all practical transistors (Fig. 12). α' will increase above unity around 70° C. for some transistors due to a secondary emission effect. Methods for preventing this undesirable effect are known.

1. J. M. Early, "Effects of Space-Charge Layer Widening in Junction Transistors." Proc. IRE, Nov. 1952 p. 1401

Cues for Broadcasters

(*Continued from page* 63)

there is no way to tell the actual speed if it is off more than a few rpm. It is also useless for 45 rpm unless a special disc is obtained.

At WGAW we use a very simple method. Take a piece of Scotch tape about 1 or 1½ in. long and attach it to the outside rim of the turntable so that the tape protrudes a short distance above the table. Rest your hand on the cabinet next to the table with your index finger extended over the table edge. Each time the table rotates the tape will slap this finger. Keep your eye on the studio clock second hand and count the revolutions per minute (or use a stop watch—Ed.)

Illinois Mfrs. Elect

Arthur J. Schmitt, pres. of American Phenolic Corp., has been elected pres. of the Illinois Manufacturers' Assn. Others named were Gordon S. Culver, pres. of Richards-Wilcox Mfg. Co. for first v.p., Charles S. Craigmile, pres. of Belden Mfg. Co. for second v.p., and Leonard C. Ferguson, pres. of Western Newell Mfg. Co. for treas.

Kanthal DR resistance wire
SAVES YOU UP TO 50% because...

. . . it is lighter in weight (more feet per pound), and the per pound price is low. Total savings approximately 50%.

. . . Kanthal DR improves the performance of resistors and precision equipment. Its electrical resistivity is high — 812 ohms per circular mil foot — its temperature coefficient is low (±.00002°C between −50° and +150°C), and it has a low thermal EMF to copper.

Available in fine gages and all types of insulation.

WRITE FOR FURTHER INFORMATION AND PRICES TODAY

KANTHAL
THE KANTHAL CORPORATION
4 AMELIA PLACE, STAMFORD, CONN.

NEW INSTRUMENTS

R. F. CRYSTAL CALIBRATOR
MODEL 542
A portable source of standard frequencies in the range from 10 KC to 1000 MC. 1 MC crystal oscillator, 100 KC and 10 KC multivibrators. Built in mixer and audio amplifier. Short term stability of the order of .0005%.
PRICE $ 165.00 F.O.B. GROTON, CONN.

CAPACITANCE METER
MODEL 543
Designed for measuring circuit capacitances from 0 to 150 MMF on the tip of a convenient probe. Range 0-25 MMF covers 30% of the dial to make measurement of small capacitances easy. Maximum resistive load across measured capacitance 1.5 Kilohm. Accuracy 3% or .5MMF.
PRICE $ 175.00 F.O.B. GROTON, CONN.

Metronix Inc
P. O. BOX 549 NEW LONDON, CONN.

www.americanradiohistory.com

NEW UHF MEGACYCLE METER

With the Widest Frequency Coverage in a Single Band

MODEL 59 UHF

FEATURES

- Excellent coupling sensitivity.
- Fixed coupling point.
- Small grid current variation over band.
- Calibration point every 10 Mc.
- Uses split-stator tuning condenser with no sliding metal contacts.
- Standard camera socket for tripod fixtures.
- Octagonal case for convenient positioning.
- Useful in television transmitting and receiving equipment.

SPECIFICATIONS

FREQUENCY RANGE: 430-940 Mc in a single band
FREQUENCY ACCURACY: ±2% (Individually calibrated)
OUTPUT: CW or 120-cycle modulation
POWER SUPPLY: 117 volts, 60 cycles, 30 watts
DIMENSIONS: Oscillator Unit 4⅝" x 2½"
Power Unit 5⅛" wide x 6⅛" high x 7½" deep

Laboratory Standards

MEASUREMENTS CORPORATION
BOONTON · NEW JERSEY

1440 pgs.
Fully catalogs Radio-TV-Electronic parts & equipment: Tubes, Transmitters, Test Equipment, Comm. Receivers, Transformers, Capacitors, Antennas, Resistors, Coils & Relays, Recording & PA Systems, Hardware, Tools, etc., etc. OFFICIAL BUYING GUIDE OF THE INDUSTRY

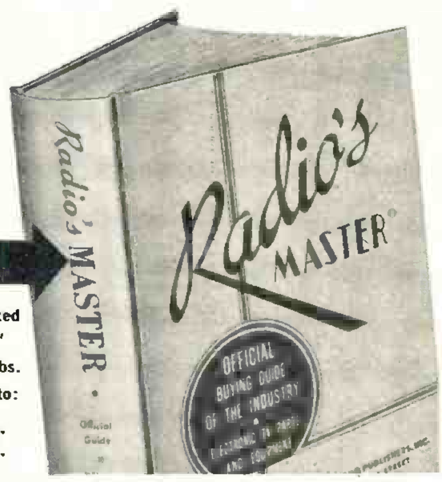
1440 page MASTER
for everything in Electronics

Make rapid selections from one industry-wide MASTER CATALOG complete with SPECIFICATIONS, ILLUSTRATIONS, DESCRIPTIONS, DIAGRAMS, PRICES on thousands of Radio-TV-Electronic parts and equipment.

NEW! 1955 BUYING GUIDE

List $6.50
As low as $1.95
• Over 85,000 items • Over 8,500 illus. • Fully indexed • 8½" x 11" • Weighs 6 lbs.

From leading parts distributors or write to:
UNITED CATALOG PUBLISHERS, INC.
110 Lafayette Street, New York 13, N. Y.



ANCHOR WELD BEAD INSULATORS for TRICOLOR TUBES
...of extruded AEROFLEX*

Perfect insulation . . . easy to attach . . . economical. From stock and to your specifications. Also: safety glass mounting channels; dust seals; flexible bumper channels. *polyethylene

ANCHOR INDUSTRIAL CO., INC. 36-36 36th St., Long Island City 6, N. Y. RAvenswood 9-1494
Chicago rep:
Pat Malone, 3844 Sherwin Ave., Lincolnwood, Ill., Orchard 5-4246

Frequency Comparator

(Continued from page 59)

directly proportional to their numerical value. This is done by using twelve tube-operated relays to switch calibrated resistors into one arm of a bridge. These resistors are chosen to add voltages in the 10 ohm summing bridge arm which are proportional to the count weight of the particular lights to which they are related. The relays are of sealed type and have dual mercury-wetted contacts giving positive action and very low resistance. Bridge arm ratios were chosen so that the maximum error introduced by the adding process is less than the amount of one of the 999 discrete steps that may be generated. The recorder

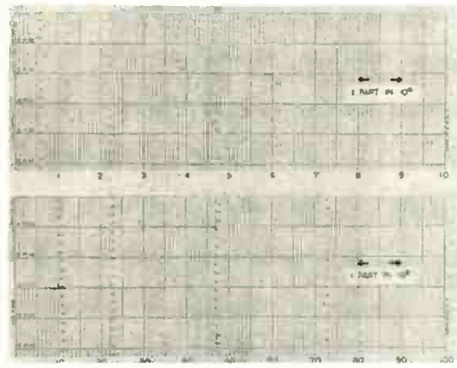


Fig. 6: (a—top) Typical chart records at a sensitivity of 1 part in 10^{11}. (b—bottom) Relative frequency at 1 part in 10^{10}

slidewire is used as one arm of the bridge and, in balancing, the movable contact seeks a voltage point in proportion to full scale voltage which is equal to the ratio of the displayed count to the maximum count of 999. It thus becomes unnecessary to regulate the voltage supplied to the bridge or to standardize the voltage calibration of the recorder, which results in simplification and freedom from calibration drift. Heavy lead wires and paralleled plug terminals are used to connect the slidewire in the recorder to the other bridge arms. However, it is necessary to generate a small voltage in the 10 ohm summing bridge arm to compensate for this lead drop and set the recorder for zero-scale balance with all relays open. A similar full-scale recorder calibration control, adjustable over a narrow range, is provided by varying the resistor in series with the slidewire bridge arm. As with any servo device, it is necessary to keep the loop sensitivity below a certain critical point to prevent overshooting or hunting in the recorder. A slight lowering of the available bridge supply voltage eliminated hunting and assured stable operation near maximum sensitivity; it also reduced the power dissipation in the calibrating resistors.

It should be noted that the recorded data gives directly only the last three digits of the difference frequency. Thus for all beat frequencies above 10 CPS the fourth and higher digits must be obtained visually from the other readout lights. As the shaping circuits in the counter do not pass frequencies much below 10 CPS and because, for other monitoring conveniences, the reference oscillator is generally set about 60 parts in 10^8 low in frequency, the beat frequency obtained at 1000 MC is about 600 CPS. Thus, for oscillators differing from 100 KC by amounts ranging up to $\pm$ 1 part in 10^7, numbers between 50 and 70 will be registered on the fourth and fifth decades. These numbers must be supplied ahead of the recorded reading representing the last three digits of the counted value to obtain the complete beat frequencies. It is also possible to read the entire count from the indicating lights if desired, giving parts in 10^{11} difference in the compared oscillators directly. At first thought, it might seem undesirable to obtain a recording of only the last three digits of the difference frequencies. It is this feature, however, which permits a very wide range of difference frequencies to be automatically recorded, for as soon as a full scale reading is passed another excursion across the chart is begun. By keeping account of the number of sweeps of a given channel across the chart in either direction and knowing the extra digits applying for any particular crossing, the entire readings may be easily obtained for successive periods.

In designing the recorder system some thought was given to the use of straight binary counters. By using ten binary stages and ten relays, 1023 discrete voltage levels could be registered, as compared to 999 levels for the 12-relay decade system. It was thought that the two extra relays were more than justified to simplify visual readout and to allow checking the accuracy of the recorder periodically in following the counted values. Counters having either the 4-light or the 10-light readout are readily adaptable to the 12-relay method.

Recorder

The recorder is used to control the programming for the entire system, including the switching of the six oscillator channels and the resetting of the counters after each printing operation. The recorder is a modified commercial 12-channel recording millivoltmeter of the dot-

★ ULTRA LOW capacitance & attenuation

TYPE	µµF/ft	IMPED.Ω	O.D.
C 1	7.3	150	.36"
C 11	6.3	173	.36"
C 2	6.3	171	.44"
C 22	5.5	184	.44"
C 3	5.4	197	.64"
C 33	4.8	220	.64"
C 4	4.6	229	1.03"
C 44	4.1	252	1.03"

WE ARE SPECIALLY ORGANIZED TO HANDLE DIRECT ORDERS OR ENQUIRIES FROM OVERSEAS

SPOT DELIVERIES FOR U.S.

BILLED IN DOLLARS— SETTLEMENT BY YOUR CHECK

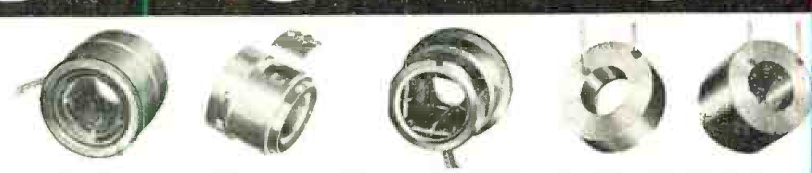
CABLE OR AIRMAIL TODAY

TRANS RADIO

NEW 'MX and SM' SUBMINIATURE CONNECTORS Constant 50Ω-63Ω-70Ω impedances

TRANSRADIO LTD. 138A Cromwell Rd. London SW7 ENGLAND CABLES: TRANSRAD, LONDON

YOKE SPECIALISTS



- Military or special yokes and focus coils designed to your specifications.
- Production yokes for TV sets.

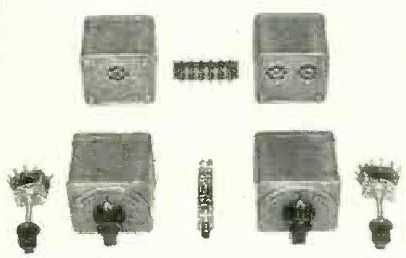
For your answer to yoke problems write Dr. Henry Marcy today.

syntronic INSTRUMENTS, INC.

100 Industrial Road • Addison, Ill. • Phone: Terrace 4-6103

For product information, use inquiry card on last page.

www.americanradiohistory.com



simplify custom installation

The 4200 Sound Effects Filter and 4201 Program Equalizer are now available in component form, as illustrated, for the custom builder.

In addition to the flexibility of installation, all the features and characteristics of the standard models are retained.

The high and low sections of either model may be obtained separately. Complete wiring instructions included.

Send for Bulletin TB-4

Model 4200 Sound Effects Filter
(Send for Bulletin S)

Model 4201, Program Equalizer
(Send for Bulletin E)

Representatives in Principal Cities

HYCOR
Company, Inc.

11423 VANOWEN STREET
NORTH HOLLYWOOD 2, CALIF.

Frequency Comparator

(*Continued from page* 127)

printing type. It originally had a full-scale reading of 100 mv. and operated from a dry cell voltage reference which was calibrated automatically at regular intervals against a standard cell. As the proportional method used did not require standardization, this equipment was removed. The voltage across the slidewire is maintained at approximately 100 mv. as a part of the bridge network. The 12-channel, two-pole commutator switch was altered to give six channels by using only alternate commutator segments and changing the cam system so that two consecutive segments are covered in rapid succession each time a new channel is switched on. One pole of this switch sequentially operates each of six relays, which connect each of the six oscillator channels in turn to one of the multipliers. By having a blank contact segment between each active contact, the difficulty of momentarily having two relays closed, and thus two oscillators in parallel, is avoided. Such a condition would cause considerable difficulty if any of the oscillator outputs were being used for other purposes. The other switch pole is used to reset the electronic counter by having all alternate sections connected in parallel. Here again the blank contact between each active position is useful, as otherwise the bridging effect of the commutator brush would keep the circuit closed continuously. Because of the double ratcheting required for switching each channel it was necessary to increase the gearing ratio between the print wheel shaft and the commutator shaft by a factor of two. Also, as a counting interval of 100 sec. was desired and additional time was required for the balancing and printing functions, the time for a complete channel cycle was increased from about 1 min. to about 3 min. This was done by addition of a concentric idler gear and jack shaft arrangement at the end of the cam shaft to operate the commutator switch and printing assembly at a lower speed.

Operation Sequence

The sequence of events and time required for each function of the recorder system are as follows:

a. Recorder switches off oscillator channel measured during previous cycle, connects another oscillator channel to multiplier input and sends a reset pulse to frequency and timing counters—8 sec.

b. Time delayed start pulse is gen-

It's the new ADVANCE SQ — a telephone type that hits a new high in ruggedness and efficiency!

Only 15 milliwatts per pole will operate the new SQ relay in the DPDT combination. Here is sensitivity teamed with stable performance—the DPDT unit withstands 10 G's vibration from 10 to 500 cycles. When power is increased to 40 milliwatts per pole, vibration resistance rises to 30 G's. A single-coil relay, the ADVANCE SQ is available in 1- to 5-amp contact ratings, and in contact combinations from SPST to 6PDT. It comes through Signal Corps tumbling and shock tests in excess of 200 G's with operating characteristics unimpaired.

Sustained efficiency keynotes SQ operation. The use of a beryllium copper armature retaining spring insures positive contact between armature and pivot points at all times. Cross-bar palladium contacts are always properly aligned. A wide variety of coil resistances is feasible. Instead of organic insulation, the unit employs Silicone glass, Kel-F, or Teflon tubing. Life expectancy for 5-amp, non-inductive loads is 150,000 cycles... for 1-amp, non-inductive load: 1,000,000 cycles.

Open type dimensions are 1" x ¾" x 1 5/16". DPDT units are supplied in a sealed container measuring 1" x 1" x 2". Write for literature on the SQ series.

ADVANCE RELAYS

ADVANCE ELECTRIC AND RELAY CO.
2435-M NORTH NAOMI ST.
BURBANK, CALIFORNIA

Sales Representatives in Principal Cities of U. S. and Canada

www.americanradiohistory.com

Plan Now
for the 4 biggest days in radio-electronics!

I R E National Convention and RADIO ENGINEERING SHOW

March 21-24
New York City

Once again, you'll soon have the opportunity of appraising all of the important new developments of the past year in radio and electronics. In 4 days, from March 21 through 24, the I R E National Convention and Radio Engineering Show will give you the complete picture of significant developments in the industry achieved during the past year.

You'll hear the presentation of scientific and engineering papers of vital interest to you, carefully arranged into related groups of technical sessions.

You'll see more than 700 exhibits in a 4-acre panorama of all that's new in the radio and electronics field, at Kingsbridge Armory and at Kingsbridge Palace.

The Institute of Radio Engineers
1 East 79th Street, New York City

erated in counter unit, starting both counters simultaneously—3 sec.

c. Timing counter totals 100,000 pulses of the 1 KC timing frequency and stops both counters—100 secs.

d. Display relay operates allowing recorder to balance on the proportional voltage generated—52 secs.

e. Recorder prints a dotted point and channel coding number on chart, print wheel clears chart and switch prepares to connect another oscillator channel (display lights are available for visual reading through d and e)—10 secs.

f. Functions repeated starting with a. Time required for a complete cycle—173 secs.

The somewhat odd period for a complete cycle resulted from adapting the gear systems to a longer period with the least complicated changes in the existing mechanisms. By changing the main drive gearing and making other adjustments, a complete cycle of events could be completed in 150 secs. which would permit each of the six channels to be measured four times per hour in sequence with the chart time calibrations.

Performance

The frequency comparator equipment is normally used for automatically comparing a maximum of six 100 KC precision oscillators with a similar standard oscillator used as a common reference. If the beat frequency is obtained at 1000 MC by using the cavity multiplier-converter unit, a maximum sensitivity of $\pm$ 1 part in 10^{11} is obtained in the 100-sec. comparison interval. A typical chart record at this sensitivity is shown in Fig. 6 (a). A similar chart record obtained by using the 100 MC converter built into the multiplier chassis, with a maximum sensitivity of $\pm$ 1 part in 10^{10}, is shown in Fig. 6 (b). The maximum sensitivities as given result from the inherent uncertainty of 1 count in the electronic counter system, and thus represent the uncertainty of the frequencies displayed on the counter lights on the front panel. Because of slight errors in the proportional voltage generator and in the recorder mechanism and chart irregularities, maximum errors of this same order are contributed by the recording system. The 1000-CPS timing frequency may be taken from the divided frequency of the reference oscillator. It may be taken from another oscillator agreeing with the reference oscillator within 1 part in 10^6 without adding appreciable error. The average total errors in recording the beat frequencies have been found to be

PIPELINE TO PRECISION

MODEL WWVR

A receiver of the instrument class which is setting a new standard for the reception and presentation of the world's finest standards of time and frequency as broadcast by the National Bureau of Standards from WWV and WWVH.

The fundamental use of this receiver is in the calibration of local equipment to the accuracy of these primary time and frequency standards.

This time saving instrument incorporates all the latest techniques for clear reception. A glance at the front panel will at once show the ease of operation and instant availability of the desired Radio and Audio frequencies.

Model WWVR allows the operator full use of the world's finest primary standards of frequency and time. All frequencies broadcast from WWV (or WWVH) are accurate to one part in fifty million. This instrument in your laboratory will truly give you a . . .

PRIVATE PIPELINE TO PRECISION

—Specifications—

SENSITIVITY—Better than 1 microvolt on all frequencies.

SELECTIVITY—Less than 18 KC for —60db, 2.5 KC for —3db.

FREQUENCIES—Choice of three RF front ends delivered with receiver, 2.5, 5, 10, 15, 20 or 25 mc.

SMALL IN SIZE—Standard 5¼" relay rack panel.

DOUBLE CONVERSION—First IF amplifier at 2 MC, crystal converter to 60 KC second IF amplifier.

FRONT END—Four tuned circuits at the signal frequency for maximum sensitivity and image rejection.

AGC and AVC—AGC system provides constant RF input to second detector. AVC system independently controls audio resulting in constant output on tones.

INDIVIDUAL INPUTS—Three individual inputs for tuned antennas plus one common input for broad-band antenna. Balanced 300 ohm or unbalanced 72 ohm input.

Send for complete specifications, prices and delivery schedule.

SPECIFIC PRODUCTS
14515 DICKENS STREET
SHERMAN OAKS 4, CALIF.

www.americanradiohistory.com

LERCO
a name to remember *in* *electronic hardware*

new!
taper pin terminals

Four different types available including double-end taper, taper from front, taper from back, and taper from front with blind hole. Sizes for standard terminal board thicknesses, or to your specifications. Half-hard brass bar, with copper flash and electro-tin plate finish.

solderless connections

A simpler and more efficient means of making electrical connections. Lerco taper pin terminals fit taper pin inserts manufactured by Aircraft-Marine Products, Inc.

No loose wires develop after high and low temperature tests, vibration tests, and electrical noise tests. Avoids problems of soldering.

Write for catalog of complete Lerco electronic hardware to
LERCO
DIVISION OF
LYNN-DEATRICK, INC.
501 SOUTH VARNEY
BURBANK, CALIF. • VI. 9-5556

Frequency Comparator

(*Continued from page* 129)

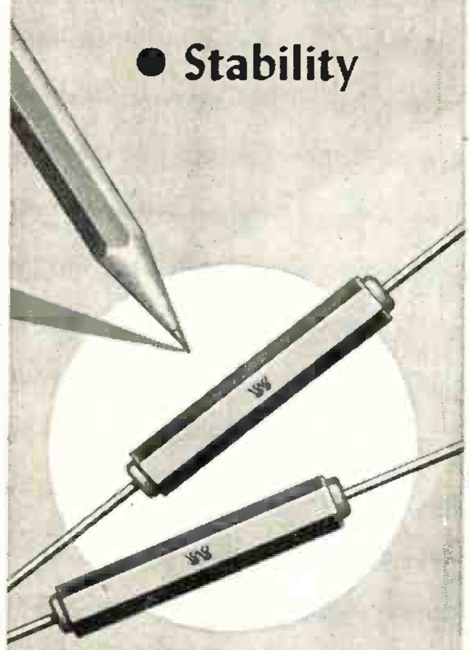
within the amounts listed.

The high-sensitivity range has been very useful in studying and improving the short-interval performance of the oscillators constituting the national primary standard of frequency and time. The frequency differences recorded between pairs of oscillators represent average values for the 100-sec. sampling intervals. Very-short-interval performance, over periods of less than 1 sec., are also readily observed by connecting an oscilloscope to the counter input and observing the 1000-MC difference frequencies. By externally synchronizing the oscilloscope with a stable audio oscillator operating at the observed frequency, relative phase stability of the two contributing oscillators may be evaluated. Under favorable conditions pairs of oscillators have been observed to have very short time stabilities as high as 1 part in 10^{11}. Chart recordings of several hours duration showing comparable stability are also frequently noted, although the average deviation per hour for the best oscillators is generally several times greater than this.

Random Fluctuations

Random phase fluctuations in the frequency multiplier chains were investigated to determine their contribution to the very-short-time phase instabilities observed and their possible limitation of the suitability for use at still higher sensitivities, perhaps by multiplying to 10,000 MC. This was done by supplying the same two 100-KC oscillator outputs to two similar dual channel multiplier-converter units, and observing the stability of the elliptical pattern generated by the two converters when connected to horizontal and vertical plates of an oscilloscope. Random phase shifts with a maximum amplitude of about 14°, and with periods varying from 0.1 to 2 secs. were noted. If one assumes the phase shifts to be uniformly divided between the four channels, a maximum phase shift per channel at 100 MC of about 3.5° prevails. This is equivalent to an uncertainty of about 1 part in 10^{10} per sec. per multiplier channel as attributable to the multiplier itself, or about 1 part in 10^{11} for a 10-sec. observation, etc. In multiplying to 10,000 MC or higher it would thus be necessary to keep the difference frequencies high enough so that random phase shifts would

• Low noise level
• Precision
• Stability



S.S.White 65X
MOLDED RESISTORS

RATING—1 watt.

TEMPERATURE COEFFICIENT—From approx. +0.1%/°F for 5000 ohm values to approx. —0.2%/°F for 10 megohm values.

VOLTAGE COEFFICIENT—Rated at less than 0.02%/Volt.

UPPER TEMP. LIMIT—170°F for continuous operation.

NOISE LEVEL—Low noise level inherent, but at extra cost we can test and guarantee standard range resistors with "less noise than corresponds to a resistance change of 1 part in 1,000,000 for the complete audio frequency range."

VALUES
Standard Range—1000 ohms to 9 megohms.
Extra High Value Range—Up to 10,000,000 megohms.

BULLETIN 5409
has full details. Send for a copy. Attention Dept. QR

THE S.S.White INDUSTRIAL DIVISION
DENTAL MFG. CO.
10 EAST 40th ST.
NEW YORK 16, N.Y.
Western District Office • Times Building, Long Beach, Calif.

www.americanradiohistory.com

Write today for your free copy of this Technical Paper.

ask for data file **106**

Characteristics of Precision Servo Computer Potentiometers

BY D. C. DUNCAN

General Manager, Helipot Corporation

Presented at A.I.E.E. CONFERENCE ON FEEDBACK CONTROL SYSTEMS

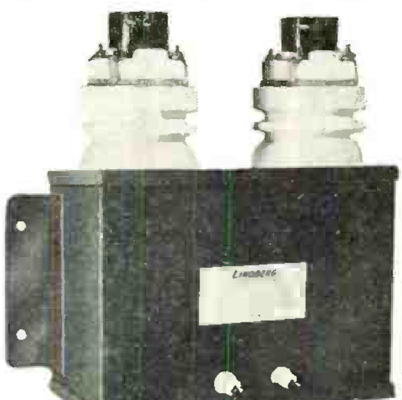
388

Helipot

first in precision potentiometers

Helipot Corporation / South Pasadena, California

a division of BECKMAN INSTRUMENTS, INC.



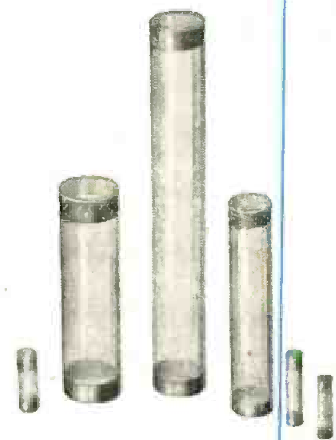
LINDBERG Dual Filament TRANSFORMERS

Illustrated here is one of several dual filament transformers that Lindberg has developed specifically for industrial electronic applications. Each of these transformers will supply the precise filament requirements of TWO rectifier tubes.

For further information write for Specification Sheets E201-2 and E201-3.

TRANSFORMER DIVISION
LINDBERG ENGINEERING COMPANY
2450 West Hubbard Street, Chicago 12, Illinois

5 idea starters for product improvement in Metallized Glass



In each of the components shown here, the unique properties of metallized glass have helped solve a design problem and make a better product.

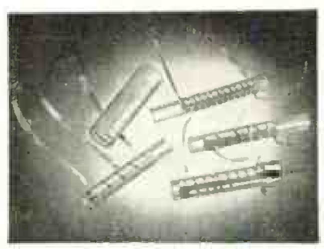
A basic idea starter is the Metallized Glass Enclosure Tube. You see six of the many available sizes at the right.

You can use these tubes to hermetically enclose many kinds of components. Such enclosure gives the components performance characteristics they otherwise do not have.

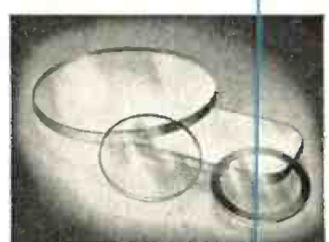
Corning's metallizing process makes possible a true hermetically sealed enclosure. Components encased in metallized glass enclosures are impervious to moisture, moulds, and atmospheric changes. Assemblies complete with end caps are capable of withstanding severe temperature changes. Glass has excellent electrical characteristics, and its transparency permits visual inspection. Bond strength for metallizing used on enclosure tubes has been measured at 1500 to 2000 pounds per square inch.

These characteristics can perhaps broaden your use of some product, expand its performance limits, or reduce servicing and minimize breakdown possibilities.

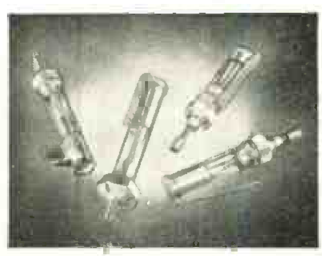
Illustrated below are other applications of Corning's metallizing process. If none of them exactly meets your needs—or, if metallized glass characteristics suggest solutions to other problems, write us your requirements. Chances are, we'll be able to help you. There is no obligation.



CORNING METALLIZED GLASS INDUCTANCES are made with a precision that guarantees duplication within close limits. When used in either FM or TV circuits, you can be sure that they will contribute negligible drift even under unusual temperature changes.



METALLIZED GLASS INSTRUMENT WINDOWS are made of both tempered and untempered glass with metallized bands on the edges. They can be easily soldered into a bezel to form a hermetic seal. Available in sizes and shapes to meet your needs.



MIDGET TRIMMER CAPACITORS are available in standard types from 0.5 to 12.0 mmfds., or they can be designed to your requirements. Temperature coefficient for brass core units is approx. 200 ppm/deg. C.; for invar core units, approx. 50 ppm/deg. C.

METALLIZED BUSHINGS AND STANDOFF INSULATORS for high voltage applications. Bushings can provide hermetically sealed insulators for high voltage transformer and capacitor terminals. Standoff insulators are made of tempered low loss glass. Both can be furnished in special sizes.

CORNING GLASS WORKS, CORNING, N. Y.
New Products Division
Corning means research in Glass

For product Information, use Inquiry card on last page.

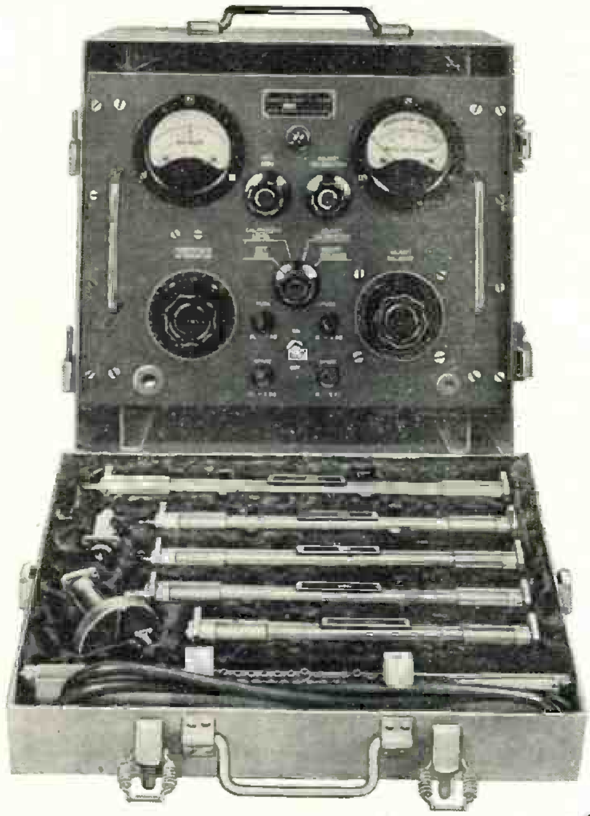
www.americanradiohistory.com

Broadband RF Power Meters

THE CHOICE OF ALL ARMED SERVICES FOR MICROWAVE POWER MEASUREMENTS

POWER: PULSE and CW—5μW to 5W average
FREQUENCY: 20MC — 10,000MC
ACCURACY: 5% Absolute at all ranges, frequencies, temperatures

...... **INDICATIONS:** Direct Reading
...... **CALIBRATION:** Compensates for All Variables
...... **R-F COMPONENTS:** 3, 6, 10 and 20db Attenuators, Bolometer Mount and Elements, R-F Cable
...... **BOLOMETER:** Broadband, High Overload Capacity
...... **PLUMBING:** ⅜" and ⅞" 50-ohm Coaxial
...... **POWER SOURCE:** 115VAC ±15%, 50-1000 cps
...... **CONSTRUCTION:** Rugged, meets all JAN, MIL requirements



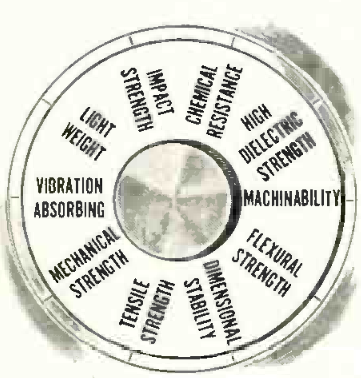
TYPICAL APPLICATIONS
Microwave Links . . . Television . . . Communications . . . Radar . . . Telemetering . . . Signal Generators . . . Laboratory Standards.

Write for descriptive literature to Department TT-1

Bruno - New York Industries Corporation
DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT
460 WEST 34th STREET • NEW YORK 1, N. Y.

The Right Combination of Properties in this One Material

• When you seek a material with many properties in combination, you are probably looking for *Synthane*. It's dimensionally stable, tough, machinable, light in weight, chemically resistant, high in dielectric strength, heat and moisture resistant, and practically unbreakable. For full details, see our catalog.



SYNTHANE

SYNTHANE CORPORATION
11 RIVER ROAD, OAKS, PENNA.

Manufacturers of Laminated Plastics

Please send me a copy of the Synthane catalog.

Name__________
Address__________
City__________(zone)______State______

HIGH SPEED TV LENSES

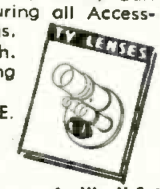
F/0.8, 2" COOKE LENS for 16 mm "TV EYE"

WORLD'S LARGEST STOCK

Coated Hi-resolution Lenses for every TV need . . . Wide-Angle, Normal, Telephoto—1¼ to 20" . . . **COOKE**, Zeiss, Ektar, Carl Meyer, B & L, Wollensak, Ross, Astro, etc. Featuring all Accessories . . . Baffle Rings, Counterbalances, Fittings, Foc. Mounts fit RCA, DuMont, G.E. Image Orth. Special Mounts for G P 1 and others. Expert Fitting Service.

15-day FREE TRIAL . . . Unconditional GUARANTEE.

Write for Free TV LENS BULLETIN #754 TV
Serving TV since 1936



BURKE & JAMES, INC. 321 South Wabash Ave., Chicago 4, Ill. U.S.A.

TELE·TECH

CLOSING DATES

25th of second month preceding date of issue, for all ads requiring proofs, composition, foundry work, key changes, etc.

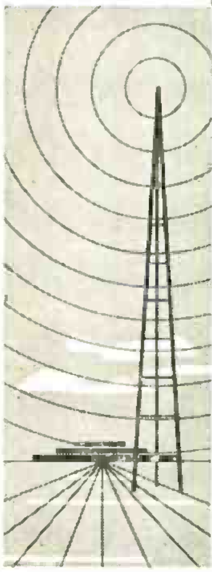
1st of preceding month for complete plates only—no setting.

20th of preceding month—Publication Date. Cancellations not accepted after 1st of preceding month.

Caldwell-Clements, Inc., 480 LEXINGTON AVENUE, NEW YORK

www.americanradiohistory.com

from
MIKE


to
ANTENNA
Collins

Your one best source for broadcast equipment

855 35th St., N.E., Cedar Rapids, Iowa
261 Madison Avenue, New York 16
1930 Hi-Line Drive, Dallas 2
2700 W. Olive Ave., Burbank
Dogwood Rd., Fountain City, Knoxville, Tenn.
Petroleum Bldg., Tallahassee, Florida
74 Sparks St. Ottawa, Ontario

COLLINS

Frequency Comparator

(*Continued from page* 130)

not reduce the instantaneous beat frequency to zero or a negative relative value. These random phase shifts in the frequency multipliers are attributed principally to what is generally called the "flicker effect," in the electron emission from the tube cathodes.[4] These variations are thought to result from localized irregularities which are in a continuous process of change at the cathode surface. In a class-C harmonic generator this results in slight changes in the instant of plate-current conduction during successive cycles which cause a phase modulation of the harmonic frequencies. As the phase shift is multiplied in each stage the input multiplier stages contribute most of this variation. For similar reasons, oscillators with only medium short-time, or phase stability, must be recorded with a higher difference frequency or on a lower sensitivity range to prevent the instantaneous difference frequency from going through a zero value and thus giving an improper count. To obtain proper operation on the high-sensitivity range it is also necessary to prevent stray coupling from other oscillators, local broadcasts, or from power fields from getting on the multiplier input lines. For instance, it was found necessary to operate the switching relays on direct current to prevent coupled a-c fields from getting into the toroidal transformers in the switching unit.

Applications

In addition to the normal use for monitoring precision oscillators, the recorder system is readily adaptable to a variety of special test applications. Very-short interval stability tests may be made by supplying timing frequencies of 10 KC or 100 KC to the rear counter and thus obtaining 10- or 1-sec. sampling periods. Visual tests of this type may be made in rapid sequence by using the manually operated controls, but automatic recordings may be made only at about the rate of one sampling determination per three minutes. In similar manner any frequency from the low audio range to above 100 KC may be directly connected to the front or frequency counter and average values over 1, 10 or 100 sec. intervals recorded automatically. Ratios of any two unrelated frequencies between 1 and 100 KC may also be recorded by simply connecting the two frequency sources to the front and rear coun-

MISSILE SYSTEMS

Research and Development

PHYSICISTS AND ENGINEERS

Inquiries are invited from those who can make significant contributions to, as well as benefit from, a new group effort of utmost importance.

Lockheed

MISSILE SYSTEMS DIVISION

research and engineering staff

LOCKHEED AIRCRAFT CORPORATION

VAN NUYS • CALIFORNIA

For product information, use Inquiry card on last page.

www.americanradiohistory.com

Digital Communication Engineers

with experience in the fields of

- Systems Engineering
- Miniaturization
- Circuit Development
- Electromechanical Development
- Digital Techniques

Long-Range Information Transmission

New advancements in the field of long-range information transmission are being made at Hughes with digital techniques.

Areas of Work

To further expand work in this area, Hughes Research and Development Laboratories are interested in people with experience in airborne communication systems, digital storage, low frequency measurements, modulation systems, miniaturized packaging, audio, IF and RF circuitry in the HF range, analog to digital—and other data conversion methods.

Scientific and Engineering Staff

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

CULVER CITY, LOS ANGELES COUNTY, CALIFORNIA

Relocation of applicant must not cause disruption of an urgent military project.

Frequency Comparator

(*Continued from page* 133)

ters respectively.

By means of fairly simple auxiliary equipment the range of frequency measurements may be extended throughout the high frequency spectrum. For instance, by using a receiver tuned to select simultaneously the unknown frequency and a calibrated marker from any harmonic generator, such as a 9, 10, or 11-KC calibrator, an audio beat frequency may be obtained. When supplied to the front counter this frequency may be determined to 0.01 CPS if counted for 100 secs. The overall comparison precision is then the ratio of 1 to the unknown frequency in CPS times 100, or 1 part in 10^9 for an unknown frequency near 10 MC.

The automatic frequency comparator described has a maximum precision of about 1 part in 10^{11}, which equals the short time constancy of the most stable oscillators currently available. The effective precision of a given measurement is thus generally limited by the stability of the oscillators being compared during the measurement interval. The instrument is very useful for continuous automatic monitoring of a group of primary oscillators and in development and test work on precise oscillators for quick evaluation of operating and design parameters. The high sensitivity obtained by recording only the last three significant figures gives automatically the advantage of the offset zero method widely used, while eliminating the difficulty of separate adjustments for each range setting and the annoyance of drift beyond the chart range. The adaptability of this principle and the versatility of the entire system suggest a wide variety of applications in the field of frequency measurement.

REFERENCES

1. R. L. Chase, Measuring a Varying Frequency. *Electronics*, Vol. 23, p. 110. Mar. 1950.
2. H. B. Law, An Instrument for Short-Period Frequency Comparisons of Great Accuracy, *Jour. AIEE*, Vol. 94, Part III pp. 38-41, January 1947.
3. John M. Shaull, Adjustment of High-Precision Frequency and Time Standards, *Proc. IRE*, Vol. 38, pp. 6-15, Jan. 1950.
4. Stanford Goldman, *Frequency Analysis, Modulation and Noise*, p. 208, McGraw-Hill Book Co., Inc., N. Y. 1948.

R.F. Circuit

(*Continued from page* 62)

with polystyrene would be a flowing of the material due to the heat of the tube. Teflon would be more suitable but, according to experimental tests, will not take a firmly adhering coat

The ANSWER to ADJACENT CHANNEL INTERFERENCE

GUARANTEES NORMAL RECEPTION in the most extreme cases. Mounted externally on TV receiver. This trap has returned thousands of TV viewers to otherwise lost markets. Moderately priced . . .

ADVANCE ELECTRONICS CO.
8510 North End Ave. Oak Park, Mich.

STOP METER DAMAGE now

FOR THE FIRST TIME for only $70.00 F.O.B. Upper Darby, Pa.

20,000 OHM/VOLT AC/DC MULTI-RANGE METER

Model 430

With Automatic Overload Cut-Out Protection

Sensitivity: 20,000 ohms per volt A.C. and D.C. 33 ranges. A.C. and D.C. volts: 3-10-30-100-300-1000-5000 D.C. current: 50 microA—1-10-100 mA—1-10 Amp. Resistances: 0 to 20 Megohms. Output meter: 3-10-30-100-300-1000 volts. Accuracy: D.C. 1.5%: A.C. 2.5%. Dimensions: 8¼ x 5⅞ x 3⅛ ins. Weight: 3 lbs. 8 ozs. Made by Metrix.

30 KV probe and leather case available at extra cost.

Other Precision Electronic Instruments Available. Write to:

U. S. A. DISTRIBUTORS

M. E. GERRY & CO., Inc.
230 BAYARD RD., Upper Darby, Pa.

www.americanradiohistory.com

Only **Precision** OFFERS YOU HIGHEST QUALITY, LOW COST PAPER TUBING

DIELECTRIC KRAFT • FISH PAPER • CELLULOSE ACETATE COMBINATIONS PHENOL IMPREGNATED

Round, square, rectangular, triangular, any shape, any size—Precision Paper Tube Co. can provide *all* your paper tubing needs. Your specifications are met to the most exacting tolerances. Precision Paper Tubes are sturdy, crush resistant, have high tensile strength and excellent dimensional stability.

Send in your specifications for samples. Request Arbor List of over 2000 sizes.

Sales Representatives in:

New England: Framingham, Mass., Framingham 7091
New York, New Jersey: Jersey City, New Jersey, Journal Square 4-3574
Upstate New York: Syracuse, N.Y., Syracuse 76-8056
Maryland: Baltimore, Maryland, Plaza 2-3211
Philadelphia: Philadelphia, Pa., Chestnut Hill 8-0282
Northern Ohio, Western Pennsylvania: Cleveland, Ohio, Atlantic 1-1060
Indiana, Southern Ohio: Logansport, Indiana, Logansport 2555
Missouri, Southern Illinois, Iowa: St. Louis, Missouri, Sterling 2318
California: Pasadena, California, Sycamore 8-3919
Canada: Montreal, Quebec, Canada, Walnut 2715

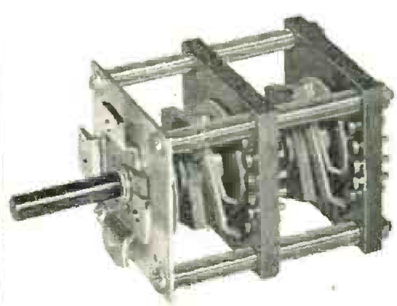
PRECISION PAPER TUBE CO.
2057 W. CHARLESTON ST. CHICAGO 47, ILL.
Plant No. 2: 79 Chapel St., Hartford, Conn.
Also Mfrs. of Precision Coil Bobbins

CESE

CINEMA *switches*

for **INSTRUMENTS AND CONTROL CIRCUITS**

Glass epoxy insulation brings an expanded range of characteristics to these new CESE Switches. Write for catalogue on your letterhead.



CINEMA ENGINEERING CO.
DIVISION AEROVOX CORPORATION
1100 CHESTNUT ST. • BURBANK, CALIF.

---

to your specifications ...for quick delivery

You tell our engineers your needs, and Thermador's Electronics Plant goes into immediate operation. Complete, unsurpassed facilities and precision craftsmanship manufacture transformers that meet your most exacting requirements.

Your completed transformers are subjected to extreme environmental conditions; tested under critical loads. Thermador transformers with-

Precision-designed Thermador Transformers

stand the severest testing—will exceed any MIL requirements or exacting specifications. Thermador certifies your transformers without delay.

We work from your specifications to develop a transformer for your application, chassis or performance standards . . . one or a thousand. Delivery is quick. Tell us what you need. Call us today. Request literature from: Electronic Division, Thermador Electrical Manufacturing Company, 2000 South Camfield Avenue, Los Angeles 22, Calif, PARKVIEW 8-2105

THERMADOR
Electronic Division

S E V E N L E A G U E S A H E A D

3-919

For product information, use Inquiry card on last page.

www.americanradiohistory.com

ENGINEERS
DESIGNERS • DRAFTSMEN
Electronic *Mechanical*

THE MELPAR SYMBOL STANDS FOR

Growth - Progress - Leadership

IN RESEARCH AND DEVELOPMENT OF ELECTRONIC EQUIPMENT

Diversified and Challenging Problems

A real appreciation and recognition of the individual's merit and ability

An opportunity for qualified men to join a company that is steadily growing

A location that offers many advantages

Our Technical Personnel Representative will give you complete details of the opportunities available to men qualified in the following fields:

- Network Theory
- Microwave Technique
- UHF, VHF or SHF Receivers
- Analog Computers
- Digital Computers
- Magnetic Tape Handling Equipment
- Photographic Equipment Design
- Radar and Countermeasures
- Packaging Electronic Equipment
- Pulse Circuitry
- Microwave Filters
- Flight Simulators
- Subminiaturization Techniques
- Electro-Mechanical Design

send complete resume to
Technical Personnel Representative,

melpar, inc.
A Subsidiary of the Westinghouse Air Brake Co.
452 Swann Ave., Dept. TT-13
Alexandria, Virginia
or 11 Galen St., Watertown, Mass.

of silver.

The tuning characteristics of a cylindrical rotor are far from a straight line frequency curve, as can be seen from Figs. 7, 8, and 9. However, proper shaping of the rotor and the use of variable loading between grid and plate (i.e. on end of line) and between cathode and plate can give a straight line frequency tuning curve.

The effect of tube lead inductance is also shown in Figure 9 and indicates that for wide coverage a planar type tube should be used.

The frequency coverage of the 8.2 cm line is over two to one. However, at increased frequencies the coverage becomes less and less due to the lead inductance. Since one conductor rotates, it is easy to add capacity from the grid to plate of the tube, as previously indicated, and to increase this capacity load on decreasing the frequency, which can give a straight line frequency as well as a two to one coverage for 180° rotation.

Most of the lines built have been made with a two inch diameter rotor. However, a line with a one inch rotor was constructed and similar results obtained. This line had a 1/64 in. spacing between conductors and showed that with careful workmanship the size of the line can be reduced.

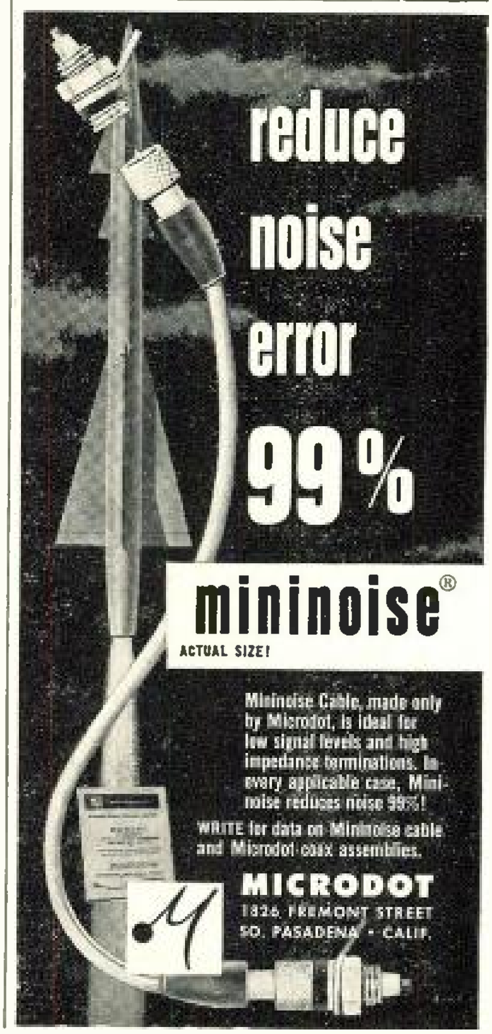
Capacity loading from cathode to plate must be used to obtain oscillations and this loading may be variable as is the loading from grid to plate. In fact, considerably increased line loading can be used with proper cathode to plate loading without inducing spurious frequencies.

If the maximum coverage is needed, a concentric type of line must have an outer conductor large enough to avoid undue reduction of the low frequency end inductance. A 3:1 ratio of the diameter of the outer conductor to the rotor diameter is probably needed, though with proper grid to plate loading, a 2:1 ratio may be enough for a 21 frequency coverage. The shield on a two wire line will be of comparable proportions.

R-F amplifier circuits have not been investigated, but it is believed that they could be designed similarly to the oscillators.

1. Isely, F. C., "A New Approach to Tunable Resonant Circuits for the 300 to 3000 MC Frequency Range," *Proc. I.R.E.*, 36, No. 8, 1017-1022 Aug. 1948.
2. *Radio Instruments and Measurements*, Bureau of Standards Circular No. 74, pp. 69-74, 2nd Ed. 1924
3. Willoughby, E. O., "Application of Field Plotting," *I.E.E.J.*, Part III, 93:275-293, 7/46.
4. "Data Sheets VI, VII, VIII, On The Resonant Length of Capacity Loaded ¼ Wave Transmission Line," *Electronic Engineering*, 14:352, Aug. 1941.

WAIT!
DON'T BUY ANY SOLDERING IRON UNTIL YOU SEE
THE *New* ESICO LUGER SOLDERING IRON
Makes all other irons obsolete!
The shape of soldering irons to come!
UNVEILING EARLY IN 1955
ESICO
ELECTRIC SOLDERING IRON CO., INC.
DEEP RIVER, CONN.



TELE-TECH ADVERTISERS — JANUARY, 1955

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.

www.americanradiohistory.com

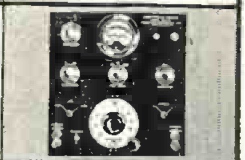
FREED

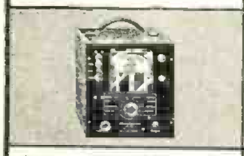
Sets A NEW
Standard for performance

PRECISION TEST INSTRUMENTS

No. 1040 VACUUM TUBE VOLTMETER. Self contained — A.C. operated. High impedance — wide frequency. For use at audio and supersonic frequencies.

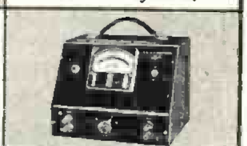
No. 1010A COMPARISON BRIDGE. Self contained — A.C. operated. Ideal for laboratory and production testing of resistors, condensers and inductors.





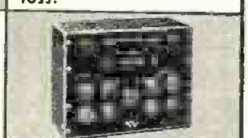
No. 1020B MEGOHMMETER. DIRECT READING. Self contained—A.C. operated. Electronically regulated supply, 1 megohm to 2 million megohms.

No. 1060 VACUUM TUBE VOLTMETER. A 50 megohm input impedance wide frequency range V.M. for use at audio and supersonic frequencies.



No. 1030 LOW FREQUENCY "Q" INDICATOR. DIRECT READING. Measures "Q" factor of coils, also inductances, distributed capacity, impedances and dielectric loss.

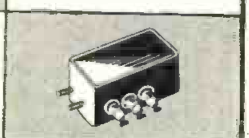
No. 1110A INCREMENTAL INDUCTANCE BRIDGE. For accurate testing of communication and television components under load conditions.



TRANSFORMERS & FILTERS

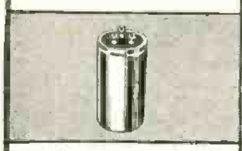
TOROIDAL INDUCTORS. 60 CPS to 1 MC. Also miniature inductors from 1000 CPS to 100 KC.

MILITARY PULSE TRANSFORMERS. Constructed to MIL - T - 27 specifications. Designed for optimum pulse performance.



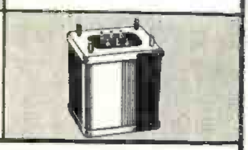
MINIATURE AUDIO. Hermetically sealed — constructed in accordance with MIL - T - 27 specifications.

HERMETICALLY SEALED COMPONENTS. Constructed in accordance with MIL - T - 27 specifications.



PRECISION FILTERS. 10 CPS to 1 MC.

HIGH FIDELITY. 1/2 DB 20 CPS to 30 KC.



COMPLETE CATALOG ON REQUEST

FREED TRANSFORMER CO., INC.

1726 Weirfield St.
Brooklyn (Ridgewood) 27, N. Y.

INDUSTRY NEWS

(Continued from page 115)

Henry V. Erben, Executive Vice-President of General Electric Co. has become group executive in charge of the Distribution, **Robert Paxton**, also Executive Vice-President, succeeds Mr. Erben as group executive in charge of the Apparatus Group.

Forrest J. Beard has been named ass't advertising mgr. of Ampex Corp., Redwood City, Calif. In the same company, **Armand L. Klein** and **J. Gordon Stillson** have been appointed field engineering representatives, Klein to operate out of Atlanta and Stillson out of Dayton.

Robert G. Marchisio has been appointed a vice president of CBS-Hytron, division of Columbia Broadcasting System, Inc. He will have general authority in all CBS-Hytron operations.

R. G. Marchisio

J. J. Clark

Admiral J. J. ("Jocko") Clark (Retired) has been appointed vice president of Radio Receptor Co., Inc.

Rear **Admiral J. S. Laidlaw**, U. S. Navy (Retired), has been named staff assistant to **Alden E. Acker**, president of Hycon Mfg. Co., Pasadena, Calif.

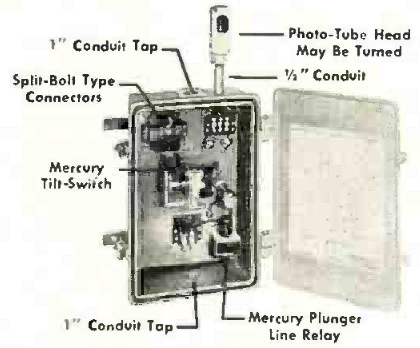
John R. Howell has been named sales manager and director of Sterling Electric Motors, the home office of which is located at 5401 Telegraph Rd., Los Angeles 22, Calif. Mr. Howell will direct the 24 district offices and the more than 400 distributors and service representatives of the company.

Stephen A. Keller has been made general manager of the Heiland division of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Mr. Keller was formerly the general manager of M-H's valve division. The Heiland division, formerly the Heiland Research Corp., Denver, Colo. was but recently purchased by Honeywell.

O. O. Schreiber, assistant to the president of Philco Corp., Philadelphia, Pa., has been made a corporation vice president. He will continue to handle special assignments for the president and the board chairman, and will act as secretary of the policy and management operations committees.

the ANSWER to

greater flexibility and simplification of installation — a combination Photo-Electric Control & Beacon Flasher



Model LC 2074 Tower Lighting Control Unit

Three Models: for two, three, four, and five light level categories.
Models LC 2072 and LC 2073 provide for alternate flashing of two beacon levels.
Write for Bulletin HPS-135

HUGHEY & PHILLIPS, INC.

Manufacturers of
300MM Code Beacons, Obstruction Lights, Photo-Electric Controls, Beacon Flashers, Microwave Tower Control & Alarm Units, Remote Lamp Failure Indicator Systems, and Complete Tower Lighting Kits.

3300 North San Fernando Blvd.
BURBANK, CALIF.

ELECTRONIC ENGINEERS

TO DEVELOP

TRANSISTOR CIRCUITRY

Opportunity to study fundamental transistor circuit problems and to apply transistors in the design of receiver, guidance and control systems of guided missiles.

Transistor experience desirable but not essential.

Located in residential suburb of Nation's Capital. Advanced educational facilities available. Moving expenses paid. Other liberal benefits.

Send resume to G. B. Mayfield

APPLIED PHYSICS LABORATORY

THE JOHNS HOPKINS UNIVERSITY

8621 Georgia Ave., Silver Spring, Maryland

www.americanradiohistory.com

Do you want *more* information about **PRODUCTS**

advertised in

TELE-TECH

& ELECTRONIC INDUSTRIES

LEADING MANUFACTURERS are using space in this issue to acquaint you with their products. Perhaps you want more information on some of them—on one or two, or possibly a score. You can cover all of your needs with the cards below. They are convenient and postfree.

Use the convenient postage-free cards below to get information quickly about products listed here—all advertised in this issue

301 Ace Engineering & Machine Co.—Screened enclosures
302 Adams & Westlake Co.—Mercury relays
303 Advance Electric & Relay Co.—Miniature relays
304 Advance Electronics Co.—TV wavetraps
305 Aerovox Corp.—Sealed electrolytic capacitors
306 Airdesign, Inc.—Transformers
307 Alford Manufacturing Co., Inc.—TV transmitting antennas
308 Allied Radio Corp.—Electronic supply catalog
309 Alpha Metals, Inc.—Printed circuit fluxes & solders
309A American Electronic Labs., Inc.—Laboratory video amplifier
310 American Lava Corp.—Ceramics
311 American Microphone Co.—Microphone, phono cartridges
312 American Phenolic Corp.—Potted a-n connectors
313 Amperite Co.—Delay relays & ballast regulators
314 Ampex Corp.—Amplifier-speakers, recorders
315 Anchor-Industrial Co., Inc.—Insulators for tricolor tubes
316 Arnold Engineering Co.—Tape-wound magnetic cores
317 Artos Engineering Co.—Automatic wire cutting & stripping
318 Audio Devices, Inc.—Magnetic tape
319 Bell Telephone Laboratories—Radio relays
320 Bendix Aviation Corp., Red Bank Div.—Reliable electron tubes
321 Berlant Associates—Tape recorders
322 Berndt-Bach, Inc.—16mm sound-on-film equipment
323 Blaw-Knox Co.—Antenna towers
324 Bruno-New York Industries Corp.—Component assembling system
325 Bruno-New York Industries Corp.—Broadband RF power meters
326 Burke & James, Inc.—TV lenses
327 Burnell & Co., Inc.—Variable toroids, telemetering filters
328 Bussmann Manufacturing Co.—Fuses & fuse holders
329 Canoga Corp.—Wobbulators
329A Century Lighting Co.—TV lighting & controls
330 Chester Cable Corp.—Wires & cables
331 Chicago Telephone Supply Corp.—Volume controls for color TV
332 Cinch Manufacturing Corp.—Parts for automation
333 Cinema Engineering Co.—Switches for instruments
334 Cleveland Container Co.—Laminated paper base phenolic tubing
335 Collins Radio Co.—Broadcast equipment
336 Columbian Carbon Co.—Red ferric oxides
337 Communication Accessories Co.—Subminiature toroids
338 Corning Glass Works—Metallized glass
339 Crosby Laboratories, Inc.—Wideband oscilloscope
340 Cunningham, Son & Co., James—Crossbar switches
341 Daven Co.—Precision resistors
341A Diamond Microwave Corp.—Waveguide & Microwave components
342 Eisler Engineering Co.—Indexing turntables
343 Eitel-McCullough, Inc.—Pulse klystrons
344 Electric Soldering Iron Co.—Soldering irons
345 Electro Motive Manufacturing Co.—Miniature dipped mica capacitors
346 Ford Instrument Corp.—Automatic control systems
347 Freed Transformer Co., Inc.—Test instruments & transformers
348 Gates Radio Co.—Transcription turntables
349 General Electric Co.—Germanium power rectifiers
350 General Electric Co.—Uni-level amplifiers
351 General Precision Lab., Inc.—Remote control TV camera
352 General Radio Co.—Potentiometers
353 Gerry Co., M. E.—Multi-range meters
354 Gertsch Products, Inc.—VHF-UHF microwave generators
355 Gray Research & Development Co.—TV opaque & transparency projector
356 Gudebrod Bros. Silk Co., Inc.—Non-slip lacing tape
357 Gudeman Co.—Capacitors, filters, transformers
358 Helipot Corp.—Paper on servo pots
359 Heppner Manufacturing Co.—TV centering device
360 Hermetic Seal Products Co.—Glass-to-metal seals

Listings continued on next page ▶

Use these postage-free cards to get further information

Write in boxes the code numbers of products for which you want information. See list above and on next page.

Your company ....

Address ....

....

Your name ....

Your title ....

TELE-TECH—JAN. 1955

CALDWELL-CLEMENTS, INC., 480 Lexington Avenue, New York 17

INQUIRY CARD **Not good after Mar. 1, 1955**

Write in boxes the code numbers of products for which you want information. See list above and on next page.

Your company ....

Address ....

....

Your name ....

Your title ....

TELE-TECH—JAN. 1955

CALDWELL-CLEMENTS, INC., 480 Lexington Avenue, New York 17

PRODUCT INFORMATION?

If that is what you need, use the cards below to get it quickly, through . . . **TELE-TECH** & ELECTRONIC INDUSTRIES

Listings continued from preceding page

361 **Hopkins University, Johns**—Engineering personnel
362 **Houston-Fearless Corp.**—TV camera heads
363 **Hughes Aircraft Co.**—Silicon junction diodes
364 **Hughes Research & Development Labs**—Engineering personnel
365 **Hughey & Phillips**—Photo-electric control & beacon flasher
366 **Hycor Co., Inc.**—Sound effects filter, program equalizer
367 **Ilsco Copper Tube & Products Inc.**—Connectors, fuse clips, terminals
368 **Institute of Radio Engineers**—Radio Engineering show
369 **International Rectifier Corp.**—Selenium rectifiers
370 **JFD Manufacturing Co.**—Variable piston capacitors
371 **Johnson Co., E. F.**—Miniature air capacitors
372 **Jones Div., Howard B., Cinch Mfg. Corp.**—Plugs & sockets
373 **Kahle Engineering Co.**—Production machinery
374 **Kanthal Corp.**—Resistance wire
375 **Kearfott Co., Inc.**—Microwave equipment, X-band test set
376 **Kester Solder Co.**—Flux core solders
377 **Klein & Sons, Mathias**—Pliers
378 **Kollsman Instrument Corp.**—Synchro transmitters, monitors
379 **Lindberg Engineering Co.**—Dual filament transformers
380 **Lockheed Aircraft Corp.**—Engineering personnel
381 **Loral Electronic Corp.**—Military electronic equipment
382 **Lynn-Deatrick, Inc.**—Electronic hardware
383 **Mallory & Co., Inc., P. R.**—Vibrators
384 **Measurements Corp.**—UHF megacycle meter
385 **Melpar, Inc.**—Engineering personnel
386 **Methode Manufacturing Corp.**—Tube accessories & electronic hardware
387 **Metronix Inc.**—R.F. crystal calibrator, capacitance meter
388 **Microdot Div., Felts Corp.**—Low-noise cable
389 **Norris-Thermador Corp.**—Transformers
390 **Onan & Sons Inc., D. W.**—Standby electric plants
391 **Orradio Industries, Inc.**—Recording tape
392 **Oster Mfg. Co., John**—Motors, servos, blowers
393 **Phaostron Co**—Custom panel instruments
394 **Philco Corp.**—Hermetically sealed transistors
395 **Polarad Electronics Corp.**—Microwave signal generators
396 **Polarad Electronics Corp.**—Microwave power meter, klystron tester
397 **Potter Co.**—Capacitors, noise filters
398 **Precision Paper Tube Co.**—Paper tubing
399 **Presto Recording Corp.**—Recording discs
400 **Radio Corporation of America**—Color TV test equipment
401 **Radio Corporation of America**—Series string tubes
402 **Radio Materials Corp.**—Ceramic disc capacitors
403 **Raypar Inc.**—Transformers for printed circuits
404 **Resinite Corp**—Transformer coil forms
405 **Robinson Aviation, Inc.**—Vibration & shock mountings
406 **Shallcross Mfg. Co.**—Decade resistance & voltage dividers
407 **Shure Brothers, Inc.**—Ceramic pickup cartridge
408 **Sigma Instruments, Inc.**—Relays
409 **Sorenson & Co., Inc.**—Electronic AC voltage regulator
410 **Specific Products Corp.**—WWV receiver
411 **Sprague Electric Co.**—Subminiature paper capacitors
412 **Sprague Electric Co.**—Miniaturized wirewound resistors
413 **Stackpole Carbon Co.**—Resistors, switches, cores
414 **Standard Greetings, Inc.**—Plant facilities
415 **Stoddart Aircraft Radio Co.**—Radio interference & field intensity meters
416 **Stone Paper Tube Co.**—Impregnated paper tubes
417 **Sylvania Electric Products Inc.**—Ruggedized tubes
418 **Sylvania Electric Products Inc.**—Traveling wave tubes
419 **Sylvania Electric Products Inc.**—Engineering personnel
420 **Synthane Corp.**—Laminated plastics
421 **Syntronic Instruments, Inc.**—Yokes, focus coils
422 **Texas Instruments, Inc.**—Junction transistors
423 **Transradio Ltd.**—Low capacitance cable
424 **Triad Transformer Corp.**—Instrument transformers
425 **Truscon Steel Corp., Republic Steel Corp**—Antenna towers
426 **Tung-Sol Electric Inc.**—Series string tubes
427 **United Catalog Publisher, Inc.**—Electronic catalog
428 **University Loudspeakers, Inc.**—Loudspeakers, drivers
429 **Varian Associates**—Reflex klystron
430 **Waterman Products Co.**—C-R tubes, oscilloscopes
431 **White Dental Mfg. Co., S. S.**—Molded resistors

MAIL CARD TODAY

NOT GOOD AFTER MARCH 1, 1955

TELE-TECH
& ELECTRONIC INDUSTRIES
480 Lexington Avenue, New York 17, N. Y.

FIRST CLASS
PERMIT No. 22273
(Sec. 34.9, P.L.&R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN UNITED STATES

POSTAGE WILL BE PAID BY

TELE-TECH
& ELECTRONIC INDUSTRIES
480 LEXINGTON AVENUE
NEW YORK 17, N. Y.
Caldwell-Clements, Inc.

FIRST CLASS
PERMIT No. 22273
(Sec. 34.9, P.L.&R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN UNITED STATES

POSTAGE WILL BE PAID BY

TELE-TECH
& ELECTRONIC INDUSTRIES
480 LEXINGTON AVENUE
NEW YORK 17, N. Y.
Caldwell-Clements, Inc.

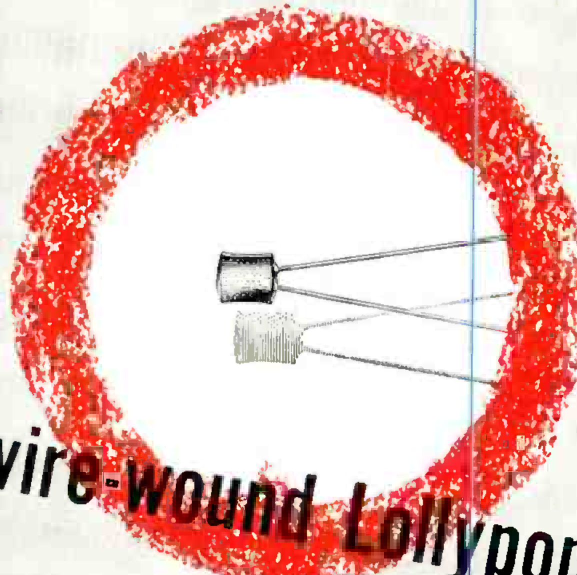
www.americanradiohistory.com

For maximum resistance in minimum space!

NEW Lollypop Precision Resistor

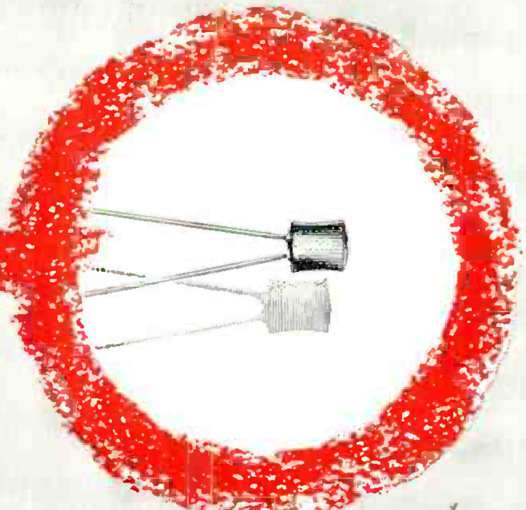
Davohm Type 1273

It's no trick at all with Daven's unique and extremely small si resistor to achieve ease of mounting in new printed circuit ar transistor assemblies. The trick is inside this tiny unit . . . it's completely new specialized winding technique developed by Davei which enables them to use extremely fine sizes of resistance wi to obtain two or three times the resistance value that was pr viously supplied on a bobbin of this size.



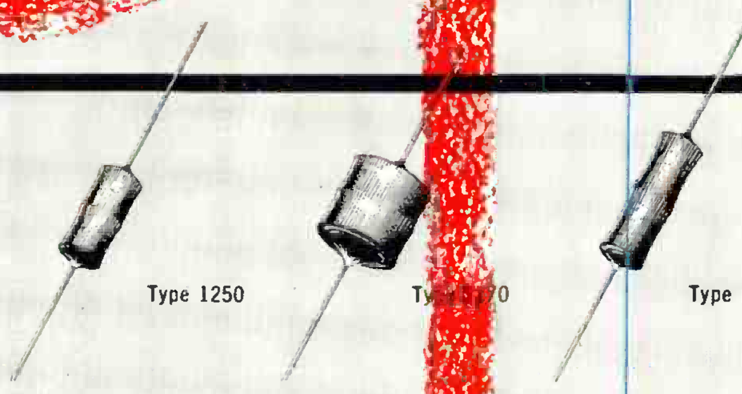
You can't lick Daven's new wire-wound Lollypop Resistor

Only 1/4" in diameter by 5/16" long, yet is available in values as high as 400,000 ohms:



- Fully encapsulated
- Exceeds all humidity, salt water immersion and cycling tests as specified in MIL-R-93A Amendment 3
- Operates at 125°C continuous power without de-rating
- Can be obtained in tolerances as close as ±.02%
- Standard temperature coefficient is ±20 PPM/°C. Special coefficients can be supplied on request

Below are other miniature encapsulated Daven resistors, part of the largest selection of precision wire-wound resistors available:



	Type 1250	Type 1170	Type 1195
Max. Ohms	450K	2 Meg.	760K
Dia.	1/4	1/2	1/4
Length	1/2	1/2	3/4
Max. Watts	1/8	1/3	1/4

All Daven resistors can be operated at 125°C continuous power without de-rating.

Write for complete resistor catalog.

THE DAVEN CO.

179 Central Avenue, Newark 4, New Jersey

WORLD'S LARGEST MANUFACTURER OF ATTENUATORS

www.americanradiohistory.com

Another RCA "First!"

NEW "WORKHORSE" FOR TV

RCA-6CG7..Miniature Version of the Popular 6SN7-GT

- New miniature design
- Same ratings as RCA-6SN7-GT
- 600 ma heater with controlled warm-up time *(for "series-string" operation)*
- New isolating shield between triode units

Designed with the same ratings as the 6SN7-GT, RCA-6CG7 is another product of RCA's basic program to anticipate and develop tubes to meet designers' tube requirements today—and in the future.

Engineered for modern TV circuitry including "series string" designs, RCA-6CG7 is particularly useful as a deflection oscillator. It employs a 600-milliampere heater having controlled warm-up time to insure dependable performance in television receivers employing a single series-connected heater string. Then too, it has an internal shield to prevent electrical coupling between the triode units.

The 6CG7 is also well-suited for use as a phase inverter, multivibrator, synchronizing separator and amplifier, and resistance-coupled amplifier in electronic equipment.

For technical information, call your local RCA Field Representative. Or write RCA, Section A50Q, 415 S. Fifth St., Harrison, N. J.

RCA ®

RADIO CORPORATION of AMERICA

ELECTRON TUBES HARRISON, N.J.

www.americanradiohistory.com