

TELE-TECH

& Electronic Industries



FUTURE of ELECTRONIC INDUSTRIES

New horizons and opportunities

October - 1954

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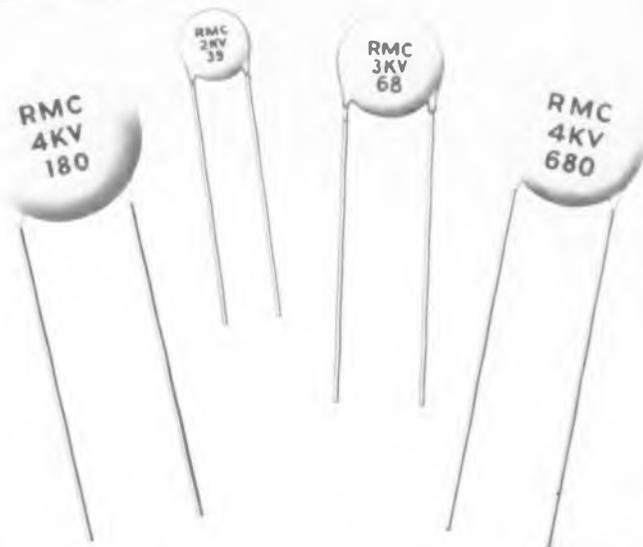
CAPACITY	DIELECTRIC	SIZE	AVAILABLE CAPACITY TOLERANCES	
2-KV				
5-47	N-750	3/16"	5-10-20%	GMV
48-68	N-750	1/2"	5-10-20%	GMV
69-82	N-750	3/8"	5-10-20%	GMV
83-130	N-750	1/2"	5-10-20%	GMV
131-200	N-1500	3/8"	5-10-20%	GMV
201-250	N-1500	3/4"	5-10-20%	GMV
251-330	N-1500	7/8"	5-10-20%	GMV
3-KV				
5-15	N-750	3/16"	5-10-20%	GMV
16-20	N-750	1/2"	5-10-20%	GMV
21-56	N-1500	3/8"	5-10-20%	GMV
57-180	N-1500	1/2"	5-10-20%	GMV
181-240	N-1500	3/4"	5-10-20%	GMV
241-330	N-1500	7/8"	5-10-20%	GMV
4-KV				
5-68	N-1500	7/8"	5-10-20%	GMV
69-180	N-1500	1"	5-10-20%	GMV
5-KV				
5-30	N-1500	3/8"	5-10-20%	GMV
31-60	N-1500	3/4"	5-10-20%	GMV
61-130	N-1500	7/8"	5-10-20%	GMV
6-KV				
5-20	N-1500	3/4"	-10-20%	GMV
21-100	N-1500	7/8"	-10-20%	GMV

POWER FACTOR: .1% Max. (I) 1M C (initial)
INSULATION: Durez phenolic—vacuum waxed

CAPACITY	DIELECTRIC	SIZE	AVAILABLE CAPACITY TOLERANCES	
2-KV				
331-470	1200-K	3/16"	20%	GMV
471-1000	1200-K	1/8"	20%	GMV
1001-2700	HI K	3/16"		GMV
2701-5000	HI K	3/8"		GMV
5001-10000	HI K	3/4"		GMV
3-KV				
220-500	1200-K	3/8"	20%	GMV
501-1000	1200-K	3/8"	-20%	GMV
1001-5000	HI K	3/4"		GMV
4-KV				
181-680	1200-K	3/4"	20%	GMV
681-1000	HI K	3/8"		GMV
5-KV				
131-330	1200-K	3/8"	-20%	GMV
331-1000	HI K	3/8"		GMV
6-KV				
101-220	1200-K	3/4"	-20%	GMV
221-470	1200-K	3/4"	-20%	GMV
221-1000	HI K	7/8"		GMV
471-1000	HI K	7/8"		GMV

POWER FACTOR: 1.5% Max. (I) 1 KC (initial)
INSULATION: Durez phenolic—vacuum waxed

Discaps with a dielectric of 1200 K or over are not recommended for deflection yokes or other 15,750 cycle applications.



production costs go down

down

down with **RMC**
HIGH VOLTAGE DISCAPS

In addition to lower initial cost, RMC high voltage DISCAPS, offer the advantages of smaller size and greater mechanical strength for faster production line handling.

Rated at 2000, 3000, 4000, 5000 and 6000 volts DC, RMC DISCAPS assure the voltage safety factor required in deflection yoke or special electronic applications. They are available in any capacity between 5 MMF and 10,000 MMF.

RMC engineers are prepared to help you with your problems on standard or special ceramic capacitors. Write us today about your specific requirements.

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

FACTORIES AT CHICAGO, ILL. AND ATTICA, IND.

OCT -5 1954

TELE-TECH & Electronic Industries

OCTOBER, 1954

FRONT COVER: SYMBOL OF THE ELECTRONIC FUTURE. This issue affords an interesting opportunity for readers to look beyond the immediate horizons and scan some of the effects that further electronic research and development will bring to man over the next twenty-five or more years. Dr. A. N. Goldsmith, whose quarter century predictions have come to pass with amazing accuracy, again ventures to prophesy the future in his current article "The Years Ahead." It starts on page 80.

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An Announcement

of the Utmost Importance to Engineers
Doing Research and Design
Work in the Entire Audio
Frequency Range.



Burnell and Co., Inc.

is proud to announce the development
of an entirely new product—

ROTOROID®

a Variable Toroidal Inductor (patent applied for)

ROTOROID will prove to be a valuable aid in the solution of many engineering problems—in research and design—and opens new possibilities for production which were previously impractical or impossible.

ROTOROID

- . . . is a continuously variable, stepless toroidal inductor which can provide a 3:1 range of maximum to minimum inductance in 180° rotation of a shaft.
- . . . employs no mechanical resistance contacts and is therefore free of noise and wear.
- . . . requires no DC saturating currents and thereby eliminates the need for circuitry.
- . . . is applicable over the entire audio range (from approximately 300 cps). ROTOROID is not limited to any stock value of nominal inductance. It is available in any value of inductance now available in regular toroids.
- . . . is hermetically sealed and is virtually vibration and shock-proof, can be chassis or panel mounted.



Write Department G for further information.

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Yonkers 2, New York

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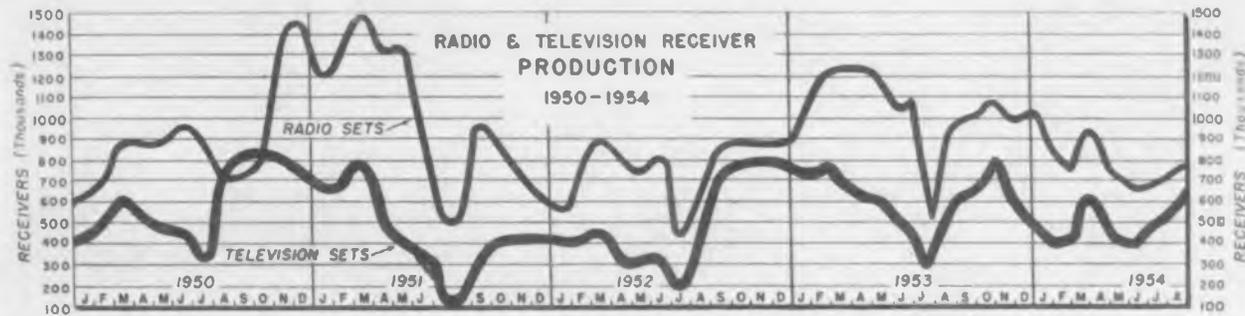
An outstanding feature of ROTOROID is that, at maximum inductance, it provides the full Q of the toroid it contains. Thus, the user is at once able to take advantage of the high Q characteristics of toroids while at the same time having available a variable inductor not previously available in a toroid.

Applications: Virtually unlimited. Just a few of the many possible uses of ROTOROID are:

- Tunable Audio Oscillators
- Variable Z Devices
- Servo Systems
- Telemetry
- Adjustable Selective Networks
- Variable Phase Shift Networks
- Variable Filters
- Electro-Mechanical Control Systems

Availability: Immediately available: ROTOROIDs VTI-A and VTI-B which are equivalent in electrical characteristics to Burnell toroids TC-16 and TC-3 in cases 2 1/4" in diameter, 3-1/16" long. Soon to be available: two miniature types, VTI-C and VTI-D, equivalent to Burnell toroids TCO and TC-6.

FIRST IN TOROIDS AND RELATED NETWORKS



GOVERNMENT ELECTRONIC CONTRACT AWARDS

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

Accelerometers	\$ 164,874	Cores	50,903	Quartz Crystals	50,096	Systems, radar range finding	147,622
Adapters, crystal socket	29,475	Countermeasure Repeaters	83,901	Radar Sets	12,803,168	Tachometers, oscilloscope	497,702
Analizers	312,397	Counters and Amplifiers	36,450	Radar Relay Systems, microwave	45,703	Tape, recording	341,830
Amplifiers	1,025,291	Couplers, antenna	74,123	Radiac Detecting Elements	54,892	Target Detectors	139,989
Antennas	674,676	Diodes	293,474	Radio Compasses	3,945,889	Target Drones	3,266,190
Antennas & Drive Units	225,400	Direction Finder Sets	286,492	Radio Equipment, police	15,090	Telémetering Systems	38,996
Antenna Reflectors	130,667	Displays, plotting board group	453,744	Radio Sets	4,032,447	Telephones, central office	1,737,208
Batteries, dry	876,275	Driftmeters	1,015,458	Radiosonde Receivers	364,650	Telephones Systems, dial	48,000
Battery Boxes	110,373	Dummy Directors	175,205	Receiver Elements, telephone	25,725	Teletypewriter Sets	8,742,768
Battery Chargers	52,627	Dynamotors	38,680	Receivers, radio	1,040,563	Terminals	45,118
Battery Packs	418,500	Generator Sets	5,417,854	Receiving Sets, sonar	176,320	Terminal Sets, radio	495,865
Broadcast Equipment	25,773	Generators, signal	770,077	Receiving Sets, microwave	326,591	Terminal Telegraphs	3,555,281
Cable Assy	163,903	Generators & Voltage Regulators	431,950	Recorder-Transmitters	498,682	Test Equipment, master	80,100
Cable	263,088	Head & Chest Sets	34,622	Recorder-Reproducers	712,184	Test Sets, characteristic	39,318
Cable, multiple conductor	61,714	Headsets	449,027	Rectifiers	30,114	Test Sets, distortion	168,631
Cable, telephone	322,890	Indicators, speed	107,769	Reels Cable Assys	2,023,185	Test Sets, impedance meter	36,020
Capacitors	99,779	Jack Box Assys	41,666	Relays	69,312	Test Sets, radio	79,485
Cavities, tuned	114,726	Loudspeakers	97,301	Resistance Bridges	63,991	Test Sets, servo	96,404
Circuit Breakers	47,354	Meters, grid dip	44,200	Resistors	147,154	Test Sets, teletypewriter	46,000
Code Practice Equipment	14,794	Meters, field strength	155,776	Slotted Sections	50,050	Thermometers, dual thermocouple	57,838
Coil Winders	44,303	Meters, frequency	1,120,801	Simulators	4,689,879	Towers	1,191,436
Communication Sets, radio beacon	345,490	Microphones	186,209	Sound Recorders	69,420	Tower Supports	83,278
Components, electronic measuring	60,356	Microwaves Systems	963,690	Spare Parts, generator set	631,072	Trainers, radar	2,386,349
Components, computer set	6,782,524	Motors	28,990	Spare Parts, oscilloscope	32,639	Training Sets, radio	148,796
Connector Assys	147,487	Multiplexers & Demultiplexers	123,831	Spare Parts, recorder	90,889	Transformers & Reactors	52,704
Connectors, receptacle	43,718	Oscilloscopes	565,834	Spare Parts, radio set	875,333	Transformers, synchro control	87,719
Consoles	162,786	Oscillographs, multi-channel	39,650	Spare Parts, transmitter-distr.	201,272	Transmitter Elements, telephone	30,430
Containers, crystal kit	38,400	Panels	29,394	Station Beacons	121,173	Transmitters	3,010,316
Control Assys, receiver	460,746	Parts, fluxmeter	25,384	Station Equipment, mobile	306,716	Transmitters, rate of flow	241,211
Control Indicators	66,974	Plug Assys, reel	56,986	Switchboards	177,951	Transmitting Sets, radio	1,013,457
Controls, radio set	26,338	Plugs, telephone	38,400	Switches	115,550	Transistors, matched pair	394,625
Controls, monitor set	157,322	Power Supplies	647,026	Switching Units	76,701	Transistors, high frequency	764,519
Converters, dual diversity	873,725			Synchros	1,565,637	Tube Checkers	28,400
Converters, tone	817,600					Tubes, electron	2,932,708

FOREIGN TELEVISION TODAY



COUNTRY	ESTIMATED TOTAL SETS	HOURS PER WEEK	ANNUAL FEES	TRANS-MITTERS	SYSTEM	PRICE OF SETS
LATIN AMERICA						
BRAZIL	110,000	130	None	4	525 & 625 LINES	\$900 to 1,100.
ARGENTINA	30,000	35	None	1	625 LINES	1,000.
COLOMBIA	400	21	None	1	525 LINES	Sets Not Available
VENEZUELA	30,000	84	None	3	625 LINES	500.
CUBA	135,000	176	None	5	525 LINES	165.
MEXICO	75,000	130	None	6	525 LINES	165.
DOMINICAN REPUBLIC	5,000	40	None	1	525 LINES	165.
TOTAL	385,400	616				
WESTERN EUROPE						
ENGLAND	3,500,000	45	\$ 8.40	8	405 LINES	\$185.
FRANCE	108,000	28	12.00	3	819 LINES	285.
GERMANY	60,000	32	20.00	8	625 LINES	315.
ITALY	50,000	17	15.00	7	625 LINES	230.
BELGIUM	10,000	30	—	2	625 & 819 LINES	300.
NETHERLANDS	8,000	4	—	2	625 LINES	290.
SWITZERLAND	4,000	16	14.00	2	625 LINES	240.
DENMARK	1,400	5	7.00	1	625 LINES	290.
SPAIN	600	3 1/2	19.00	1	625 LINES	375.
TOTAL	3,742,000	180 1/2				

Barium Titanate
Condensers

6.4-7.2 million lbs. sold annually
10-12 such condensers/radio
50-60 such condensers/TV
Above figures from Industrial Bulletin of Arthur D. Little, Inc.

Belgian TV Imports

Kredietbank Weekly Bulletin indicates Belgian TV imports 1948-1953:

1948	4,134,000 fr.
1949	527,000
1950	2,040,000
1951	804,000
1952	1,731,000
1953	9,268,000*

* 10 months
70% imports from Netherlands

ASSIGNMENT:

How to achieve excellent color TV quality and be practical about it!

SEE NOTES →



PYRAMID PLAN FOR COLOR TV



3.

GE puts all precise controls under supervision of ONE operator not each camera man.

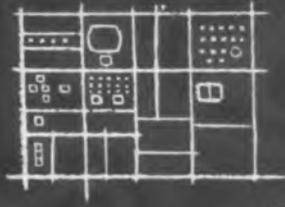
NOTE: Each "3-tube" camera you add only multiplies the already complex task of color registration.

GE's light weight camera design points up flexible application either in the studio or on remotes

RECYCLED

PRINT IN BLEND

Color balance and registration work can be squeezed into a camera...or...

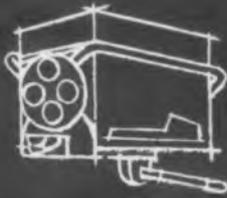


... be located remotely, as in the G-E CHROMACODER



Excellent colorcasting results from either system, but Chromacoder, in fixed location, handles registration for all cameras in its system, and such adjustments are stable. See 3,5+7 for other advantages of fixed equipment.

G-E "1 tube" cameras are, therefore, much less complicated than "3-tube" types...much easier to operate... less expensive.



A GE Chromacoder and one camera channel costs no more than a single "3-tube" camera system. However, by adding a second camera, or a third, you multiply savings tremendously.



2 new G-E cameras up to \$40,000
 3 new G-E cameras up to \$80,000
PLUS additional savings of approximately \$15,000 on each black and white camera a station converts to color application.

*Savings based on average selling price of "3-tube" cameras.

Ask our local representative for an in-person presentation of this realistic program. Call the G-E man today, or write: General Electric Company, Section X284-9, Electronics Park, Syracuse, N. Y.

In Canada, write: C. G. E. Electronics
 830 Lansdowne Avenue, Toronto

Progress Is Our Most Important Product

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Lights! Action! Camera!



Typical Installation of B & M Spotlights in "I Love Lucy" TV Show

"Paint With Light" with

BARDWELL & McALISTER'S TV SPOTS
Engineered Television Lights



TV SPOT
Model 5000



TV SPOT
Model 1000, 2000



TV SPOT
Model 500/750

This complete line of television spotlights was especially designed and engineered for television stage lighting. The many years of experience in the production of studio lights for stage and motion pictures was drawn upon to produce the B & M TV Spots which make possible painting with light. Painting with light is the ability to control the light source in order to emphasize the necessary highlights and all the important shadows. Only through controlled light can the scene and subject be given the desired brilliance, beauty, and third dimensional effects to produce ideal screen pictures.

Our specialists are always ready to assist and advise your engineering staff so that your studios and stages will be fully equipped to properly paint with light. Write for complete specifications and prices of these B & M TV Spots.



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BURBANK, CALIFORNIA

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MANUFACTURING

- Electronic equipment, communications, broadcasting, microwave relay, instrumentation, telemetering, computing.
- Military equipment including radar, sonar, guided missiles, fire controls.
- TV FM AM receivers, phonographs, recorders, reproducers.

OPERATION

- Fixed, mobile and airborne communications in commercial, municipal, aviation and government services.
- Broadcasting, video and audio recording, records, audio and sound systems, motion picture production
- Military, civilian and scientific electronic computing and control systems.
- Reg. U. S. Pat. Off.

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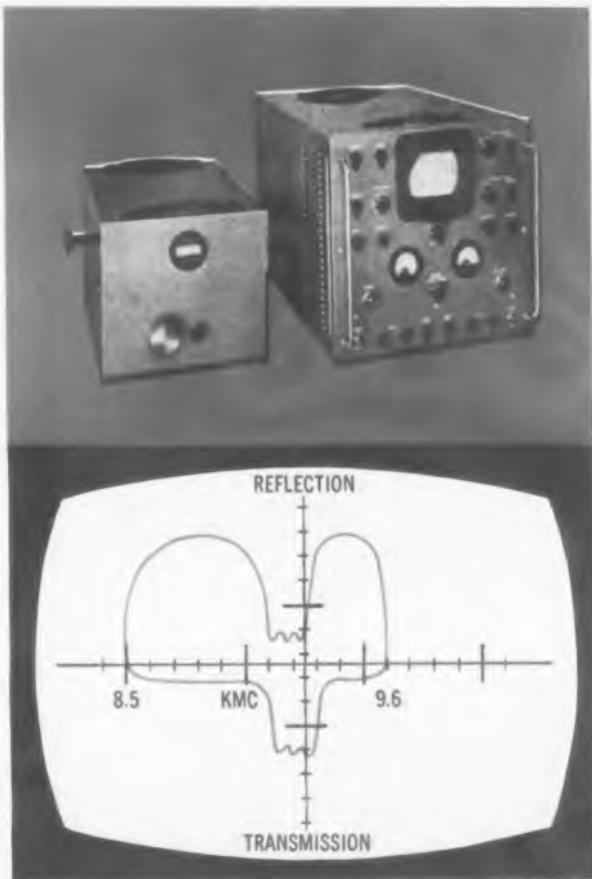
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first of its kind

X-BAND SWEEP OSCILLATOR



wide band--8500 to 9600 mc;
output constant within one db;
for dynamic testing of microwave
components and systems



Now, for the first time, an instantaneous graphic display of the entire frequency range 8500 to 9600 MCS. This new Polarad X-Band Sweep Oscillator makes possible rapid, dynamic testing of microwave components such as TR tubes, antennas, crystal mounts, even complete microwave systems over a 1100 MC sweep at X-band. Eliminates laborious point-by-point testing methods. A unique display unit shows both reflection and transmission characteristics simultaneously, since two deflection amplifiers are utilized.

The X-Band Sweep Oscillator is an important instrument for laboratory and production line application. It gives one quick answer where formerly hours of checking were necessary. For further information, write to your nearest Polarad representative or the factory.

A Typical Scope Display (at left)
Shows transmission and reflection characteristics of a double tuned cavity under test. This is an example of how the dynamic display reduces time required to test X-band components and systems. As a design tool in the laboratory, the effects of electronic or mechanical changes may be evaluated instantaneously. As a production tool, "go" and "no go" limits may be checked visually.

SPECIFICATIONS	
Frequency Range	8.5 to 9.6 KMC
Output	+ 12 db - minimum into matched load
Output Variation	± 1 db maximum
Sweep Rate	12 cycles per second
Operating Voltage	115 V ± 10%
Input Power	400 watts
Type of Output Connector	UC 52A U
Size of Control and Display Unit	15" wide x 10 1/2" deep ± 1/4" high
Size of Sweeper Oscillator	12" wide x 14 1/4" deep ± 1/2" high
Approx. Wt. of Control and Display Unit	135 lbs.
Approx. Wt. of Sweeper Oscillator	85 lbs.

Polarad ELECTRONICS CORPORATION 100 METROPOLITAN AVENUE, BROOKLYN 11, NEW YORK

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THERE'S ONE IN THE SPRAGUE FAMILY
TO MEET YOUR PARTICULAR REQUIREMENTS!



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Precision wirewound • Resin encapsulated • Tolerances up to $\pm 0.1\%$ • Ambient temperatures to 150°C • Wattage ratings to 1.5W • Resistances to 2.8 megohms • Write for Engineering Bulletin 122



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Power-type wirewound • Vitreous enamel coating • Tolerances to $\pm 5\%$ (to $\pm 2\%$ on special order) • Available in 5W and 10W ratings • Resistances to 35,000 ohms • Write for Engineering Bulletin 111



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FILMITE B® RESISTORS

Borocarbon-film • Molded plastic housing • Tolerances to $\pm 1\%$ • Ambient temperatures to 70°C • Available in $1/2\text{W}$, 1W, and 2W ratings • Resistances to 10 megohms • Write for Eng. Bul. 130



SPIRAMEG® RESISTORS

Film resistance element • Resin encapsulated • Voltage ratings to 15KV • Available in 1W, $1/2\text{W}$, and $2/2\text{W}$ ratings • Resistances to 200 megohms • Standard tolerance, $\pm 20\%$ (to $\pm 5\%$ on special order) • Write for Engineering Bulletin 135

The Sprague family of axial lead resistors offers sizes, ratings, and characteristics to meet most any application requirement. Their tough impervious jackets provide maximum protection against physical damage and atmospheric conditions. Completely tested and proven, these extremely stable units assure consistent and reliable performance in commercial and military equipment. ★ ★ ★ ★ ★ ★ ★

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Depend upon SPRAGUE for quality,
production capacity, and economy.



As We Go To Press...



New Transistor Operates at 440 MC

Bell Telephone Labs. has revealed a transistor which will operate at 440 mc, reportedly higher in frequency than any transistor yet known.

Dr. J. M. Early, who is credited with inventing the new transistor, was assisted by W. C. Hittinger and Dr. J. W. Peterson.



Bell Labs engineer uses "dry box" to assemble new UHF transistor. He is shown placing casing over transistor. Units operate at 440 mc

The UHF device, called an "intrinsic barrier" transistor, can increase an electrical signal a thousand-fold. In addition to its ability to amplify signals, it may be used as an oscillator. Frequencies as high as 3,000 mc are theoretically possible.

The new transistor builds on the basic theory that resulted in the first transistor and the recently announced Bell Solar Battery. Bell scientists have now made, in effect, a "club sandwich" by adding an intrinsically pure layer to the basic p-n-p junction wafer which acts as a "shock absorber" for high voltage electrical charges. This chemically pure part of the germanium crystal remains neutral, while three adjoining sections become positively or negatively charged. The "intrinsic" region in the midst of the transistor permits the faster movement of positive charges, isolates the input and output areas, and reduces the stored energy to make functioning at higher frequencies possible. The increased separation of input and output areas also permits operation at higher voltages than was possible before.

RCA 21-IN. COLOR TV TUBE REVEALED



RCA's new 21-in. color TV picture tube (left) is impressive contrast to the company's 15-in. tube with 12-in. screen (right). The large tube has 250 sq. in. of picture area, is lighter than the small tube, and employs a shadow mask and metal cone. Special feature is the use of a color equalizer which eliminates the former magnetic shield and rim coil. New tube contains 3 improved electron guns with wider deflection, providing brightness to the rim comparable to a monochrome tube. RCA is also placing into production a color TV receiver with 28 tubes, including the new picture tube

NMRS Launches Campaign Against Bell Mobile Radio

The National Mobile Radio System, an organization of miscellaneous common carriers, has instituted a program to combat the sales efforts of Bell System companies in the two-way radio communications field. Specifically attacking the activities of Pacific Telephone & Telegraph, NMRS stated that attempts are being made to buy existing radio systems

at a high price, and to operate these systems at a loss for some time in spite of high maintenance costs. Further it was charged that unfair sales methods were being used. NMRS also noted that other associations, including the American Petroleum Institute and Associated Police Communications Officers, were preparing to oppose this activity.

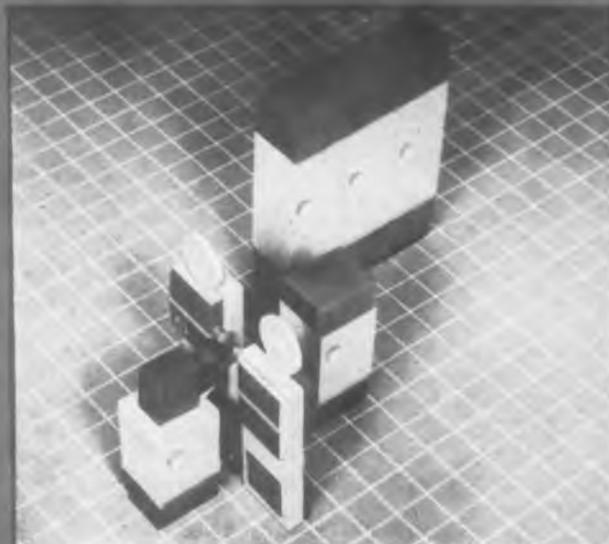
UHF BOOSTER ANTENNAS



Extension of UHF-TV service into areas blacked out because of geographic conditions has been proved feasible, according to field tests conducted by RCA in conjunction with WJTV, Jackson, Miss. Booster equipment installed 37 miles from the transmitter stepped up field intensities 23 db to Grade A service. At left is 8-ft. sq. receiving antenna with power gain of 100. At right is 38-ft. transmitting antenna with power gain of 100 which transmitted 10 watts from booster amplifier

Install the PHILCO

◀ This Philco 16mm CineScanner and its companion, the 35mm model, provide the finest film reproduction in either color or monochrome.



Multiplexed arrangement of two 16mm CineScanner film units and automatic dual slide changer for four program sources in color.

CineScanner—superior for monochrome
... *the only practical method for color!*

PHILCO CORPORATION

CineScanner

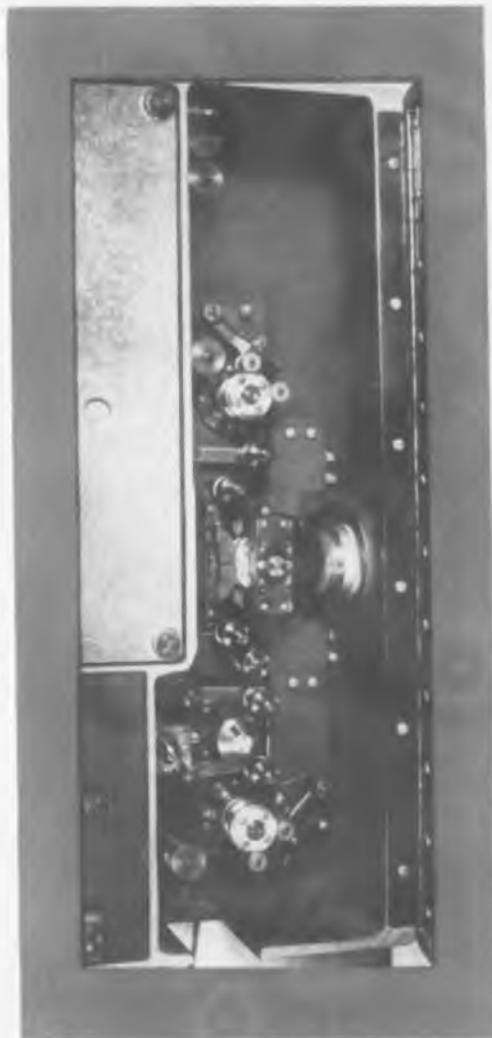
and enjoy modern film telecasting!

- Smooth, Silent Operation — No Flutter
- Preview of all Program Sources
- Color and Monochrome,
16MM and 35MM Models

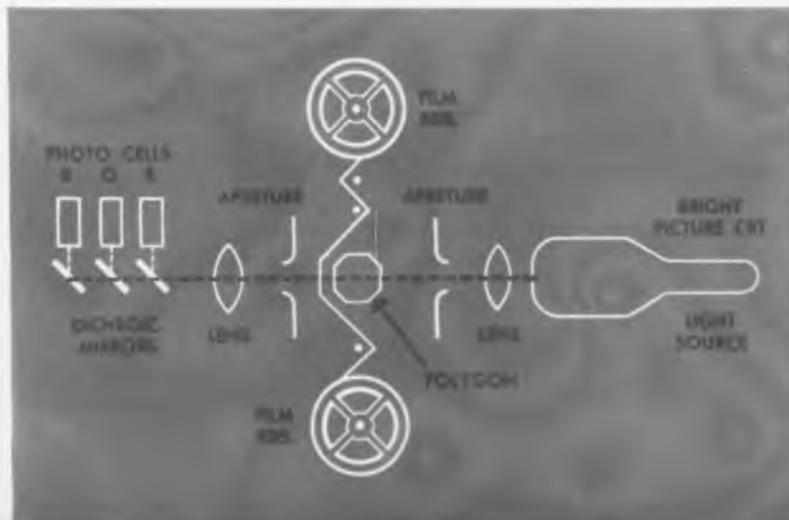
Once you've seen CineScanner operate—witnessed the clear, steady pictures and observed the smooth, silent performance—you will agree it's the only way to televise film—in *monochrome or color!*

There are good technical reasons why: The Philco CineScanner employs flying-spot scanning, a technique never equaled in producing high definition pictures. In CineScanner, there's no hot projection lamp to fail or burn the film. Only source of light is a long life, cathode-ray tube with dependable "cold" light harmless to film. CineScanner employs a special continuous-motion film transport mechanism designed by Philco and built by the Mitchell Camera Corporation of Hollywood . . . no noisy, film-damaging intermittents in the CineScanner! Most important of all to color Broadcasters, CineScanner uses economical photo tubes instead of expensive camera tubes . . . *and there are no color registration problems in CineScanner!*

With the Philco CineScanner, you can start today in monochrome, convert tomorrow to color—with no obsolescence of equipment! Get full technical data on this new and greatly improved method of televising films and slides. Contact Philco, Dept. T today.



Interior view of the film unit showing precision film transport mechanism, sound head and the simplicity of the optical system.



Simplified diagram showing the basic principles of CineScanner operation.



GOVERNMENT & INDUSTRIAL DIVISION • PHILADELPHIA 44, PA.

In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario

As We Go To Press . . . (Continued)

New Airborne Radar



Artist's conception of the way USAF's new Sperry radar APN 59 reproduces what the "turtle-shell" antenna sees on the surface. Area depicted is region near Cape Cod, Mass. Dark plastic wedge at top swings to any compass heading for exact measurement of drift

A new compact airborne radar for troop-carrying transports and essential cargo planes is the smallest and lightest radar system yet for its high power and wide range of aircraft uses. A single 5-inch radar screen combines many radar functions of search and surveillance, accurate navigation over uncharted airplanes, detection of distant storms and best-weather routes, anti-collision warning of mountaintops and tall structures, or of other nearby aircraft while flying at any altitude up to 50,000 feet. This single lightweight system weighs 150 lbs. including the oddly-shaped "turtle shell" antenna only 18 inches in size, and gyro-stabilized for positive steadiness against pitch and roll of the plane. Radar beacon interrogation and reception are also incorporated in the APN-59.

Immediate production of these miniature systems in quantity for Air Materiel Command is presently under way at the Sperry Company. The APN-59 operates in the 'X Band' or 10,000 megacycle band of the spectrum. Following are performance abilities and characteristics:

- Two-beam configurations — pencil beam or fan beam.
- Gyro-stabilized antenna—18 inch or 30-inch, as space permits.
- Two types of presentation—ground pattern, or various cloud levels.
- Weather warning; near or long range search.
- Adjustable contrast of ground pattern; short and long range.
- Multiple pulse lengths, automatically applied.
- Radar beacon interrogation and reception.
- Full 360° or sector scanning.
- Terrain clearance (mountain peaks, etc.) or nearby aircraft.
- Ground mapping, and exact drift measurement. (2 ways; by heading marker, or Doppler drift).

TV DUNKING



To demonstrate how rugged its TV receivers are, the Quality Control Dept. of Allen B. DuMont Labs. took a set off the production line and dropped it in the river. After it was hauled out and dried—you guessed it—it worked fine

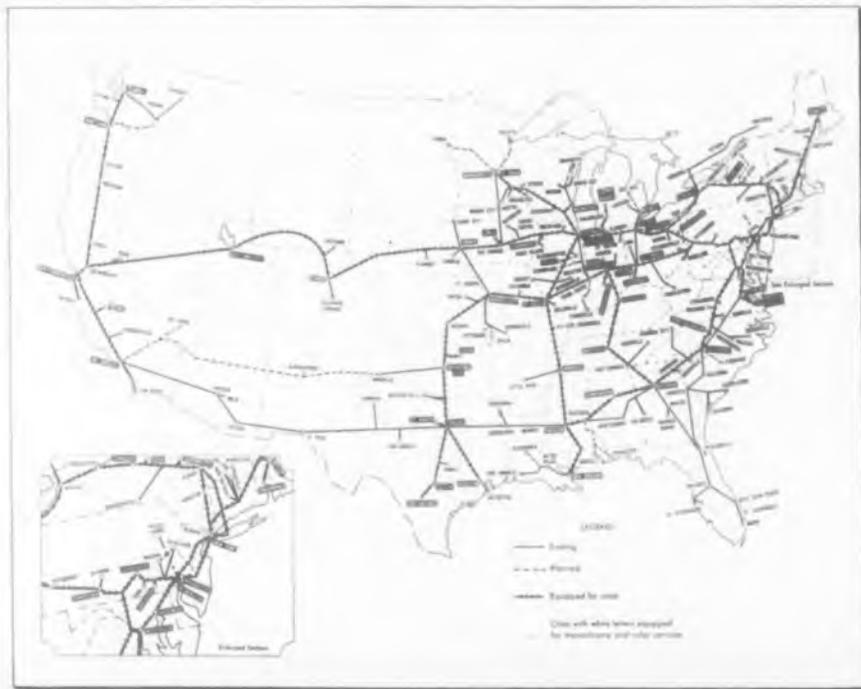
AT&T Ready for Color TV in 65 Cities

The Long Lines Department of American Telephone and Telegraph Co. reports that color TV can now be transmitted to 65 cities across the nation. At present, 145 TV stations in these cities are receiving network TV service, and about 95 of them are getting color in addition to black-and-white.

Ralph L. Helmreich, Long Lines Director of Operations, estimated the Company would be able to transmit color programs to about 95 cities by the end of the year.

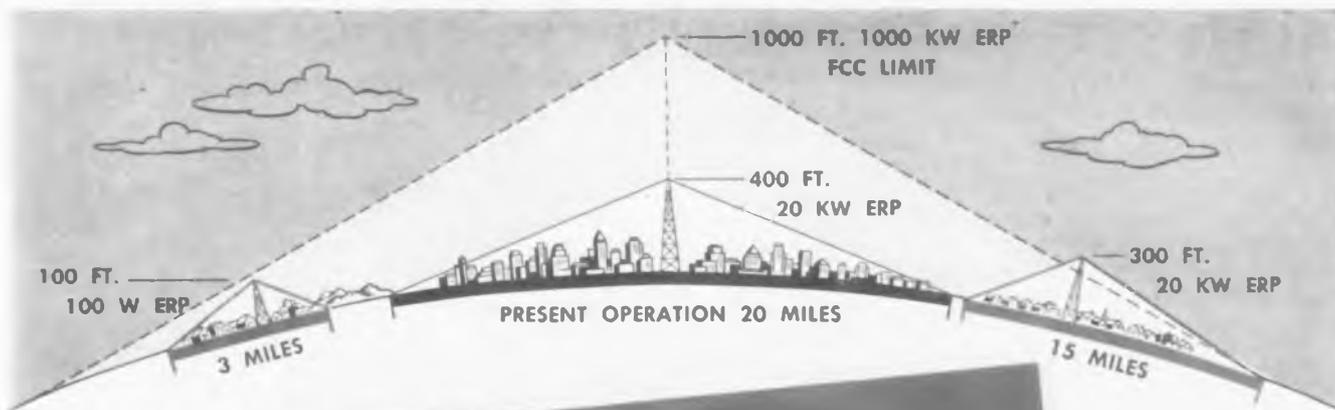
"Of the 187 stations presently located in these cities and receiving network service, a total of about 125 are expected to be ready to broadcast in color by late December," he said.

Existing and planned Bell System TV network routes equipped for color and monochrome



MORE NEWS
on page 14





**FILL IN OR EXTEND
YOUR CLASS A AREA
with
GPL SATELLITE EQUIPMENT**

PHONE, WIRE OR WRITE THESE
GPL REGIONAL OFFICES:

R. H. Johnston
188 West Randolph Street
Chicago, Illinois
Dearborn 2-6453

W. M. Witty
4212 S. Buckner Boulevard
Dallas, Texas
Evergreen 1137

E. J. Manzo
992 West Peachtree Street, N.W.
Atlanta, Georgia
Emerson 6831

J. M. Cunningham
1607 Flower Street
Glendale, California
Chapman 5-6046

N. M. Marshall
63 Bedford Road
Pleasantville, New York
Pleasantville 2-2000

• With the relaxation of operational requirements for certain types of TV stations, it is now possible to doctor your service pattern . . . to extend your Class A contour, gain a bigger audience, a stronger market for both local and network sales.

To cover that nearby community with an additional slave transmitter operated as a *Special Service Authorization**; use GPL CONTINENTAL low-powered UHF equipment: 100 W to 1 KW. This equipment is offered as a complete package, including off-the-air receiver, transmitter and antenna plus associated video items.

Holes in the UHF pattern can be brought up to par by additional low-powered radiation in an *On-Channel Satellite** operation. For this, GPL offers Adler Communications Laboratories equipment: Models UST-10 or UST-100.

Contact GPL regional representatives for analysis and recommendations to solve your special problem.

*Nomenclature under consideration by FCC as recommended by RETMA.



General Precision Laboratory

INCORPORATED

PLEASANTVILLE NEW YORK

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION



As We Go To Press . . . (Continued)

4-Megawatt Klystron Developed for Radar

A giant electronic tube has been announced by the Air Research and Development Command. Known as a megawatt klystron, the tube is eight feet tall and is the first to produce 4,000,000 watts of precisely



First photo of 4-megawatt klystron designed for high power Air Force radar. The 8-ft. tall tube is shown being installed at Rome ADC, N. Y.

controlled radar power for military systems as yet undisclosed. Experimental proof of a new "electron-packing" technique, which uses a shaped magnetic field to force electrons through the hole in the kly-

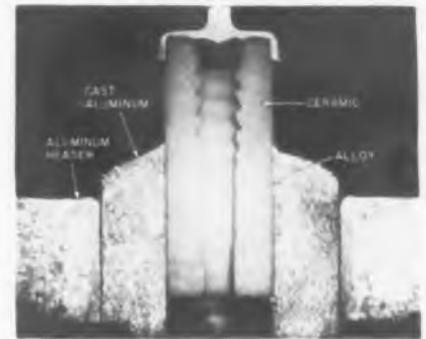
Aluminum-to-Ceramic Joining Process Developed

Light-weight aluminum can now be used in place of heavier conventional metals in many electrical applications as the result of a new aluminum-to-ceramic joining process developed by the General Electric Co. The firm's General Engineering Lab. said the new process can be used to advantage in the making of capacitors, high speed relay switches, aircraft instrument panels and ignition systems, and other items requiring insulated hermetic seals.

The ceramic section to be joined to aluminum is coated with an alloy. Molten aluminum is then alloyed to the coated ceramic. The resulting dense aluminum layer around the

stron's rhumbatron, was successfully attained through basic klystron research of the Sperry Gyroscope Co.

In the klystron, electrons are so tightly packed that a one-inch beam now transmits more current through a vacuum than a 1/8 inch copper wire can safely carry.



Cross-section of aluminum-to-ceramic seal

ceramic is machined to the required diameter and brazed into the aluminum structure for which the ceramic seal was designed.

MORE NEWS
on page 18



COMING EVENTS

- Sept. 30-Oct 1—5th Annual Meeting and Exhibit of the Professional Group on Vehicular Communications of IRE. Rice Hotel, Houston, Texas.
- Sept. 30-Oct. 1—Fall Assembly Meeting of the Radio Technical Commission for Aeronautics. Willard Hotel, Washington, D. C.
- Sept. 30-Oct. 2—High Fidelity Show, International Sight and Sound Exposition, Inc., Palmer House, Chicago.
- Oct. 4-6—Tenth Annual National Electronics Conference, Hotel Sherman, Chicago, Ill.
- Oct. 5-7—AIEE Middle Eastern District Meeting. Abraham Lincoln Hotel, Reading, Pa.
- Oct. 11-15—AIEE Fall General Meeting, Morrison Hotel, Chicago, Ill.
- Oct. 13-15—Joint Meeting of RTCM and IRE Professional Gp. on Communications Systems. Somerset Hotel, Boston, Mass.
- Oct. 13-17.—1954 Annual Convention, Audio Engineering Society. Hotel New Yorker, N. Y.
- Oct. 18-20—RETMA Radio Fall Meeting, Hotel Syracuse, Syracuse, N. Y.
- Oct. 18-22—42nd National Safety Congress and Exposition, Conrad Hilton, Congress, Morrison and La Salle Hotels, Chicago, Ill.
- Oct. 21-23—8th New England Conference of the American Soc. for Quality Control. Ten Eyck Hotel, Albany, N. Y.
- Oct. 26-28—2nd National Conference on Tube Techniques, sponsored by the Working Group on Tube Techniques of the Dept. of Defense. Western Union Auditorium, 60 Hudson St., N. Y. C.
- Oct. 27-30—30th National Convention of the National Assoc of Education Broadcasters. Hotel Biltmore, New York.
- Nov. 1-5—National Metal Exposition. International Amphitheater, Chicago, Ill.
- Nov. 4-5—East Coast Conference on Airborne and Navigational Electronics, sponsored by the Baltimore section of IRE and IRE Professional Group on Aeronautical and Navigational Electronics. Sheraton-Belvedere Hotel, Baltimore, Md.
- Nov. 10-11—AIEE Conference on Electronic Instrumentation and Nuclear Medicine, Morrison Hotel, Chicago, Ill.
- Nov. 10-12—18th Annual Time and Motion Study and Management Clinic, sponsored by the Industrial Management Society. Sherman Hotel, Chicago, Ill.
- Nov. 12-13—National Symposium on Quality Control Methods in Electronics, sponsored by the Professional Group on Quality Control of IRE and Electronic Technical Comm. of the American Soc. for Quality Control. Hotel Statler, New York.
- Nov. 17—Western Area Development Conference sponsored by Stanford
- Research Institute, Nat'l. Assoc. of Mfrs., Calif. Mfrs. Assn., Soc. of Industrial Realtors, and Chamber of Commerce of Hawaii, Mark Hopkins Hotel, San Francisco, Calif.
- Nov. 18-19—6th Annual Electronics Conference, sponsored by the Kansas City Section of IRE, Hotel President, Kansas City, Mo.
- Nov. 21-22—Automatic Control Equipment Exhibition. Waldorf-Astoria Hotel, N. Y. C.
- Nov. 29-Dec. 4—First International Automation Exposition, 242nd Coast Artillery Armory, New York, N. Y.
- Dec. 8-10—4th Annual Eastern Joint Computer Conference and Exhibition, jointly sponsored by the AIEE, IRE, and ACM. Bellevue-Stratford Hotel, Phila. Pa.

1955

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

Feb. 10-12—Audio Fair-Los Angeles, sponsored by Los Angeles Section of AES, Alexandria Hotel, Los Angeles, Calif.

ACM: Assoc. for Computing Machines.
AES: Audio Engineering Society.
AIEE: American Institute of Electrical Engineers.
IRE: Institute of Radio Engineers.
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

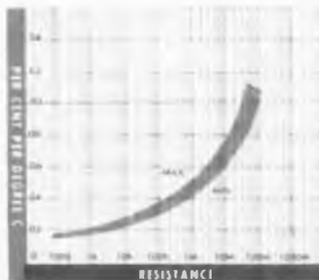
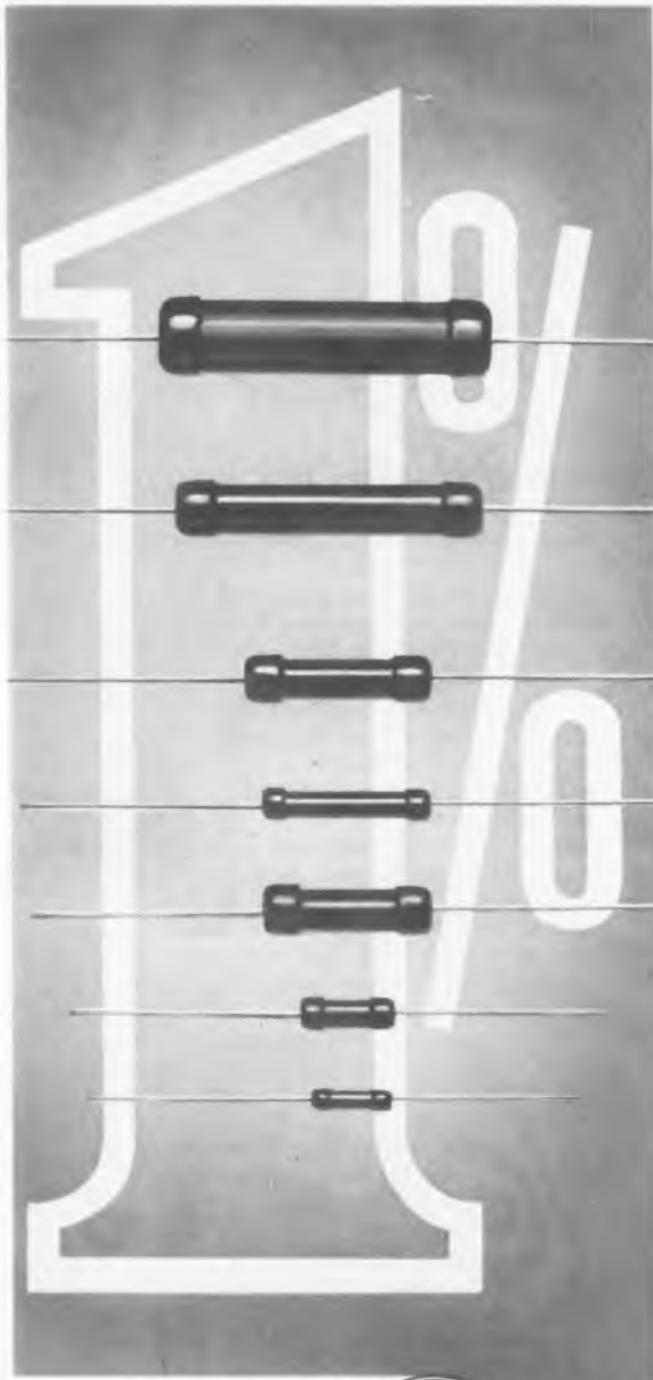
ALLIES' Precision Deposited Carbon RESISTORS

Ambient Temperatures
from -70° to $+250^{\circ}$ C

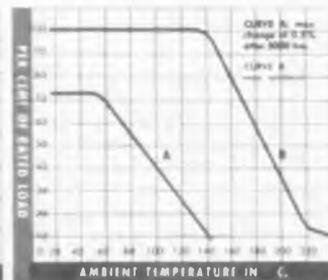
One Per cent Standard

Allies' Products precision carbon deposit resistors are replacing wire wound resistors in many circuits requiring high precision at low cost.

Allies' Products resistors are the standard of many computer and missile manufacturers.



Typical temperature coefficient characteristics for Allies' Products carbon deposit resistors.



Typical derating curve for $\frac{1}{2}$ watt Allies' Products carbon deposit resistors.

VALUES and SIZES

RESISTOR	WATTS	OHMS
APT-5	5	20 ohms to 20 meg. $\pm 1\%$
APT-2	2	10 ohms to 50 meg. $\pm 1\%$
APLT-1	1	100 ohms to 50 meg. $\pm 1\%$
APT-1	1	10 ohms to 10 meg. $\pm 1\%$
APCT-1	1	25 ohms to 10 meg. $\pm 1\%$
APBT-1	1	10 ohms to 50 meg. $\pm 1\%$
APLT- $\frac{1}{2}$	$\frac{1}{2}$	10 ohms to 10 meg. $\pm 1\%$
APST- $\frac{1}{2}$	$\frac{1}{2}$	5 ohms to 10 meg. $\pm 1\%$
APXT- $\frac{1}{2}$	$\frac{1}{2}$	5 ohms to 2 meg. $\pm 1\%$
APT- $\frac{1}{4}$	$\frac{1}{4}$	1 ohm to 3 meg. $\pm 1\%$
APYT- $\frac{1}{4}$	$\frac{1}{4}$	5 ohms to 1 meg. $\pm 1\%$



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Kum-Kleen

LABELS *make...*

they're pressure-sensitive!



...production's really sold on 'em—and they're priced right!”

Plant... department... or individual—everyone's sold on Avery Pressure-Sensitive Labeling. Here's why:

■ *Countless hand operations are eliminated...one simple motion and they're on to stay—without moistening!* Avery Kum-Kleen Labels are fed, either one-at-a-time from an automatic dispenser, or from sheets for individual labeling.

SPECIFICALLY SPEAKING...
how to handle a hard-to-label surface...



Kirkhill, Inc., selected a transparent, Polyethylene bag to give extra sales appeal to their line of faucet repair kits. These kits each contain some 30 different items for repairing almost any conceivable type of swing spout faucet, and this plastic bag made an ideal display and a perfect package.

But how to identify it...how best to show off the Kirkhill brand? Avery *Pressure-Sensitive Labels*, of course! These attractive labels stick instantly to the flexible plastic surface—without drying out or popping off! They stick—and stay stuck...they identify both the product and the manufacturer. Where can you use quick, clean Avery Labeling in *your* business?

■ *Production line speed* means Avery Labels work on every labeling job faster, more efficiently and more economically. They fit into any production line, at any speed.

■ *Clean, easy application* even on hard-to-label surfaces. Self-Adhesive Avery Kum-Kleen Labels stick tight to any clean, smooth surface...they won't dry out, curl or pop off. And they stay neat and attractive—even under temperature and humidity extremes.

■ *Low cost Avery Dispensers*—either manual or electric—assure dependable labeling and top efficiency for every labeling job. Write today for details—case histories and free samples of Avery Pressure-Sensitive Labeling!

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Please send case histories and free samples Have the Avery Label man call

Name _____

Company _____

Address _____

Our Business Is _____

FREE—label analysis service!

Avery labeling specialists, experienced with the requirements and labeling problems of many industries, are at your service to help you develop improved, low-cost self-adhesive labeling methods. No obligation...write today!

AVERY
Kum-Kleen
LABELS

Tube life in time-proved GATES 5/10kw AM transmitters "exceeds estimates"

QUINCY
ILLINOIS
U. S. A.

GATES

MANUFACTURING
ENGINEERS
SINCE 1922

Gates Radio Company

Eitel-McCullough, Inc.
San Bruno, California

Gentlemen:

A few years ago our engineering department was requested to design several entirely new transmitters in the 5/10KW power range for both medium and short wave commercial service. — One of the requirements was the establishment of a modern tube complement that would substantially reduce tube cost both initially and in greater life expectancy.

After considerable investigation and exhaustive tests in our own development section, the Eimac 3X2500F3 was decided upon. Performance-wise, the results were excellent but even successful abuse tests could not be a substitute for several years that must pass to obtain records on life expectancy.

These several years have now passed. Gates transmitters employing the 3X2500F3 are all over the world in every kind of service including 24-hour a day international communications, broadcasting and many 5KW mobile units for military service. Checks indicate, as both radio frequency amplifiers and Class B modulators, the life expectancy is not only meeting our original estimates and expectations but in many instances far exceeding them.

We congratulate you on an excellent product that has indeed saved the industry untold thousands in tube expense and again express our appreciation for the excellent cooperation of your engineering department.

Yours very truly,

GATES RADIO COMPANY



P. S. Gates
President



EIMAC 3X2500F3's IN GATES 5/10KW AM TRANSMITTERS

GATES
TRANSMITTER
BC-5B
BC-10B

MODULATOR
2 Eimac
3X2500F3's
2 Eimac
3X2500F3's

PA
Eimac
3X2500F3
2 Eimac
3X2500F3's

Eimac 3X2500F3's featured in
Gates models BC-5B and BC-10B
the world over.

Eimac

EITEL-McCULLOUGH, INC. SAN BRUNO, CALIFORNIA



Look here **FOR ANSWERS
TO YOUR
ANTENNA PROBLEMS**

Facing new antenna problems?

Find important new ideas and advanced techniques leading to the ultimate answers in Gabriel's new Facilities Report. For design . . . development . . . or production, you need this 24-page well illustrated brochure.

It is, we believe, by far the most complete in the field. A few of the projects described—typical of Gabriel experience that can help you—are:

RADAR—Design and production of search antennas; IFF parasitic antennas; conical scan for gunlaying and tracking.

MISSILES—Flush-mounted antennas for intelligence transmission; beacon antennas for tracking.

AIRCRAFT—Blade, flush mounted, and block antennas for navigational radar, Shoran, communications, and homing.

MICROWAVE RELAY—For mobile military communications, railroad, TV network, and public utilities.

SEND FOR YOUR COPY. Write on your letterhead, please, indicating antenna problem involved. Address Consulting Engineering Department.

GABRIEL ELECTRONICS DIVISION

Formerly Workshop Associates Division

THE GABRIEL COMPANY, 300 Endicott Street, Norwood, Mass.



As We Go To Press

Sterling Resigns from FCC

George E. Sterling has submitted his resignation as a member of the Federal Communications Commission, effective Sept. 30. Mr. Sterling has been a member of the FCC since 1948, and the oldest member of the Commission in point of service. He is 60 years old and had been in government service for 30 years. The resignation was based on the advice of his physician.

NARTB Files Station Identification Petition

The National Association of Radio and Television Broadcasters filed a petition with the FCC asking that agency to institute rule making proceedings to amend Section 3.652(a) of the FCC Rules dealing with station identification for TV stations. NARTB contends that the present requirement for making identification announcements at the beginning and end of each time of operation by both aural and visual means is an unnecessary burden. The request is made that identification be made by aural or visual means.

Gaseous Electronics Confab

The seventh annual Gaseous Electronics Conference, bringing together some 300 physicists from the United States and foreign countries, will be conducted at Vanderbilt Hall, New York University, October 14-16.

Co-sponsor with NYU is the American Physical Society, Division of Electron Physics. About 50 papers on technical subjects in the physics of gas discharge phenomena will be presented. Conference delegates will discuss recent developments in electron ejection by ions, the physics of the ionosphere, breakdown in vacuum, and the chemistry of electric discharges.

Research in gaseous electronics has taken on new significance in recent years with the development of gas-filled tubes—the thyatron, the ignitron, voltage regulator tubes, Geiger counters, and high intensity light sources—that are essential to progress in electronics, communication, radar, high speed photography, and similar fields.

**MORE NEWS
on page 28**



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the

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after **22 YEARS**
 the Big Name in Sockets
 is still **EBY!**

1954

EBY
TUBE SOCKETS

EBY Mica-Bakelite Tube Sockets are standard equipment in the tube socket racks of most of the important American radio manufacturers. The unique design of their connector leads prevent prying and expansion to damage their connections. They are also designed to fit the most common sockets. No the more to the most important feature of the sockets is their sturdy bakelite construction. They look like the standard sockets and can be assembled in any way desired. A simple twist in the tube or slight guide the prongs of the tube into the holes.

LAMINATED BAKELITE SOCKETS

EBY Laminated Bakelite Sockets are made of the same material as the standard sockets and are made in the same way. They are made of bakelite and mica. They are made in the same way as the standard sockets and are made of the same material. They are made in the same way as the standard sockets and are made of the same material.

The E. H. EBY MFG. CO., Inc.
 1144 E. and Lehigh Ave., Philadelphia

1932

Transistor Sockets



Subminiature Sockets



UHF Sockets



Printed Circuit Sockets



Color TV Components

Today as a quarter of a century ago, Eby Tube Sockets lead the field with advanced design and quality workmanship. You can depend on Eby . . . keeping pace with the industry.

TUBE SOCKETS • PLUGS & CONNECTORS • JACKS • BINDING POSTS and other ELECTRONIC, COMMUNICATIONS, RADIO and TELEVISION COMPONENTS

HUGH H. **EBY** CO.

4704 Stenton Ave., Philadelphia 44, Pa.

TELE-TECH & ELECTRONIC INDUSTRIES • October 1954

From "The House of Resistors"*
come these outstanding

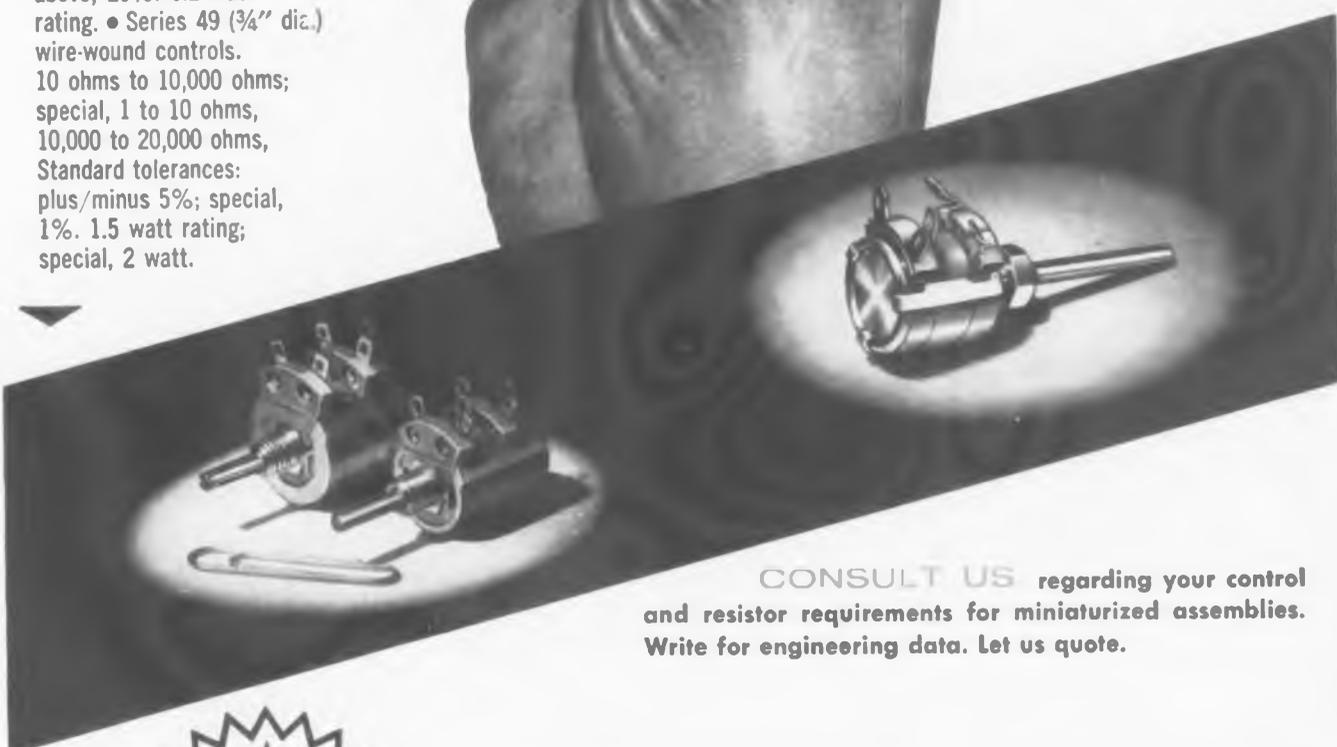
miniaturized controls

CARBON AND WIRE-WOUND

Series 48 ($\frac{5}{8}$ " dia.)
composition-element con-
trols. 500 ohms to
5 megohms, linear; 2500
ohms to 2.5 megohms,
non-linear. Standard toler-
ances: 100,000 ohms
and under, plus/minus 10%;
above, 20%. 0.2 watt
rating. • Series 49 ($\frac{3}{4}$ " dia.)
wire-wound controls.
10 ohms to 10,000 ohms;
special, 1 to 10 ohms,
10,000 to 20,000 ohms,
Standard tolerances:
plus/minus 5%; special,
1%. 1.5 watt rating;
special, 2 watt.

...AND NOW WITH SWITCH

Factory-attached S.P.S.T.
switches for both Series
48 and 49. Multipole decked
switch assemblies
available. Single and dual
units, with or without
switch. Sturdy—yet tiny!



CONSULT US regarding your control
and resistor requirements for miniaturized assemblies.
Write for engineering data. Let us quote.



CONTROLS and RESISTORS

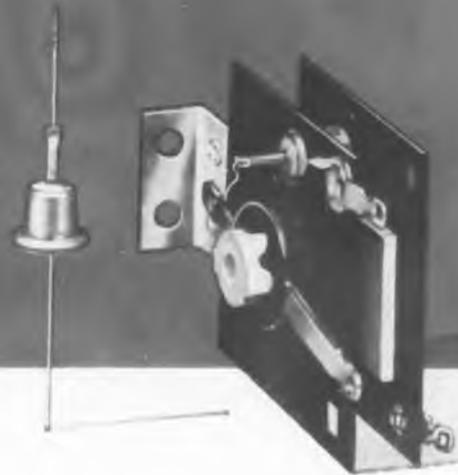
CLAROSTAT MFG. CO., INC., DOVER, NEW HAMPSHIRE
In Canada: CANADIAN MARCONI CO., Ltd., Toronto, Ont.

*Trade-mark

G. E.'s LATEST CONTRIBUTION TO



CUSTOM BUILT TO PROVIDE
143 POWER COMBINATIONS!



- ★ Smallest unit size yet developed!
- ★ Most reliable performance of any rectifier within this category!
- ★ Hermetically sealed for lifetime use!

The following germanium rectifier stacks, each occupying a volume of only 1.62" x 2.5" x 6.00", are typical of the 143 standard stacks in G. E.'s new rectifier line.

CIRCUIT	D.C. OUTPUT (55°C Resistive Load)
Half Wave	2 amps @ 280 volts or 3 amps @ 190 volts
Full Wave Center Tap	2 amps @ 280 volts or 3 amps @ 190 volts
Full Wave Bridge	1 amp @ 565 volts or 3 amps @ 210 volts
Three Phase Half Wave	1.12 amps @ 420 volts or 4.5 amps @ 140 volts
Three Phase Bridge	1.3 amps @ 575 volts or 2.6 amps @ 280 volts
Three Phase Star	1.8 amps @ 280 volts or 3.6 amps @ 140 volts



THE PROGRESS OF POWER...

Germanium RECTIFIERS



Plus IMMEDIATE DELIVERY

General Electric leads the industry again! Announcement of this revolutionary G-E Stacked Germanium Rectifier opens up new avenues of power progress that were heretofore thought impossible to travel. Now, the amazing total of 143 power combinations has been provided with this one product! Your specifications requiring series or parallel stacks in single or polyphase circuits are custom-completed at G-E's factory.

This unit is smaller, weighs less, is more reliable, lasts longer, has better power ratings than any other dry rectifier made *any place by any other company*. AND, G.E. offers you *immediate delivery*.

Designed and built to deliver new *power performance*, the G-E Stacked Rectifier is 75% less by volume and weight than any other comparable dry type rectifier. And, rectifier losses are reduced to one-third or less of those encountered with any other type of rectifier. You can count on extreme reliability . . . tested for compliance to 10,000-hour standards. Note also that there are no forming or aging effects.

WRITE US TODAY! GET
ALL THE FACTS ON THIS
IMPORTANT NEW PRODUCT!

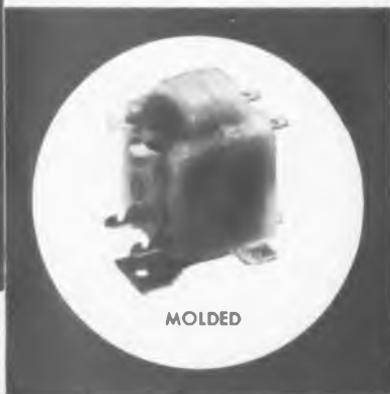
General Electric Company, Section X48104
Electronics Park, Syracuse, New York



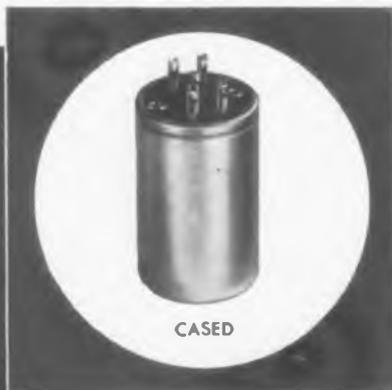
★ ★ GENERAL  ELECTRIC



MINIATURE



MOLDED



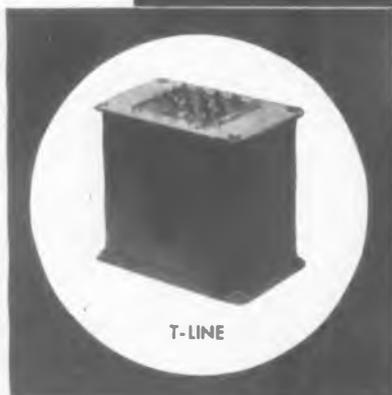
CASED



HERMETICALLY SEALED
OIL-FILLED



A-LINE



T-LINE



TOROIDS



KENYON TWINS

MILITARY COMMERCIAL

KENYON TRANSFORMERS

*Engineered and Built to Meet the Most Rigid
Military and Civilian Requirements*

Kenyon's engineering staff and production department have had more than fifteen years' experience in designing and building units which exactly meet the most rigid and unusual specifications. Your inquiries are invited.

Miniature—Molded—Cased—Hermetically Sealed Oil-Filled—
A-Line—T-Line—Toroids—The Kenyon Twins, M-Line to meet
all Mil-T-27 Requirements; C-Line for all commercial requirements.

KENYON TRANSFORMER CO., INC.
840 Barry Street, New York 59



The security of experience. Pyramid has more experienced personnel in years of actual designing and manufacturing of capacitors than any other manufacturer.

The advantage of leadership. Pyramid supplies capacitors to all leading TV set manufacturers, and to ALL Branches of Government. Being so close to initial product developments, the design engineer, purchasing agent and production man benefit by new developments in the Pyramid line.

The control of specially designed facilities.

Pyramid is the only manufacturer of capacitors whose plants were planned and built specifically for the entire manufacturing process of capacitors from drawing board conception through reception of raw materials, fabrication, packaging and shipment.

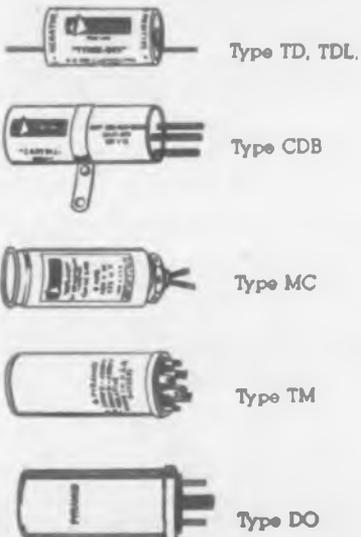
what is available from **Pyramid**

commercial
MIL-SPEC
capacitors

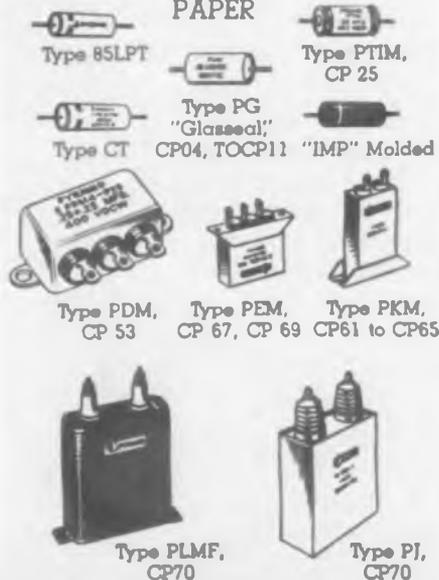
The guarantee of one standard. All Pyramid capacitors are one quality, made of the same quality materials demanded by rigid military specifications. Pyramid capacitors have a low leakage factor due to the non-hygroscopic insulating material used on all production. Pyramid delivers the best at no premium.

A complete line of capacitors—full ranges in all ratings and types.

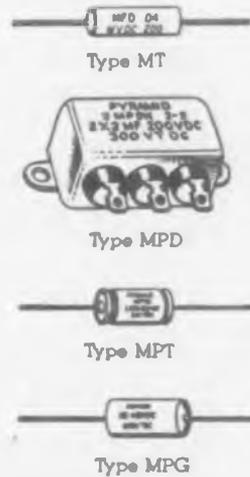
ELECTROLYTICS



PAPER



METALLIZED PAPER



▲ PYRAMID ELECTRIC COMPANY 1448 HUDSON BOULEVARD • NORTH BERGEN, N. J., U. S. A.

Burton Browne Advertising

LOOK

at the extra features that assure dependability in ADLAKE Mercury Relays!

■ **Dependability** is the sum of many things . . . and ADLAKE's dependability is built on engineering skill, exhaustive testing, and quality construction features like these:

Positive leak-proof sealing—assured by the use of properly selected metals and glass components with properly matched thermal expansion characteristics.

Arc-resisting ceramics—ceramics with great temperature-resistance are used to reduce any destructive effect caused by the arc.

Liquid mercury-to-mercury contacts—completely eliminates failures caused by low contact pressure, contact burning, pitting and sticking—and the inherent high surface tension of mercury imparts an ideal snap action to the contacts.

And, of course, ADLAKE Mercury Relays are hermetically sealed, require absolutely no maintenance, and are silent and chatterless. Write for your free copy of the ADLAKE Relay catalog today . . . The Adams & Westlake Company, 1175 N. Michigan, Elkhart, Indiana. In Canada, address Powerlite Devices, Ltd., Toronto.



"Mighty Midget" ADLAKE Relay—
Contact normally open or closed.

**EVERY ADLAKE RELAY IS TESTED
—AND GUARANTEED
—TO MEET SPECIFICATIONS!**

THE Adams & Westlake COMPANY

Established 1857 • ELKHART, INDIANA • New York • Chicago
Manufacturers of ADLAKE Hermetically Sealed Mercury Relays



What's your choice in fine tape equipment?



**NEW
PRESTO
SR-11**

Complete studio console tape recorder. Never before so much quality, operational ease and value at such a modest price. Embodies the famous PRESTO R-11 tape mechanism, matching amplifier—power supply in sturdy well-designed console cabinet. Three motors for complete flexibility; 15" and 7½" per sec. speeds.



**PRESTO
R-11**

A tape recording mechanism of truly modern design in engineering and operation. Mechanism includes three-head assembly, solenoid operated brakes and employs the exclusive Capstan drive unit. Tape reels mounted directly on heavy-duty torque motors.



**PRESTO
R-7**

Rugged, portable tape recorder with separate recording, reproduction, and erasing heads. Built around a sturdy, three-motor drive eliminating friction clutch, the RC-7 contains the same high-quality components found in PRESTO'S fine studio equipment. Heavy-duty construction throughout.



**PRESTO
PB-17A**

Reliable, long-playing tape reproducing mechanism. Automatically reversible for continuous playback for background music in eight hour cycles. Frequency response uniform from 50 to 8000 cps. Tape speed: 3¾" per sec. Reels up to 14" diam. (4800' of tape) with dual track.



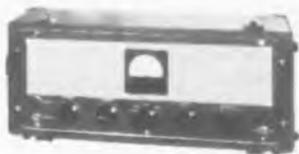
**PRESTO
900-A**

Precision tape amplifier for portable use or rack mounting. Composed of individual record and reproduce (monitor) amplifiers on a common chassis; separate power supply; three-microphone input, 250 ohm low level mixer; illuminated V.U. meter. Output of reproduce amplifier, 500 ohms, plus 10 db maximum. May be used with any model PRESTO tape recorder.



**PRESTO
TL-10**

Turntable-driven tape reproducer. Unique, low-cost unit that adapts any 16" turntable for reproduction of tape at 7½"/sec. or 15"/sec. with exceptional accuracy. No pre-amplifier required; plugs into standard studio speed input equipment.



PRESTO A-920

More compact than the 900-A. In carrying case or for rack mounting. Consists of microphone preamp, a reproduce preamp, power amplifier and power supply — all on common chassis. Two small speakers mounted behind front panel for playback. Single mike input: 250 ohms. Playback output: 15 ohms, 10 watts.



**PRESTO
CDR-200
CAPSTAN
DRIVE UNIT**

Heart of all Presto tape recorders and reproducers. Motor, capstan and flywheel, pressure pulley and pressure pulley solenoid are mounted on independent cast aluminum chassis. Positive, very quiet tape drive with minimum of parts.

Behind every piece of tape equipment are these PRESTO "extras"—painstaking craftsmanship, years of experience... quality control... and advanced production facilities that guarantee instruments of absolute precision and lifelong dependability.

PRESTO

RECORDING CORPORATION
PARAMUS, NEW JERSEY

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

WORLD'S LARGEST MANUFACTURER OF
PRECISION RECORDING EQUIPMENT
AND DISCS

MAIL THIS COUPON TODAY

Presto Recording Corporation
Tape Equipment Sales Div.
Paramus, New Jersey

Please send full information and prices on the following Presto tape equipment:

- SR-11 Tape Recorder PB-17A Tape Recorder
 R-11 Tape Transport TL-10 Tape Reproducer
 R-7 Tape Recorder A-920 Tape Amplifier
 900-A Tape Amplifier CDR-200 Capstan Drive Unit

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____

STATE _____

**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.

As We Go to Press . . .

Procurement in 1955

Maj. Gen. David H. Baker, Director of Procurement & Production, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, writes that the Air Force is continuing to show increased recognition of the function and importance of the electronic industries in our daily operations.

"We have reached a point where as much attention must be given to the application of electronics in aviation as is being given to design, development, and application of airframes and engines. This electronic 'new look' may have a tremendous economic impact on industry.

"The fiscal year 1955 electronics procurement program is comparable to the fiscal year 1953 and 1954 programs. About one-third of the program will cover end items and the balance will be used for component parts and non-end item devices.

Production "Stretch-out"

"Since it is now the procurement policy of the Air Force to wait until the completion of development production tests, before engaging in large-scale procurement, the net effect may be a 'stretch-out' of production and dollar distribution over actual allocation of funds. This may require industry to reset its production sights over the next couple of years. However, an important factor in electronic procurement is the Air Force replacement program, which will be substantial, and will help sustain production levels.

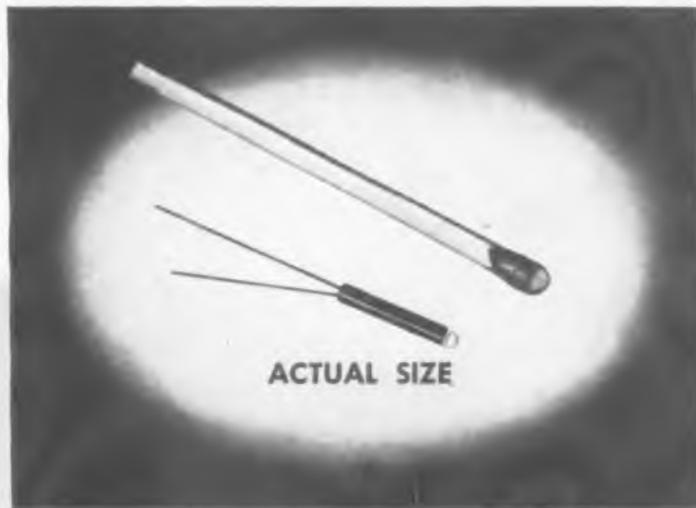
"Due to military operational necessity the Air Force is increasing procurement of fully integrated equipment. Such procurement is furnished through one contractor, instead of several, with this prime contractor having the responsibility for subcontracting.

"It is the Air Force objective to maintain competition in procurement; price will always be an important factor in awarding contracts. However, we recognize that competition on a price basis may weaken engineering support essential to the electronic industry. Therefore, we must consider the engineering put into certain equipment and the importance of the industrial firms possessing this engineering skill in order to maintain an engineering base to meet future Air Force requirements.

"It is not intended to limit procurement to any segment of the industry. The Air Force small business program is as strong as ever."

HIGHLY SENSITIVE...COMPACT IN SIZE!

SYLVANIA PHOTODIODE IN77A



The Sylvania IN77A is a highly sensitive compact junction photodiode.

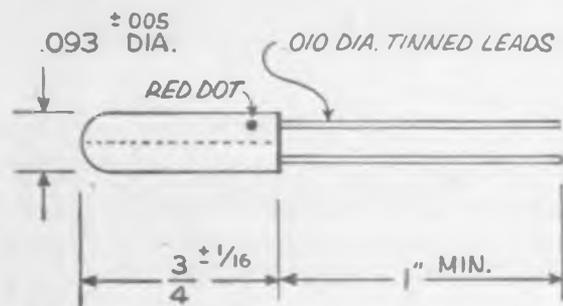
Its useful sensitivity covers the visible spectrum and extends into the infrared region where it peaks at approximately 15,000 Angstrom Units.

Consider these advantages:

- 1 Hermetically sealed in glass.
- 2 Extreme stability in operation.
- 3 Uniformly high sensitivity (8.5 volts min. to 17.0 volts max. across a 100 k-ohm load).
- 4 Low dark current (200 μ A @ -50 volts).

The high sensitivity and compact packaging of the IN77A should provide the answer to many light-sensing application problems. *Still more reasons why it pays to specify Sylvania.*

DETAILED DRAWING



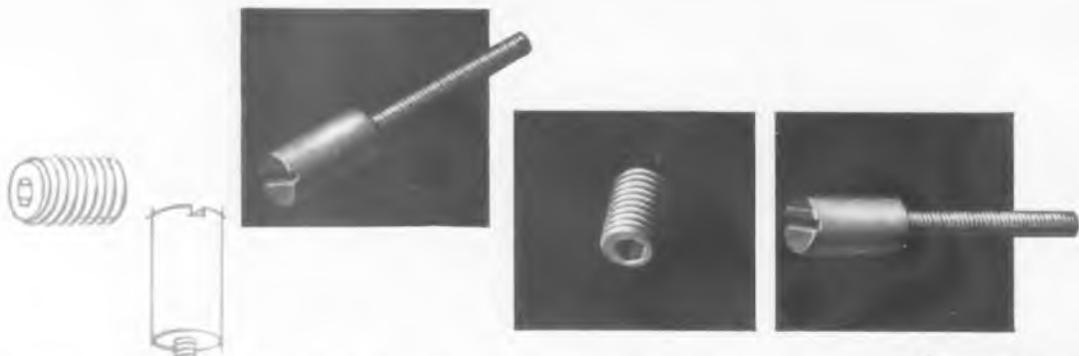
FOR FULL DETAILS about the complete line of Sylvania diodes write to Dept. 4E-4410 at Sylvania.

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



CUT IRON CORE COSTS

with Stackpole "PREFERRED TYPES"

**"EE" SERIES...
FOR
ENGINEERED ECONOMY**

Made to well-known Stackpole quality standards, these new "EE" Cores are available only in commonly needed grades and sizes. They're ready for delivery from stock . . . at low prices . . . and without the usual set-up charge for custom-engineered cores.

Mechanical specifications conform to the latest MPA recommendations. Electrical standards fully meet 8 out of 10 requirements of radio, TV, and communications equipment. Write, wire, or 'phone for details.

Electronic Components Division

STACKPOLE CARBON COMPANY

St. Marys, Pa.

STACKPOLE

New Business Getter

the RCA TV Switcher TS-5A

adds fades, lap-dissolves,
super-positions to spice up
your commercials



The RCA TS-5A Video Switcher is a flexible two-unit equipment designed to mount in a single standard console housing. The push-button and fader panel may be located as illustrated or in the upper face of the console. The TS-5A is designed for color use as well as for monochrome.

You are invited to ask your RCA Broadcast Sales Representative concerning the application of the TS-5A to your specific requirements, or write Dept. J-119 RCA Engineering Products Division, Camden, N. J.

A MUST FOR YOUR TC-4A!

RCA's new TS-5A Video Switcher will give increased flexibility to your programming. If yours is a "Basic Buy" switching layout, where video control functions are centered around the TC-4A Audio/Video Switching Console, the TS-5A will supplement your present equipment, greatly enhance the versatility of your station, give new spontaneity to your commercials.

5 EXTRA INPUTS PLUS "REHEARSAL"

FOR YOUR TS-10A!

If your station already includes the TS-10A Studio Switcher and you need to provide for more inputs and rehearsal facilities—the TS-5A Switcher is the ideal answer. A typical arrangement of these two equipments will provide for independent studio rehearsal plus 5 extra inputs.

HANDY AS AN INDEPENDENT SWITCHER!

The TS-5A also may be used for independent switching systems where maximum program flexibility and economy are desired. The TS-5A can be conveniently mounted in a standard console housing adjacent to other console control units.



RCA Pioneered and Developed Compatible Color Television

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DIVISION

CAMDEN, N. J.

THE SOLUTION...

...to your R-F noise suppression problem

AEROVOX

R-F noise suppression

FILTERS*

Ideal for R-F noise suppression in military and commercial aircraft, vehicular low-voltage DC applications, and for special usages such as shield rooms and critical equipment. Maximum reliability. High attenuation. High current ratings. Still smaller hermetically-sealed metal-case housings. Advanced pi-type construction for greatest efficiency. Definitely the solution to your R-F noise suppression problem.

FEATURING...

- Aerolite¹ metallized-paper sections provide maximum reliability and life factors.
- Unique "fault-isolation" characteristic offers added protection against surge voltages.
- High attenuation of R-F currents. Maximum attenuation available, from .15 mc to 400 mc.
- Low DC resistance assures minimum heating and low voltage drop.
- Operating temperature range from -55°C to $+85^{\circ}\text{C}$. At full rating (150 v.d.c.), operating temperature range is from -55°C to $+70^{\circ}\text{C}$. All units rated for continuous duty.
- Test voltage for all units, 200 v.d.c. at room temperature for period not exceeding 1 minute.
- Case construction of non-magnetic metal suitably protected for severest service requirements.
- Available with special terminals, special mountings and other special considerations for specific needs.

*WRITE FOR LITERATURE. Screen-room filters also available with extra-high attenuation (120 db) for AC and DC applications. Send us your R-F noise-suppression problem.



†trade-mark

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. JOMBER ADDRESS 740 Belleville Ave. New Bedford Mass. Export: Ad. Auriema, Inc., 89 Broad St., New York, N. Y. • Cable: Auriema, N. Y.

INDUSTRY NEWS

Theodore Rossman of Pentron Corp., Chicago, is the new chairman of the Association of Electronic Parts & Equipment Mfrs., a trade group consisting of 118 electronics firms in the midwest. Also elected were Wilfred L. Larson of Switchcraft to vice chairman, Helen Staniland Quam of Quam-Nichols to treasurer (for the 18th term) and Kenneth C. Prince to executive secretary.

Sig Mickelson has been named vice-president of Columbia Broadcasting System, Inc., in charge of CBS News and Public Affairs. Mr. Mickelson is a former president of the Nat'l Assoc. of Radio News Directors.

Frederick I. Kantor has been appointed nat'l sales mgr. of Electro-Magnetic Products Div., Technical Tape Corp., Morris Heights, N.Y. Mr. Kantor is responsible for sales development of "Encore" Sound Recording Tapes.



F. I. Kantor

Wynne E. Stewart has been appointed district sales mgr. for Dage Television Division of Thompson Products, Beech Grove, Ind., and John W. Mullen has been named Eastern district mgr. Mr. Stewart will head Dage bdcst. equipment sales in Southeastern U. S., while Mr. Mullen will direct Eastern sales of TV broadcast and microwave equipment.

LeRoy J. Kallmeyer has become export sales mgr. of the Export Dept. of International Standard Electric Corp., the overseas mfg. and sales subsidiary of I.T.&T. Mr. Kallmeyer has been with I.T.&T. since 1928.

Dr. Ralph A. Schaefer, v.p. and materials development director of Clevite-Brush Development Co., has been elected Supreme President of American Electroplaters' Society.

John M. Otter has been elected executive vice-president of Philco Corp., Mr. Otter has been with Philco since 1926, and was elected to the Board of Directors in 1950.

(Continued on page 38)



Immortalizing the instrument...



For the "Instrument of the Immortals" ... all great instruments and voices, there are now magnetic recording tapes of matching quality. They are Soundcraft Tapes, created by engineers with the maximum of recording experience.

We believe them to be the world's finest tapes, because Soundcraft Tapes *alone* combine:

- Constant depth oxide for uniform middle- and low-frequency response.
- Micro-Polished[®] coating, a patented Soundcraft process that eliminates unnecessary head wear and gives uniform high-frequency response right from the start.

- Pre-Coated adhesive applied directly to base — anchors oxide, no flaking, cracking.
- Surface-lubrication on *both* sides! No friction, no chatter, no squeal.
- Chemical balance throughout to prevent cupping, curling, peeling, chipping.
- Uniform output of $\pm \frac{1}{4}$ db. within a reel, $\pm \frac{1}{2}$ db. reel-to-reel.

SOUNDCRAFT TAPES FOR EVERY PURPOSE

Soundcraft Red Diamond Tape for all high-fidelity recording.

Soundcraft Professional Tape for radio, TV and recording studios. Splice-free up to 2400 feet. Standard or professional hubs.

Soundcraft LIFETIME[®] Tape for priceless recordings. For rigorous use. For perfect program timing. DuPont "Mylar" Polyester Plastic base. A third as strong as steel. Store it anywhere. Guaranteed for a lifetime!

Get the Soundcraft Recording Tape *you* need today. Your dealer has it.

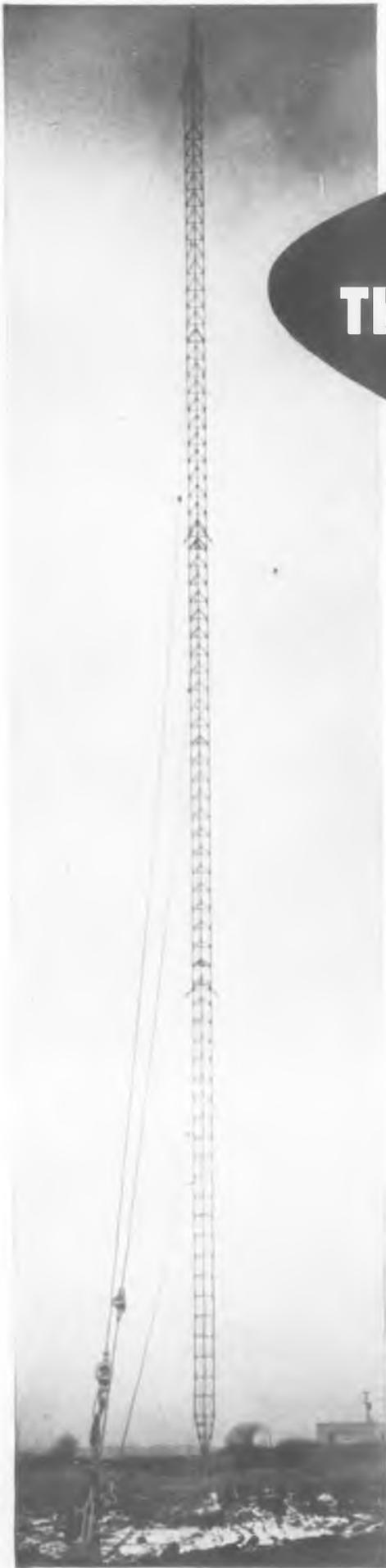
REEVES
SOUNDCRAFT
CORP. N10

10 East 52nd St., N. Y. 22, N. Y.

FOR EVERY SOUND REASON



THE WORLD'S FINEST TAPES...YET THEY COST NO MORE



ANOTHER TRUSCON THOUSAND FOOTER GOES ON THE AIR

● Truscon builds them tall! Latest Truscon tower of strength to lift an antenna over the thousand foot mark now is on the air for WFMJ-TV in Youngstown. This Truscon triangular uniform guyed tower mounts an RCA antenna.

Your own tower requirements will be in well-qualified hands when you call on Truscon. Truscon knows towers. Truscon has engineered and constructed many hundreds of towers that now stand strong and tall in all parts of the world, in all kinds of wind and weather.

Truscon will build your towers tall or small . . . guyed or self-supporting . . . tapered or uniform in cross section . . . for AM, FM, TV, and Microwave transmission. Your phone call or letter to any Truscon district office or to "tower headquarters" in Youngstown will get your tower program started without delay.

TRUSCON®



TRUSCON STEEL DIVISION

REPUBLIC STEEL CORPORATION

1092 Albert Street • Youngstown 1, Ohio
Export Dept.: Chrysler Bldg., New York 17, N. Y.

a name you can build on



NOW

172 SERIES

a true HERMETIC SEAL connector

built-in "shock absorber!"

Thousands of tiny air bubbles act as an effective shock absorber in the improved glass seal of the new 172 series of Hermetic Seal Receptacles! Under a new manufacturing procedure which at last provides the electronics industry with a tough leak-proof hermetic connector, "hard" glass is heated to around 1800°F and cooled under compression. The glass assumes a cellular structure which has a leakage rate of zero and a strength which will withstand thousands of pounds of pressure per square inch!

corrosion-resistant surface!

A sealing treatment of the electro tin-plated shells of the 172 series receptacles gives them a surface which will resist salt-spray for a period of 100 hours! This sealing treatment also offers an excellent soldering surface. Connectors are available in individual glass contact bead and complete glass insert bead. They mate with standard AN plugs with female inserts.



complete glass insert bead



individual glass contact bead

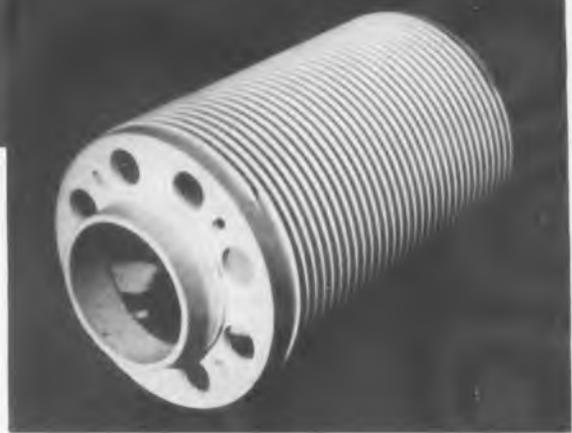
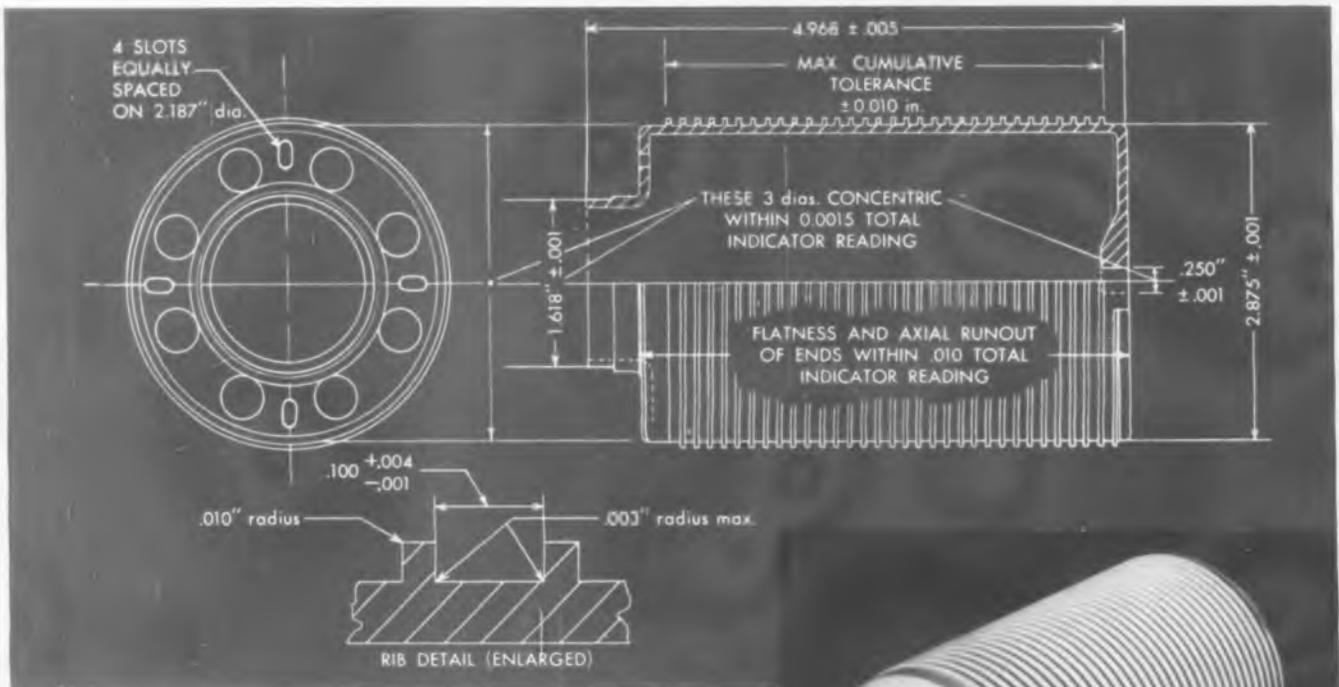


For more information on the 172 series of Hermetic Seal Receptacles write and request Amform 2399

AMERICAN PHENOLIC CORPORATION
chicago 50, illinois

In Canada:
AMPHENOL CANADA LIMITED

AMPHENOL



This coil form is made from vitrified alumina. Threads and other surfaces are ground after firing. Some of the critical dimensions and tolerances are given in the drawing above.

Stupakoff

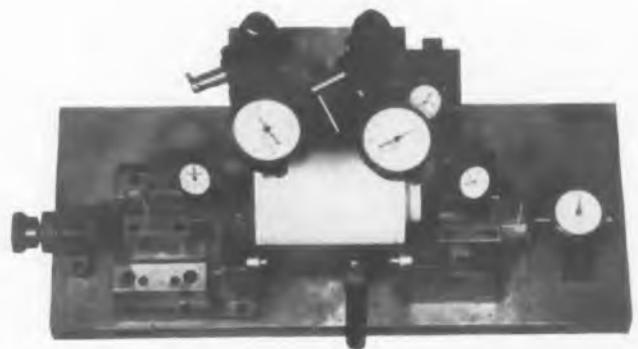
CLOSE-TOLERANCE Manufacture

SOLVES CRITICAL COIL-FORM PROBLEM

The ability of Stupakoff to make ceramic parts of exceptional dimensional accuracy solved a critical problem for the Stewart-Warner Corporation. The antenna tuning coil-form illustrated is part of a mobile radio transmitter. The tuning coil—a silver ribbon—is wound between the ribs of the threaded portion, the accuracy of which maintains the proper spacing and number of the coil turns necessary for precise tuning of the antenna to any one of many wave lengths. The close tolerances to which these and other key dimensions are held assure precise assembly of the part in the transmitter and its smooth functioning in operation.

For many years, Stupakoff has specialized in the manufacture of precision ceramic parts—meeting close specifications not only in dimensions, but also in body composition. Our facilities include large, well-equipped laboratories, modern precision production machinery and an experienced staff of quality-conscious technicians.

If precision-made ceramic parts can reduce your costs or improve your products, Stupakoff has the skill, experience and facilities to produce them in the quantity and dependable high quality you require.



Specially designed gauge, providing direct readings in ten-thousandths of an inch, checks every coil form for critical dimensions, concentricity, flatness, and axial runout.

Stupakoff

CERAMIC & MANUFACTURING COMPANY
 LATROBE, PENNSYLVANIA Dept. TT
 DIVISION OF THE CARBORUNDUM COMPANY



SPECIAL DESIGN TOWER

takes wave guide for UHF antenna

To operate on channel 41 at 269,000 watts, WROW-TV, Albany, New York, needed a wave guide to feed their UHF-TV antenna. And this required a special design tower to take the wave guide.

The result was a triangular Blaw-Knox Type TG-3 Tower as the basic design. Plus a number of major modifications to provide for the 7½" x 15" wave guide inside the tower. An inside climbing ladder permits easy inspection and maintenance of the wave guide for its entire length.

The tower has a number of features which enable it to carry heavy loads and yet withstand tremendous wind pressures. For instance, double laced structural angle bracing provides extra strong, rigid construction . . . pivoted or articulated base

avoids excessive bending stresses . . . factory pre-stressed guys are proof tested to a load greater than ever required in service . . . and hot-dip galvanized coating protects against all weather conditions.

This 700 foot tower for WROW-TV is another typical illustration of the flexibility of Blaw-Knox design and construction which is readily available to you.

For further information on the many types of Blaw-Knox Antenna Towers, write for your copy of Bulletin No. 2417. Or, for prompt service send us your inquiry, specifying height of tower and type of antenna.

BLAW-KNOX COMPANY

BLAW-KNOX EQUIPMENT DIVISION • TOWER DEPARTMENT
PITTSBURGH 38, PENNSYLVANIA



ANTENNA TOWERS

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



Detail showing wave guide as it leaves the tower.

Note sturdy angle supports for both wave guide and ladder.



ALTEC LANSING MICROPHONES

... *The best for every use!*

ALTEC LANSING manufactures a wide range of microphones to cover every sound need. Each microphone is the product of finest design, engineering skill and superior workmanship.

Whatever your microphone requirements, there is an Altec Lansing microphone to serve you best.

639

The finest directional cardioid microphone using both ribbon and dynamic elements. Used for highest quality when extraneous noises must be eliminated. Frequency response: 30-12,000 cycles.



633

The famous "salt shaker" dynamic microphone which has long been a popular choice for general studio and field use. Frequency response: 30-15,000 cycles.



670A

A broadcast quality cardioid microphone that delivers highest performance at moderate cost. Small, rugged, light in weight. Average discrimination 18 db. Selection of various pickup patterns. Frequency response: 30-15,000 cycles.



660

An economical version of the famous Western Electric salt shaker, using the same efficient dynamic unit in a smaller case. Frequency response: 35-15,000 cycles.



671A

A compact velocity microphone of outstanding quality and ruggedness. Frequency response: 30-15,000 cycles.



632C

A close talking dynamic microphone with a rising frequency characteristic for voice use only. Provides maximum intelligibility for difficult PA and paging installations.



M-20

The Altec Lipstick Microphone System which provides a lipstick size housing for the famous model 21 condenser microphone. Smoothest frequency response and greatest range on the market: 10-15,000 cycles.



M-11

The popular M-11 Microphone System using the model 21 condenser microphone is still available to those who prefer the graceful shape of the 150A base to the compactness of the Lipstick. Frequency response: 10-15,000 cycles.



ALTEC
LANSING CORPORATION

A Sound Reputation Second to None

9356 Santa Monica Blvd., Beverly Hills, Calif.
161 Sixth Avenue, New York 13, N. Y.



(Continued from page 32)

Mrs. Azilda Nielsen has been elected president of Best Mfg. Co., 1200 Grove St., Irvington, N.J., and its associates, Sampson Electric Products Co., Clinton, N.C., Fidelity Products Co., Inc., South Orange, N.J., and Best Realty, Irvington, N.J. Mrs. Nielsen is the wife of the late deceased president of the firm, which manufactures loud speakers and radio and TV components.

Stanley H. Manson has been appointed to the newly-created position of Director of Public Relations of the Stromberg-Carlson Co. David S. Cook has assumed Manson's former position as advertising manager of the Radio-TV division.

Allan G. Williams has been appointed manager of marketing administration at Motorola Inc.



V. A. Lee

Vernon A. Lee has assumed the post of manager of the new Industrial Prods. Div. of Sessions Clock Co. Also appointed to posts in the new division were Harlan L. Reycroft, field sales mgr., and Knowlton H. White, Sales Engineer.

Francis T. Eddy, formerly ass't superintendent of Waterbury Mfg. Co., has been named assistant mgr. of Technicraft Labs., Inc., Thomaston, Conn., and will direct sales, purchasing and factory engineering.

James Vrungos has been named manager of government contracts for Electronic Control Systems, Inc. of Los Angeles. Prior to this Mr. Vrungos was on the Customer Relations staff at Hughes Aircraft Co.

William M. Cagney has joined Pye Limited, Cambridge, England, as regional supervisor for Pye companies in the U.S. His office will be located at 200 Fifth Ave., New York.

(Continued on page 166)

FASTEST THING IN FASTENINGS®



SPEED NUTS turn up speaker "volume" with 51% time saving!



Heavy demand for the new Ezell Stereophonic Sound Speaker made it necessary for the Lone Star Plastics Company, Inc., Fort Worth, to find production short cuts. Produced for the Bishop-Green Manufacturing Company, Dallas, this in-a-car speaker for drive-in theatres was assembled with 15 SPEED NUT brand fasteners. The result: faster, easier assembly with savings of 51% in time, 34% in material costs!

Push-On type SPEED NUTS are used in the installation of the three speakers, handle and hanger wire. These one-piece fasteners eliminate costly threaded parts, are self-locking to provide a bite-lock on smoothest, hardest surfaces. Tubular type SPEED CLIPS fasten the speaker case to its base. They snap in place by hand, are self-retained in stud-receiving position.

Chances are similar SPEED NUT savings can be made in your own product assemblies. Call your Tinnerman representative for complete details!



PUSH-ON SPEED NUT



TUBULAR SPEED CLIP

The use of SPEED NUT brand fasteners results in substantial savings in assembly time, cost of materials, and materials handling. For example, SPEED NUTS eliminate costly threaded inserts, make faster, easier attachments in blind locations and permit greater design flexibility. A complete range of types and sizes available.

Send for your copy of SPEED NUT "Savings Stories," and descriptive literature on the above fasteners. TINNERMAN PRODUCTS, INC., Box 6688, Dept. 12, Cleveland 1, Ohio. In Canada: Dominion Fasteners Ltd., Hamilton, Ontario. In Great Britain: Simmonds Aerocessories, Ltd., Treforest, Wales. In France: Aerocessoires Simmonds, S.A.—7 rue Henri Barbusse, Levallois (Seine).



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POPULAR MILITARY TYPES ILLUSTRATED.

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Most controls available with switches and in concentric shaft tandems or with two controls operating on one shaft. Also available with locking bushing, water sealed bearing and many other special features not illustrated.

Immediate delivery from stock on many JAN-R-94, JAN-R-19 and other types.



WRITE FOR ILLUSTRATED CATALOG—
Describes Electrical and Mechanical characteristics, Special Features and Constructions of a complete line of variable resistors for military and civilian use. Includes dimensional drawings of each resistor

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1/2 watt 70°C, 3/4" diameter miniaturized variable composition resistor.

1 watt 70°C, 15/16" diameter variable composition resistor.

Meets JAN-R-94 type RV4
2 watt 70°C, 1-1/8" diameter variable composition resistor. Also available with other special military features not covered by JAN-R-94.

TYPE 65 (Miniaturized)



TYPE 90



TYPE 95



TYPE C90-65 Tandem



TYPE GC-90 With Switch



TYPE GC-95 With Switch



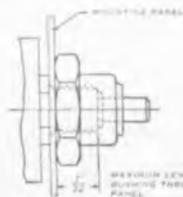
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Types 65, 90 and 95 are specially designed for military equipments subject to extreme temperature and humidity ranges: -55 C to +150 C . . . aridity to saturation.

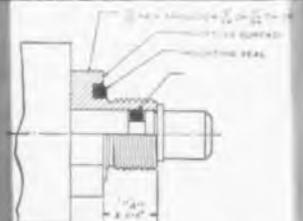
TYPE C2-90 Tandem



TYPE C2-95 Tandem



WATER SEALED MOUNTING AND BEARING FOR TYPE 65



WATER SEALED MOUNTING AND BEARING FOR TYPES 45, 35, 90, 95, 25, 252.

RESISTORS... FOR EVERY NEED

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1/2 watt 1-1/8" diameter variable composition resistor. Also available with other special military features not covered by JAN-R-94.

TYPE 35



Meets JAN-R-93
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TYPE 45



Meets JAN-R-19
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4 watt 1-17/32" diameter variable wirewound resistor. Also available with other special military features not covered by JAN-R-19.

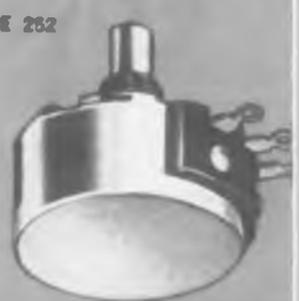
TYPE 25



Meets JAN-R-19
type RA20

2 watt 1-17/64" diameter variable wirewound resistor. Also available with other special military features not covered by JAN-R-19.

TYPE 252



TYPE GC-35
With Switch



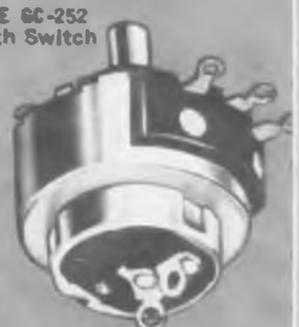
TYPE GC-45
With Switch



TYPE GC-25
With Switch



TYPE GC-252
With Switch



TYPE C2-35
Tandem



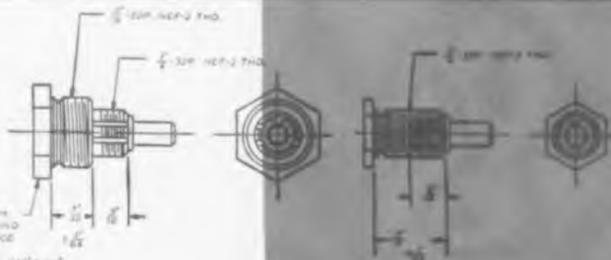
TYPE C2-45
Tandem



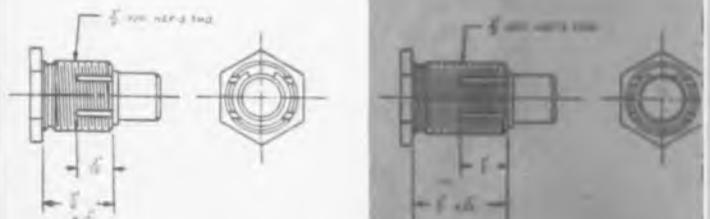
TYPE C2-25
Tandem



TYPE C2-252
Tandem



LOCKING BUSHINGS FOR TYPE 65 CONTROL



LOCKING BUSHINGS FOR CONTROL TYPES 25, 252, 95, 35, 90, 46

Specialists in Precision Mass Production of Variable Resistors • Founded 1896

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Model 985 Calibrator—\$199.50



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Representing an entirely new approach in test equipment design and operation, the 980 Line instruments have brought new *simplicity* and new *time-saving facility* to TV receiver alignment and servicing. Now available to TV technicians through leading distributors. Literature giving complete information on request. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.

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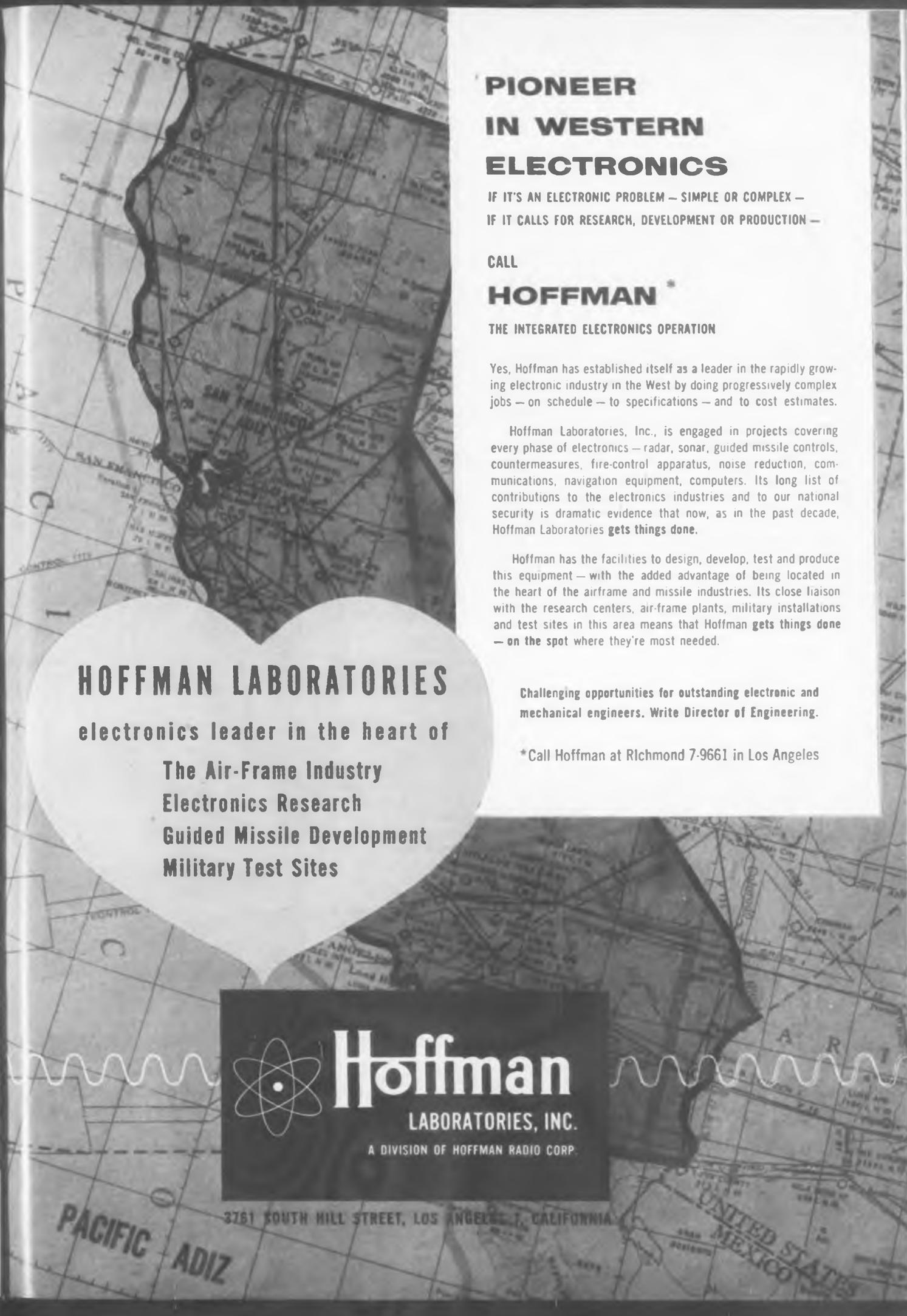
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Model 981 Tubechecker—\$199.50



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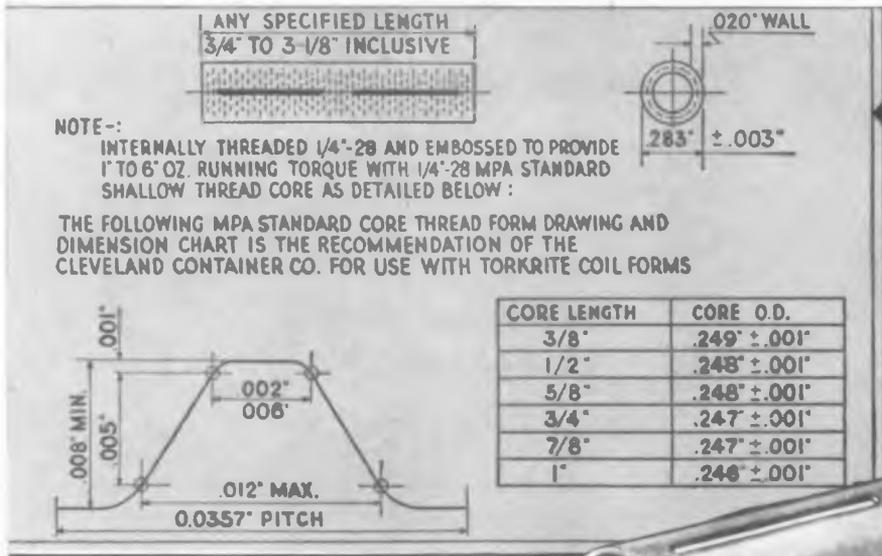


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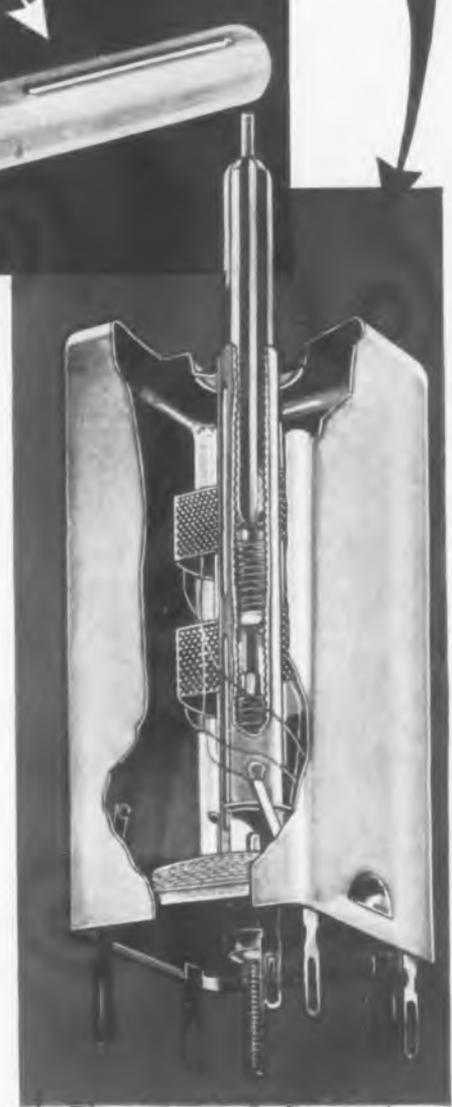
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BY THE MAKERS OF CLEVELITE® PHENOLIC TUBING.

Torakrite coil forms eliminate torque and stripping problems and are rapidly replacing other coil forms because Torakrite:

- withstands more than required stripping pressure.
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- recycling ability is unmatched.
- is stronger mechanically because of heavier wall.
- provides 1-6" oz. running torque when used with MPA standard shallow thread core.
- has no holes or perforations thru tube wall which eliminates cement leakage locking cores.
- has smooth adjustment of core without lubricant.
- torque increases less after winding as heavier wall reduces any tendency to collapse and bind core.
- maximum stability results as core cannot move in relation to winding after peaking as it is engaged in internal threads.
- embossings are evenly spaced, with a lead at each end of the form to permit easy insertion of core.



Why pay more? For good Quality . . . Call CLEVELAND!

INVESTIGATE this outstanding coil form.

* Reg. U. S. Pat. Off.

★ ★ ★
Improved new Torakrite is now available in various diameter tubes. Lengths from 3/4" to 3-1/8" are made to fit 8-32, 10-32, 1-4-28 and 5/16-24 cores.

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NEW



VIDEO TRANSMISSION TEST EQUIPMENT



1041-BR STAIR STEP GENERATOR (Variable)
Checks linearity and grey scale output relationship in linear or non-linear system. Built-in color carrier generator may be added to steps. Back porch burst allows lock-in to 3.58 MC color equipment.



1071-AM WINDOW GENERATOR (Variable)
Determines ringing, smears, steps, low frequency tilt, phase shift, mismatched terminations, etc. in TV signals or systems.



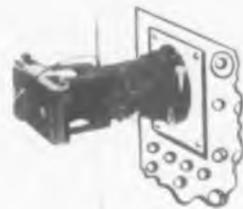
1070-BR MULTI-BURST FREQUENCY GENERATOR (13 freq. selectable from .5 to 6 MC)
Checks wide band coaxial cables, microwave links, individual units, and complete TV systems for frequency response characteristics. Produces six frequencies simultaneously plus white bar reference. Switchable color burst on back porch.



- AUTOMATIC FREQUENCY CONTROL 304AR
- COMPOSITE SYNCH GENERATOR 303BR
- STAIR-STEP GENERATOR
- WINDOW GENERATOR
- MULTI-BURST FREQUENCY GENERATOR
- REGULATED POWER SUPPLY 512AR
- REGULATED POWER SUPPLY 613BR

New Telechrome equipment designed to provide test signals for precise checking of video facilities.

This equipment is now in use by major networks, TV stations, and the Bell Telephone System. This type of equipment was recently described by H. Gronberg of NBC before the NARTB Engineering Conference in Chicago. These units are available individually or as an integrated system with 75 ohm or 110 ohm balanced output.



OSCILLOSCOPE CAMERA
MODEL 1521-A (Polaroid Land Type)

for instantaneous 1-to-1 ratio photo-recording of these or other test signals.

MODEL 608-A HI-LO CROSS FILTER
MODEL 524-D OSCILLOSCOPE



Chromalyzer



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Phase Slope
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Curve Tracer



Full facilities
Transmits,
receives,
monitors,
analyzes
composite
color pictures

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with a
DIRECT READING

HYCON DIGITAL

VTVM

MODEL 615



ILLUMINATED DECIMAL POINT
AND POLARITY SIGN

\$374.50

The Model 615 VTVM is a precision instrument — functional in design . . . professional in appearance.

The direct-reading digital display eliminates most interpolation error — shortens costly "learning curve" in factory and assembly line inspection.

Other features — never before offered in an instrument of comparable price — include 1% accuracy (DC and ohms), and 1 millivolt sensitivity. Inspect the Model 615 at your Electronic Parts Jobber's. You'll agree the new standard is Hycon . . . "where accuracy counts."

- 12 RANGES: AC, DC, OHMS • AC FREQUENCY RESPONSE TO 250 MC (with auxiliary probes) • OVERLOAD PROTECTION
- LIGHTWEIGHT, STURDY STEEL CASE • PROVISIONS FOR BENCH STACKING

The Model 615 VTVM is one of a matching set of precision test instruments, which includes the Model 617 Oscilloscope (designed for color TV) and the Model 614 Standard VTVM.



Service facilities in your area.

Hycon Mfg. Company

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"Where Accuracy Counts"

TELE-TIPS

RENTING expensive electronic test equipment may develop into a new trend, particularly for small companies unable to lay out much investment capital. A rental plan recently instituted by Polarad Electronic Corp., which also includes a purchase option, enables a firm to rent a \$7000 instrument for as little as \$400 per month. Other advantages include current expenditure tax deduction, direct charge to specific government contract, and no ceiling limitation on fixed assets acquisition.

ELECTRONIC BARTENDER is another ingenious application of remote radio control. A retired British farmer who loves his leisure has rigged up a barrel-in-a-barrel device named Nellie which rolls out of his cottage to his chair on the lawn when called by the chairside 465 mc transmitter. The inner barrel contains some 70 gallons of beer; the outer one does the rolling, even up steep hills, but she hasn't mastered stairs yet. Nellie even pours the drink. The inventor believes Nellie's the most important invention since the bottle opener.

POPULAR HUMOR is paying increasing attention to TV. Recent issues of *The New Yorker* magazine carried two cartoons with special appeal. One showed a group of men displaying their brainchild—a monstrous Cinemascope type of TV cabinet—to the president of a manufacturing firm. The boss is pleased with the progress, and remarks that it is now engineering's baby. The second cartoon shows a crowd gathered around the window of a TV dealer displaying a color TV set. Reminiscing on 1946-47, the salesman in the store remarks—Here we go again!

STEAM ROOM, modern variety, is said to have excellent results in improving employee relations. Magnecord reports 17 industrial plants have set up telephone booth type of cubicles in which employees can blow off steam. The telephone is actually connected to a tape recorder. Not only does the outlet for anonymous complaints lift morale, but in many cases management has picked up valuable suggestions.

(Continued on page 48)

Get a head-start in mechanical assembly

Let Hermetic's Vac-tite® Headers
win part of the race for you
with mechanical designs to solve
your problems.

Here are just a few Hermetic Vac-Tite® seals that eliminate extra production operations and save you money!

1. **Unit Header with Studs Attached**—Saves space; shaped to fit enclosure or can; eliminates extra welding and soldering operations.
2. **Weld Seals**—Has the proper projections for leak-tight welds.
3. **Lock-Ring "Safety" Seal**—Simple, sure method for installing headers that is not dependent on solder alone for mechanical security; removable.
4. **Threaded Bushing Seal**—Firm mechanical connection has maximum shock and vibration resistance and adaptability for positioning and adjustment.
5. **Taper Tab Headers & Terminals**—Quick, solderless connections adaptable to many applications.
6. **Terminal Strip**—Pre-mounted terminals offer advantages of a conductive surface for heat dissipation, arc-resistance of glass, one piece assembly.
7. **Attached Bracket Seal**—Supports entire assembly on built-in structural member.

Write for engineering assistance, data, prices

HERMETIC SEAL PRODUCTS CO.

33 South Sixth Street, Newark 7, New Jersey

*VAC-TITE is HERMETIC's exclusive vacuum proof compression construction glass-to-metal seal.

FIRST AND FOREMOST IN MINIATURIZATION

the KEY
to your problems



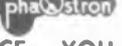
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-  **MIRROR SCALES**
-  **PRICE — YOU CANNOT BUY BETTER**

Inquiries are invited and catalogue sheets are available on this
NEW LINE of CUSTOM INSTRUMENTS which also include 2½" & 3½" sizes.

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48 For product information, use inquiry card on last page.

TELE-TIPS



(Continued from page 46)

ULTRASONICS TESTS TITANIUM—Republic Steel Corp., first steel firm to use the "sound-echo" techniques in testing steel products, now announces extension of these methods to test titanium for existence and location of internal flaws.

X-RAY MICROSCOPE that "looks inside" magnified specimens offers promise of wide application in medicine, biology and industry. New unit developed at GE magnifies up to 1500 diameters. X-ray source measures only one 100,000th of an inch. Electrostatic lenses are used in focusing electrons.

TREND IN FERRITES is toward more intricate tooling and more difficult shapes according to GE spokesman. They are now producing TV flyback transformer cores with round legs. Memory cores for computers, radio antenna cores, and gyrators for microwave tuning equipment are among other products. Current research is directed toward single crystal ferrites.

ELECTRONIC HAND functions more delicately than a human hand at distances ranging from 12 in. to 1000 ft. The new electronic remote positioning system developed by Minneapolis-Honeywell is said to be 100 times more responsive than hydraulic systems used previously to operate remotely located control of reciprocating aircraft or automotive engines during test work.

NAMES NOT NUMBERS—At the Lincoln-Mercury Division, Ford Motor Co., identification badges have been redesigned to display employees names in larger type. Idea, of course, is that people like to be known by name rather than by number.

RADIO COFFEE RESCUER—Coffee Vending Service in Oak Park, Ill. now uses radio telephone to dispatch routemen to vending machines needing emergency service. The new system is reported to save hundreds of dollars monthly in travel costs and maximizes income from each machine.

(Continued on page 52)

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ONE SOURCE TO MEET ALL

YOUR FUSE NEEDS!...



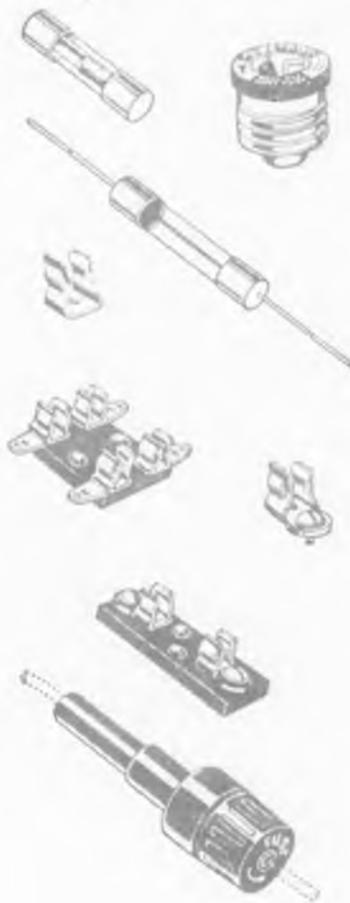
Constant research and engineering over the past 39 years have resulted in a most complete line of BUSS fuses: dual-element (slow blowing), renewable and one time types . . . in any size from 1/500 amperes up — plus a companion line of fuse clips, blocks and holders.

To make sure that BUSS fuses meet the highest standards of dependability . . . every BUSS fuse normally used by the Electronic Industries is tested in a sensitive electronic device that automatically rejects faulty fuses.

Many manufacturers and service organizations have standardized on BUSS fuses to simplify their buying, stock handling and records — and to safeguard their good-will and reputation. You too, will find it good business to let BUSS meet all your fuse needs.

Let BUSS save you engineering time

If you should have a special problem in electrical protection, BUSS places at your service the world's largest fuse research laboratory and its staff of experienced engineers to help you determine the right fuse for the job and if possible, one available in local wholesalers' stocks.



Makers of a complete line of fuses for home, farm, commercial, electronic and industrial use.



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Please send me bulletin SFB containing facts on BUSS
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10 cps to 4 mc



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**VACUUM TUBE
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**Accurate within 2%
to 1 mc**

**Measures 0.1 milli-
volt to 300 volts**

Reads dbm direct

High sensitivity, stability, input impedance

Light, small, portable, dependable

-hp- 400D combines new features never before found in one voltmeter, with time-tested conveniences of the famous *-hp- 400C*.

Frequency coverage is extremely broad—10 cps to 4 mc. A new amplifier provides 56 db of feedback (mid-range) for highest stability and freedom from change by external causes. Input impedance is 10 megohms so circuits under test are not loaded. Coupling and by-pass condensers are sealed; electrolytic condensers are long-life type. Construction is highest quality throughout; circuitry is clean, easy to reach. New compact metal case simplifies handling, occupies less bench space. Front tilts upward for convenient reading angle.

Use the new *-hp- 400D* for measuring amplifier gain, network response, output level, hum and noise, power circuit, broadcast high frequency voltages, as an audio level meter, high gain broad band amplifier, null detector, waveform monitor, and coil "Q" meter. \$225.00.



**-hp- 410B Vacuum Tube
Voltmeter**

Wide range, flat response ± 1 db, 20 cps to 700 mc. Small, convenient, simple to use. Diode probe places approximately 1.5 μmf capacity across circuit under test. This plus 10 megohms shunt impedance (high frequency) means circuits are not disturbed, and true voltage reading are assured. Also measures dc voltage to 1,000 volts and resistances to 500 megohms. \$215.00.



**-hp- 400A Vacuum Tube
Voltmeter**

Direct voltage readings between 10 cps and 1 mc. 30 millivolts sensitivity full scale; accuracy is $\pm 3\%$ to 100 kc, $\pm 5\%$ to 1 mc. Voltage range .005 to 300 volts. Input impedance 9 megohms shunted by 25 μmf . \$185.00.

**-hp- 400B Vacuum Tube
Voltmeter**

For measurements 2 cps to 100 kc. Sensitivity 30 millivolts full scale. Measures voltage .005 to 300 volts, input impedance 9 megohms shunted by 25 μmf . Accuracy $\pm 3\%$ to 100 kc. Usable as stabilized amplifier. \$195.00.



**-hp- 404A Battery-
Operated Voltmeter**

For general voltage measurements where ac power is not available. Compact, portable, splash-proof, ruggedly built. 2 cps to 50 kc, .0005 to 300 volts, impedance 10 megohms with 20 μmf shunt. Ideal for remote broadcast, carrier, strain gauge, telemetering, geophysical work; completely hum free measurements. \$185.00.



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INSTRUMENTS**

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WORKS WHERE OTHER
METHODS FAIL**



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hard, brittle
materials**

**for controlled
removal of
deposited
surface coatings...**



**...for shaping
fragile
crystals**

The "Airbrasive" method has proved successful on many jobs considered to be "impossible" to do by conventional means.

The process—which produces a cutting effect by the impingement of an ultra high-speed stream of finely graded abrasive particles . . . can be used for a variety of precision operations on hard, brittle

materials including cutting, drilling, scribing, film removal and light delicate deburring.

We'll be glad to demonstrate the Unit to you at either our New York or California Office. Or, if you prefer, we'll conduct tests on your samples and advise you as to the suitability of the "Airbrasive" process to your needs.

BULLETIN 5307 has full details on how the "Airbrasive" Unit operates as well as full details on its application and use. Send for a copy.



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DENTAL MFG. CO.**



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NEW YORK 16, N. Y.

Western District Office • Times Building, Long Beach, California

TELE-TIPS

(Continued from page 48)

TRANSISTOR RELIABILITY—According to Dan Noble at Motorola it is now possible to manufacture single frequency, hermetically sealed, transistorized radio receivers that will have reliable performance for ten years or more. Julian Loebenstein at Radio Receptor reports that at MIT's Digital Computer Lab. 450 of their type RR87 have been operating for 2300 hours with no failures. For another 128 units one failure occurred after 4650 hours. He concludes that from a maintenance point of view only one transistor need be replaced after operation for 1,630,200 transistor hours.

SHAKESPEARE had an expression for most situations, and following quotes are what he may have said regarding the various subjects:

DOLLY IN: *The fringed curtains of thine eyes advance.*

ELECTRONIC AGE: *The golden age.*

BURNT INSULATION: *The rankest compound of villanous smell that ever offended nostril.*

PERFORMANCE SPECS: *I shall laugh myself to death.*

ENGINEER PIRATING: *O brave new world, that has such people in't.*

FALL BUSINESS UPSWING: *I have been in such a pickle since I saw you last.*

HOT SOLDERING IRON: *What is't that you took up so gengerly?*

TV VIEWING: *How use doth breed a habit in man!*

NTSC: *Thereby hangs a tale.*

STUDIO LIGHTING: *We burn daylight.*

CONTRACT DEADLINE: *Better three hours too soon than a minute too late.*

VOICE OF AMERICA: *I'll tell the world!*

IMPENDING MERGER: *There's something in the wind.*

JOB OFFER: *Bait the hook well: this fish will bite.*

(Continued on page 56)



Invites you to **COMPARE BENEFIT** **SAVE!**

COMPARATIVE REPORT PROVES S-E'S LOWER OPERATING COSTS AND TOP PERFORMANCE...

As compared to comparable Transmitter "B"...

1. INVESTMENT SAVINGS \$8,844

	10 KW Driver—High Band			50 KW Amplifier—High Band			Total Initial Savings
	Trans. "B"	S-E TH-614	Savings With S-E Equip.	Trans. "B"	S-E TH-654	Savings With S-E Equip.	
Initial Investment	\$89,000	\$85,000.	\$4,000	\$135,000.	\$136,000.	(-\$1,000.)	\$3,000.
Replacement or Spare Tube Cost*	\$ 2,817.	\$ 2,605	\$ 212.	\$ 10,361.	\$ 4,729.	\$5,632.	\$5,844.*

2. OPERATIONAL SAVINGS (5-year basis) \$145,200

		Transmitter "B"—High Band		S-E TH-654—High Band	Net Savings With S-E Equipment
		"Ideal" Life, 5,000 Hours	Est. Field Life, 2,500 Hours	Proven Life, 5,000 Hours †	
Tube Costs	Tube Cost Per Hour	\$2.60/hr.	\$5.20/hr.	\$0.96/hr.	\$4.24/hr.
	5-Year Tube Cost ††	\$78,000	\$156,000	\$28,800.	\$127,200
Power Costs	Power Consumption: Black Picture	234 KW		178 KW	app. 23%
	Average Picture	189.5 KW		143.6 KW	app. 23%
	5-Year Average Power Cost †††	\$72,180		\$54,180.	\$18,000.

3. SPACE SAVINGS and DESIGN ADVANTAGES with S-E equipment

	Transmitter "B"—High Band	S-E TH-654—High Band	Benefit and/or savings With S-E Equipment
Approx. Floor Area Required	852 sq. ft.	702 sq. ft.	150 sq. ft.
Self-Contained	No	Yes	Quick, convenient accessibility to all components; no units away from main cabinet.
Air Cooling	External	Integral	Valuable space saver; keeps construction cost low.
Loading Door Requirements	84" x 32-9/16"	81 3/4" x 33"	Simplified installation; no door removal problem.
Accessibility of Tubes and Meters	Hidden	Visible and accessible from front.	Easy maintenance and checking.
Equipment Weight	23,000 lbs.	27,000 lbs.	Additional weight of S-E equipment from extra heavy frame and components... helps insure more dependable service.
Power Supply	460 V, 3 φ	208/230 V, 3 φ	Requires no special wiring or transformers.

SUMMARY: In your first five years of operation . . . Standard Electronics equipment saves you **\$148,200** **PLUS** THE ADDITIONAL SAVINGS YOU DERIVE FROM S-E SPACE SAVING AND DESIGN ADVANTAGES (CHART # 3).

Get all the facts on the advantages of S-E equipment over Transmitter "B" from your Standard Electronics Sales Engineer. Write to S-E today!



RCA

TECHNICAL NEWS FOR DESIGNERS

FROM THE RCA TUBE DIVISION

TRANSMITTER TYPES—SPECIALLY "TAILORED" FOR MOBILE DESIGNS

For the 450-470 Mc Mobile Band
RCA-6524



RCA-6524 is a new twin-beam power tube well-suited for fixed and mobile UHF design—as a balanced push-pull rf power amplifier or frequency tripler. The tube can deliver 20 watts (approx.) in class C cw and fm services—at 462 Mc! Max. plate dissipation is 25 watts (ICAS). A common cathode for the two units reduces cathode inductance to a negligible value.
Max. length, 3-9/16"
Max. diameter, 1-13/16"

For the 152-174 Mc Mobile Band
RCA-5763



No bigger than your thumb, RCA-5763 fills your need for a compact "miniature" beam power tube capable of taking 13.6 watts input at 175 Mc—in mobile, portable, or fixed services. Useful as a frequency multiplier, oscillator or rf power amplifier. Max. plate voltage as multiplier 300v. Heater voltage, 6.3v. (For 12.6v. heater circuits specify RCA-6417, identical in all but heater characteristics to the 5763.)
Max. length, 2-5/8"
Max. diameter, 7/8"

For the 152-174 Mc Mobile Band
RCA-2E26



RCA-2E26 is a beam power tube well-suited as an rf or af amplifier, frequency multiplier, or oscillator. Max. plate voltage for class C service is 600v. As a class C plate-modulated amplifier, the tube takes 27 watts (ICAS). As a class AB₂ amplifier/modulator, two RCA-2E26's will deliver 54 watts (ICAS) of audio power at a dc plate voltage of only 500v. Heater voltage, 6.3v.
Max. length, 3-21/32"
Max. diameter, 1-5/16"

For the 152-174 Mc Mobile Band
RCA-6146



RCA-6146 is a versatile beam power tube capable of handling 60 watts (ICAS) at 175 Mc at a plate voltage of 400v. Will handle 90 watts input (ICAS) at frequencies up to 60 Mc at plate voltage of 750v. Heater voltage, 6.3v. (For 26.5v. heater circuits, specify RCA-6159, identical in all but heater characteristics to the 6146.)
Max. length, 3-13/16"
Max. diameter, 1-23/32"

For Color-TV—New RCA Color-Bar Generator



RCA WR-61A Color-Bar Generator is designed for testing color-TV receivers and monitors. FOUR crystals—more than any other make—provide the high accuracy necessary for color TV. Generates signals for producing 10 bars of different colors simultaneously (without manual switching) including bars corresponding to R-Y, B-Y, G-Y, I, and Q signals for adjusting phase and matrix circuits in all makes of color receivers... Luminance signals at bar edges for checking color "fit" or registration. Adjustable sub-carrier amplitude for checking color sync action.

Make Your design work Easier



New Fourth Edition of the Radiotron Designer's Handbook puts technical facts right at your fingertips. Only \$7 per copy. Write Commercial Engineering for further information.

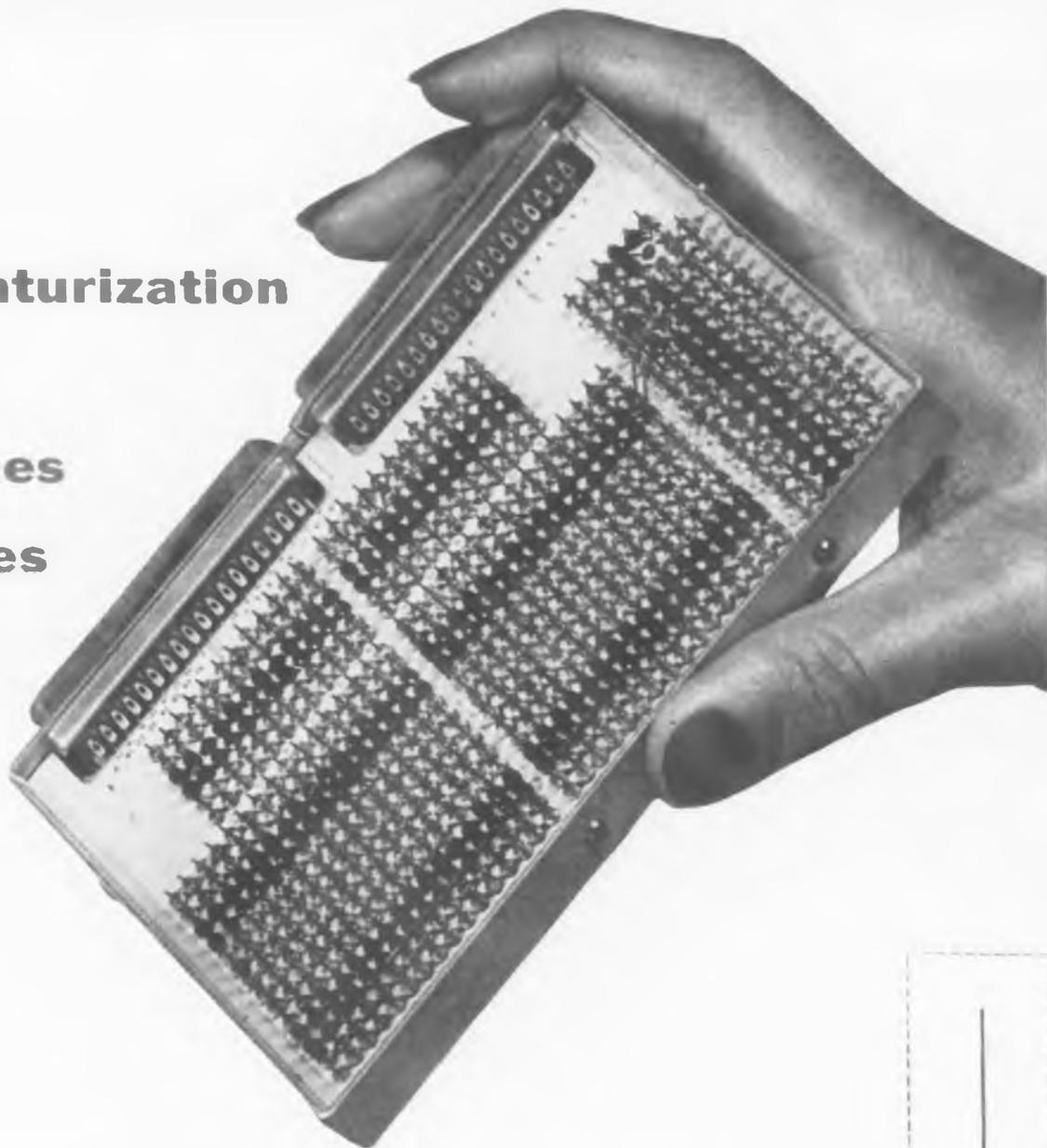
For COMPLETE TECHNICAL DATA, write RCA Commercial Engineering, Section J-50-R, Harrison, N. J.

ELECTRON TUBES • SEMICONDUCTOR DEVICES • BATTERIES • TEST EQUIPMENT • ELECTRONIC COMPONENTS



RADIO CORPORATION of AMERICA
TUBE DIVISION
HARRISON, N. J.

Miniaturization with Hughes Diodes



New computer matrix has high component density

This experimental reading gate matrix for airborne computers effectively utilizes the subminiature size of Hughes Point-Contact Germanium Diodes. Developed by the Miniaturization Group of Hughes Research and Development Laboratories, the unit measures 5 1/4 by 3 7/8 by 1/2 inches (excluding plugs and frame). It contains 504 diodes, 209 resistors. Average component density: 94.5 per cubic inch!*

Frequently, space requirements of conventional wiring techniques will not permit electronic equipment to be miniaturized to the same extent as the components. However, spot-welded connections can effectively reduce wiring space . . . and it is easy to spot-weld the dumet leads of Hughes diodes. There is no adverse effect on diode characteristics, even when the connections are welded close to the diode body. With Hughes

diodes, designers can take full advantage of advanced packaging and wiring techniques.

Hughes diodes are easy to mount in conventional assemblies or in subminiature equipment. In service, these diodes have earned a reputation for reliable performance and stability under severe operating conditions. Make your selection from the many standard and special types available — all listed and described in our new Bulletin, SP-2A.



*Actual size, diode body 0.265 by 0.130 (incom. maximum)

Reprints of a paper describing the packaging techniques of the subminiature matrix are available, too. Your copy will be sent promptly on request.

Hughes

SEMICONDUCTOR SALES DEPARTMENT

Aircraft Company, Culver City, Calif.



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another Raypar first

HIGH VOLTAGE TUBE SOCKETS*



for 1X2 type tubes



for 1B3 type tubes

*patent applied for

- For 30,000 Volt OPERATION.
- Underwriters Laboratories approved.
- Molded of shock-proof, mica-filled phenolic.
- Ample room for built-in network.
- Simple, easy feed-thru of high voltage leads eliminates chassis grommets.
- Available with or without corona ring.
- For low voltage operation, these tube sockets can be molded of economical paper resin phenolics.
- Socket can be supplied for elevated or submerged mounting.

for further information, write today

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TELE-TIPS



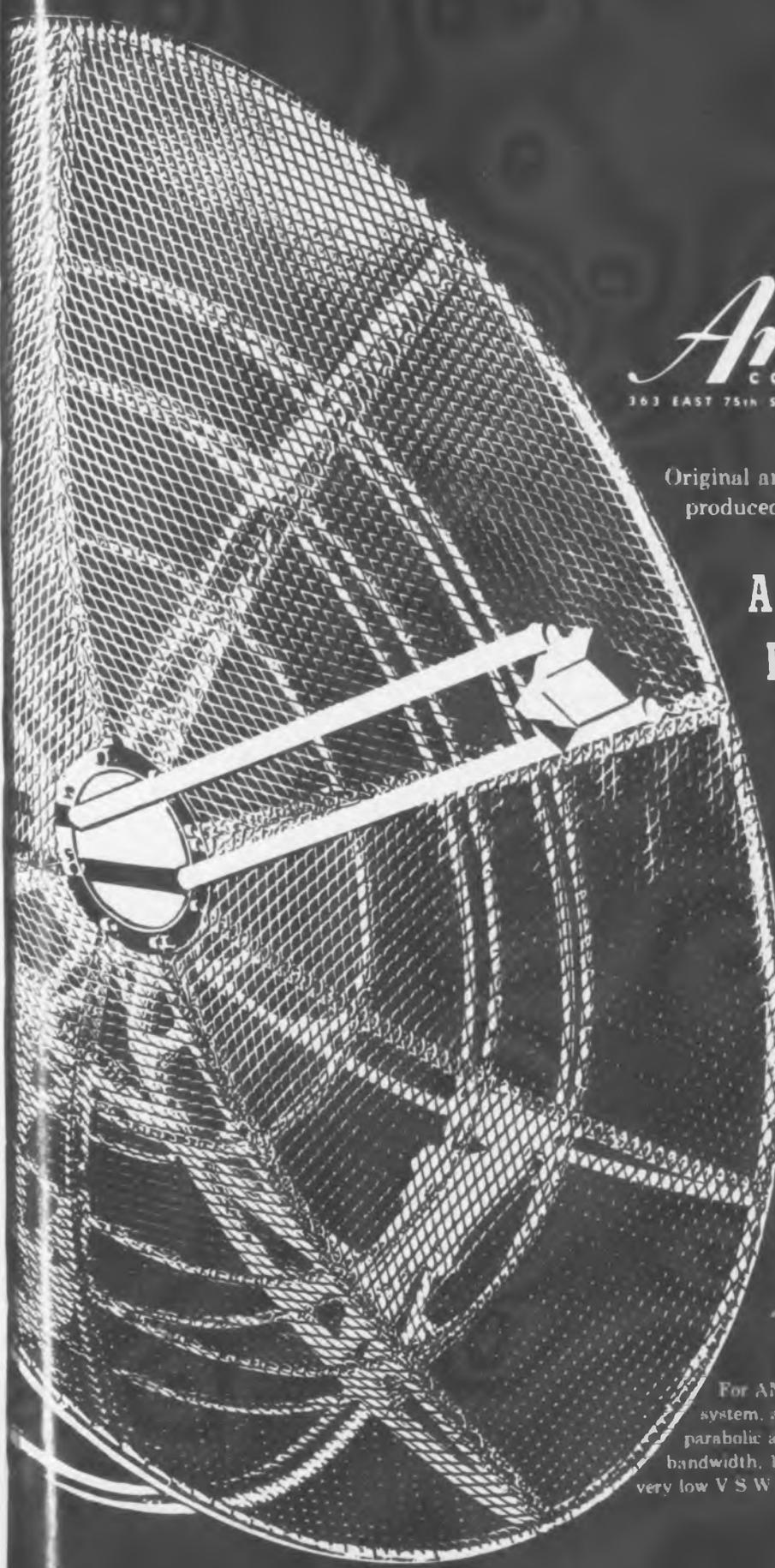
(Continued from page 52)

SHREWD SCHEME by horserace hustlers using concealed radio transmitters, which was described in last month's *Tele-Tips*, made several readers recall an earlier beat-the-bookie racket. It happened back in the late 1930's, when TV was still a glint in some engineer's eye. Seems that a few hundred experimental TV receivers were sold below cost and set up in a town not too far from New York City. The hustlers would simply view the horserace on TV, and lay a bet on the winner before the bookie knew the race was over.

"BERTH CONTROL" is among the many applications of tiny pressure-actuated switches. In Pullman trains the switch automatically dowses the night light and shuts off the fan and heater when the porter puts up the empty beds. An ingenious father whose son is addicted to sleep-walking has installed one of these switches in Junior's bed, according to Minneapolis-Honeywell. Removal of the boy's weight from the bed when he goes on a nocturnal expedition closes the switch, and sets off an alarm in the parents' room.

TV COLLEGE DEGREES are on the horizon. On Sept. 27, WQED in Pittsburgh went on the air with courses that lead to high school diplomas, college entrance or both. Present series of eighteen weekly half-hour telecasts include English, Algebra, History and Physics. Course costs \$5 with privilege of taking final examination for credit. WQED is non-commercial station on the air since April 1, 1954.

TV IN AFRICA is now a reality with the recent opening of a commercial station in Casablanca, chief seaport of French Morocco. Arno G. Huth, in his World Wide Special Report on this subject, points to a familiar pattern in establishing foreign TV stations. Private enterprise will succeed while government sponsored projects lie dormant and in many cases become hopelessly snarled by red tape, lobbying etc. African viewers pay 3000 francs (\$8.50) annual license fee on home receivers or 5000 francs (\$14) on receivers in public places.



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CORPORATION
363 EAST 75th STREET - CHICAGO 19

Original antenna system specially
produced for the Military

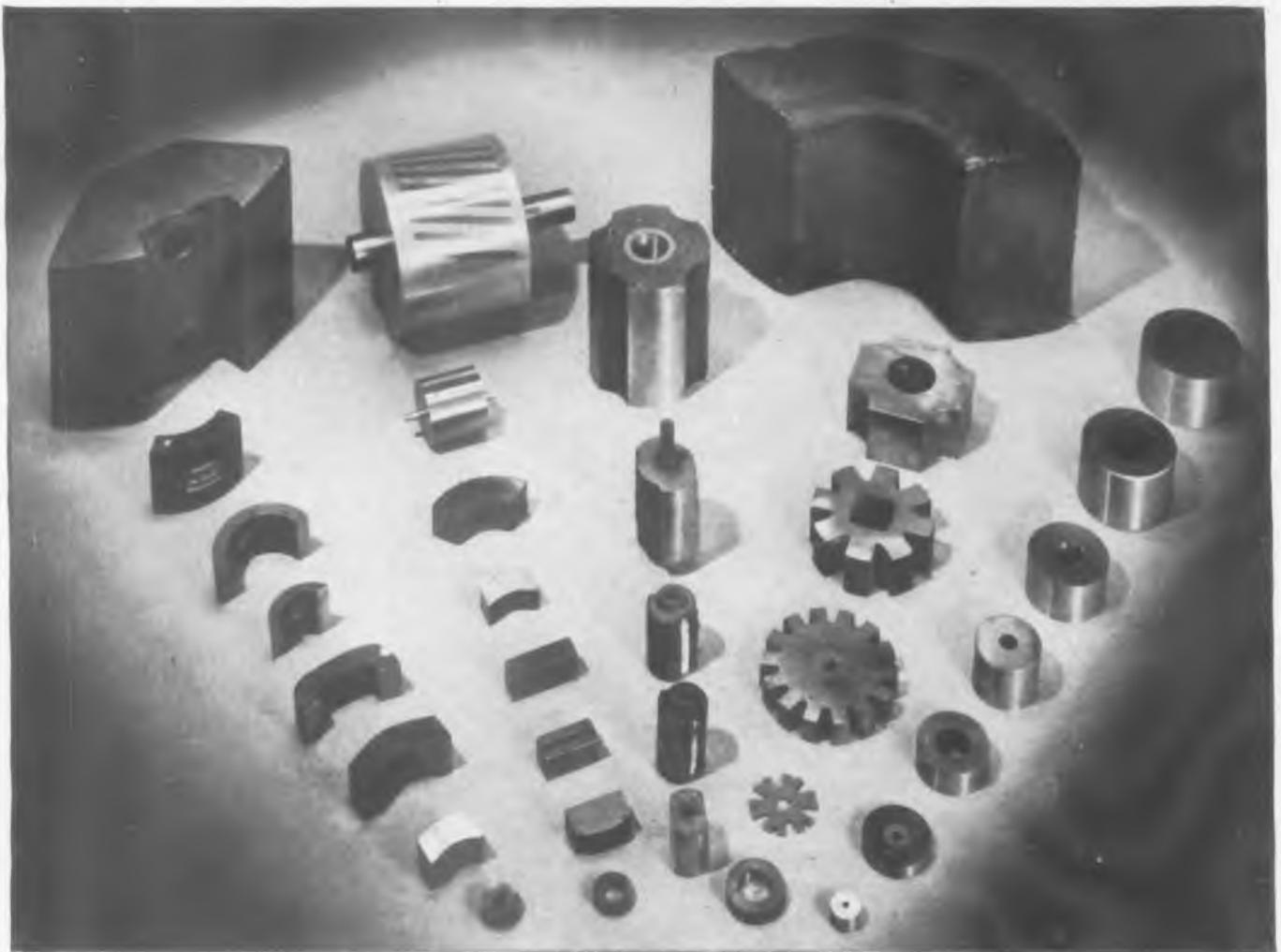
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manufacture of complete antenna
systems for communications
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coaxial cables and rigid
transmission lines.



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bandwidth, 1700-2400 MC,
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Magnets for rotors or stators ...any design or size you may require



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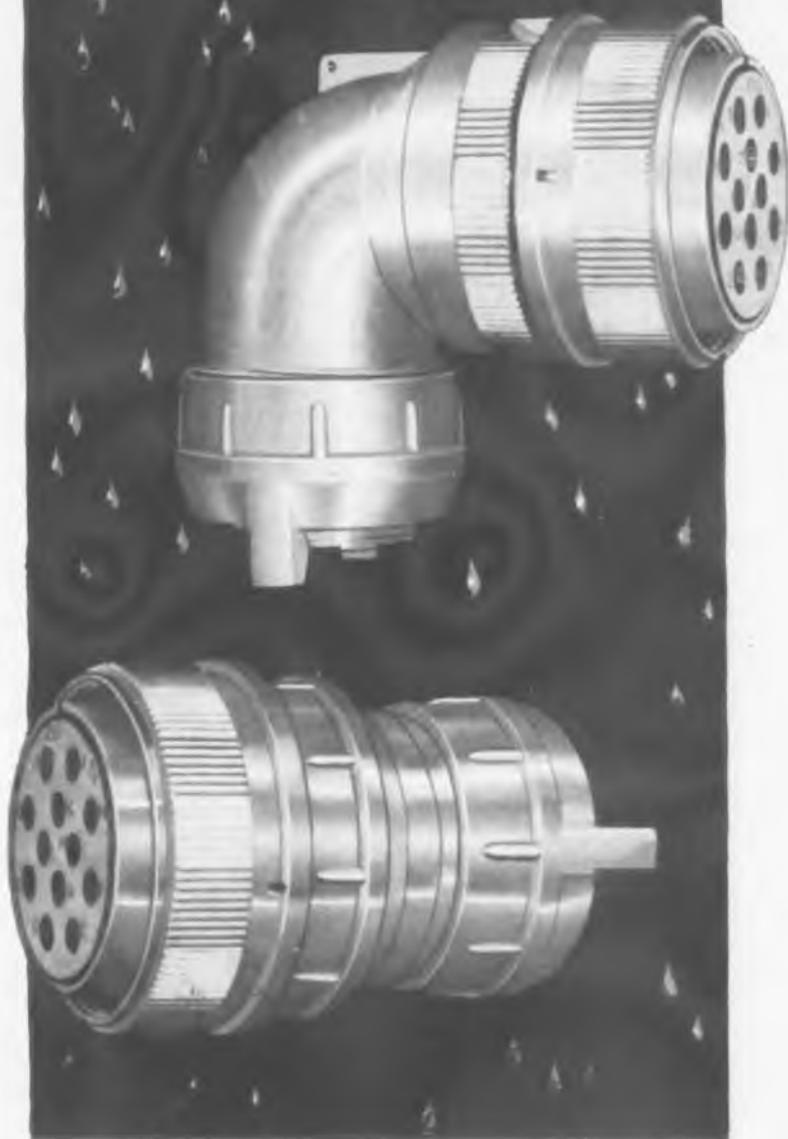
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waterproof

plugs

for use with
multi-conductor
cables



These new Bendix* -Scinflex waterproof plugs are a modification of our standard AN type "E" (environment resistant) connector. They are designed to meet all "E" performance requirements when used with multi-conductor cables. Each plug includes a modified AN3057B cable clamp which provides inward radial compression on multi conductor cables. This unique feature completely eliminates cable strain—a common source of circuit trouble.

In addition, there are gaskets at all mating surfaces and an accessory sleeve is available to accommodate an extreme range of cable sizes. A folder describing this new waterproof plug—and the various sizes in which it is manufactured—may be obtained by writing our Sales Department.

* TRADE MARK

THESE BUILT-IN FEATURES ASSURE TOP PROTECTION AGAINST CIRCUIT FAILURE:

Shock and Vibration Resistant • Die Cast Aluminum Shell
• Cadmium Plate—Olive Drab Finish • Moisture-Proof,
Pressurized • High Arc Resistance, High Dielectric
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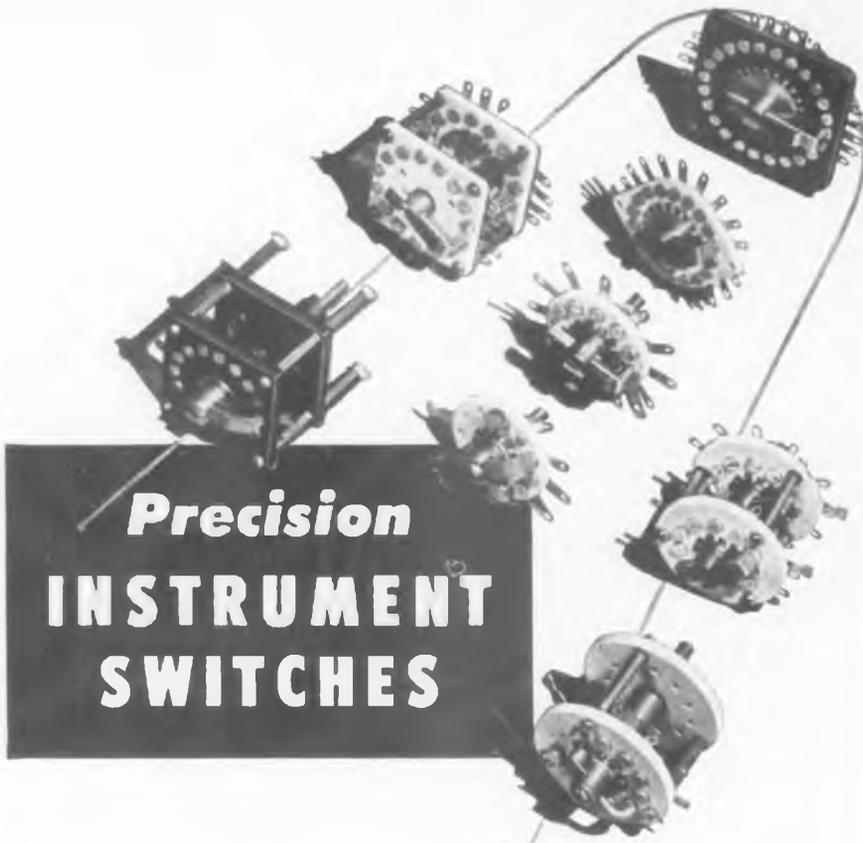
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BOOKS

Television

By V. K. Zworykin and G. A. Morton. 2nd Edition. Published 1954 by John Wiley & Sons Inc., 440 Fourth Avenue, New York 16, N.Y. 1037 pages. Price \$17.50

The second edition of this famous book reflects the tremendous technological advances that have raised television from a restricted experimental field to a nationwide major industry. In the 14 years since the work was first published engineering development has been so profound that nearly every chapter has been rewritten. A special feature is the detailed discussion of color television. Its consideration of both the theoretical and practical aspects is detailed enough to give the reader a sound working understanding of this new and important development. A comprehensive discussion of industrial television and other related topics is also included in this volume.

Throughout the book, the problems of television are presented from the standpoint of the fundamental physical processes involved. At the same time technical coverage is broad, with detailed considerations of the practical construction and operation of television devices. The careful analyses offered by the authors permits the reader to establish limits of performance for both ideal and practical television tubes and equipment. Chapter topics include: fluorescent materials, electron optics, video pickup devices, picture reproducing systems, video amplifiers, scanning and synchronization, color television, industrial television, practical television systems.

The Oscilloscope At Work

By A. Haas and R. W. Hallows. Published 1954 by Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1. 172 pages. Price 15s.6d.

This book is a practical guide to the applications of cathode ray oscilloscopes, having especial reference to radio and television receivers. The wealth of oscillograms (over 200) throughout the volume do much to enhance its value. Among the topics covered are: audio and radio frequency amplifiers, oscillators, rectifiers and detectors, modulators, phase changing and wave shaping circuits. An interesting chapter discusses how the cathode ray oscilloscope can be made to diagnose its own troubles when faults develop.

Electroacoustics

By Frederick V. Hunt. Published 1954 by Harvard University Press, Harvard University, and John Wiley and Sons Inc., 440 Fourth Avenue, New York 16, N.Y. 260 pages. Price \$6.00

This book presents a unified basis for the analysis of electroacoustical transducers. The subject is introduced with an account of the historical origins of
(Continued on page 62)

Spotlighting Standardization!



hermetically-sealed terminations and miniature closures*

● **MULTIPLE HEADERS** — Strain-free, vacuum tight headers featuring cushioned glass construction. Silicone treated for maximum dielectric strength and tin dipped for easy soldering.

● **SEALED TERMINALS** — These E-I terminals offer high thermal shock resistance and feature cushioned glass construction. Available in many economical preferred types and special designs.

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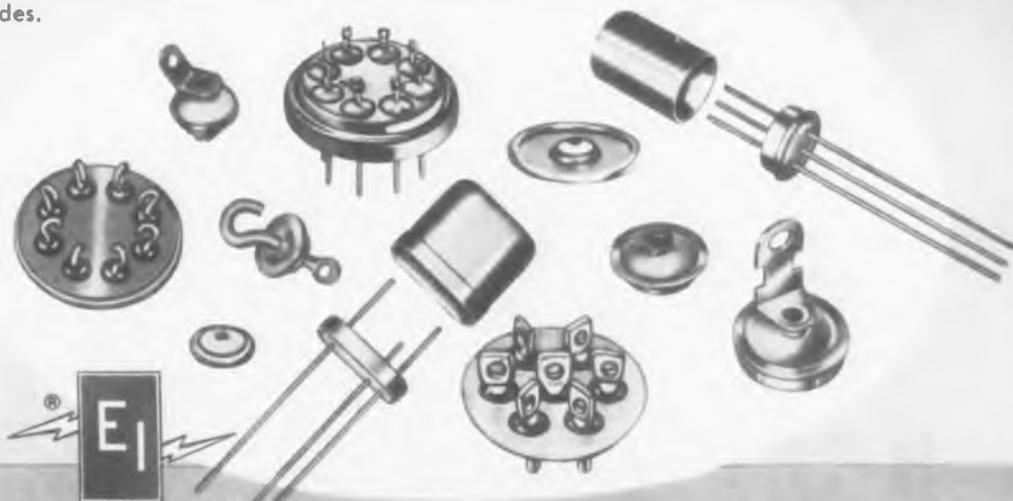
● **MINIATURE CLOSURES** — For transistors and other components requiring hermetic sealing. Square, rectangular and round cases. Supplied in E-I standard types or custom designs to specifications.

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Economical E-I standardized hermetically-sealed terminations and miniature closures are available to meet almost any electronic application. Samples and recommendations on your particular needs will be supplied promptly on receipt of your data. Call or write for complete E-I catalogs, today!

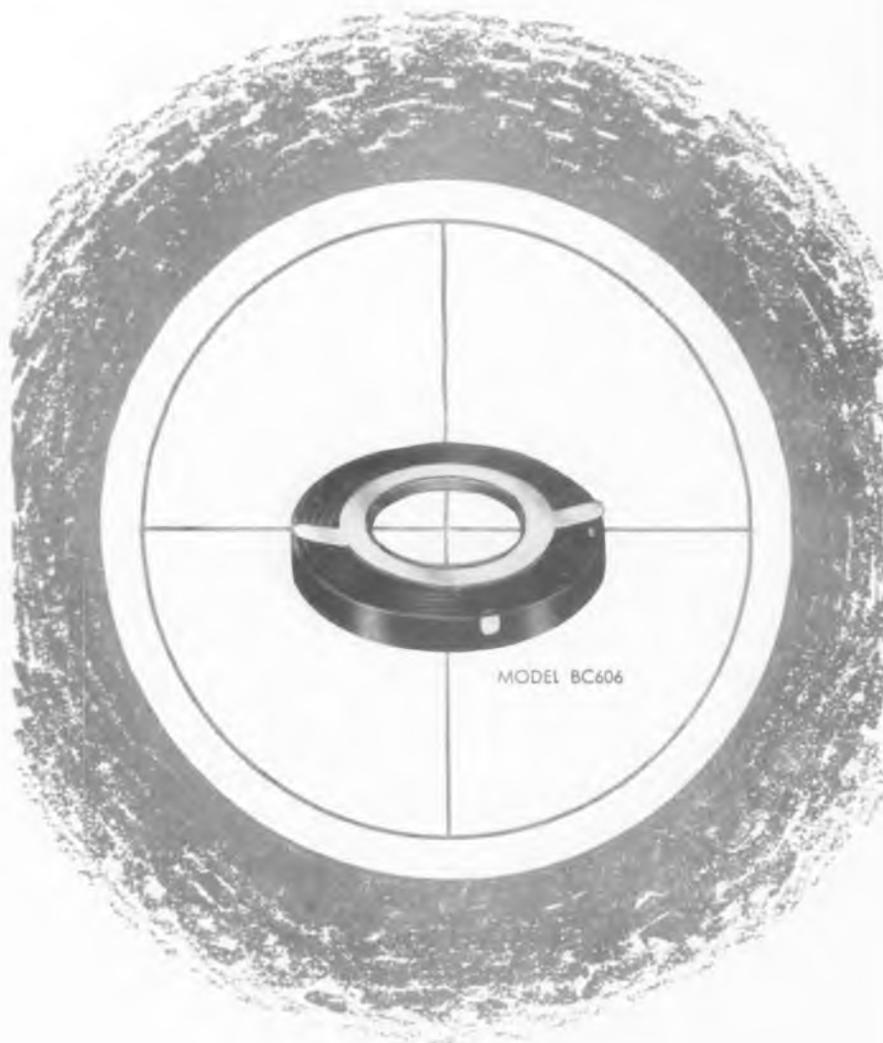


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Each unit is tested in both open and closed position before shipment.



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BOOKS



(Continued from page 60)

these devices in the basic sciences and their allied arts. Some of the new and hitherto unpublished material deals with such topics as the origins of echo ranging, the crystal oscillator, electrostatic transducers, and the evolution of the dynamic loudspeaker. A modified formulation of the electromagnetic relations, involving the introduction of a space operator, allows all transducer types to be represented by the same form of equivalent circuit. For the first time some of the results of wartime research carried out under NDRC auspices at the Harvard Underwater Sound Laboratory are presented.

East Coast Airborne Conference

The East Coast Conference on Airborne and Navigational Electronics, sponsored by the Baltimore Section of The I.R.E. and the I.R.E. Professional Group on Aeronautical and Navigational Electronics, will be held on November 4 and 5 at the Sheraton-Belvedere Hotel in Baltimore. Registration fee for I.R.E. Members and students is \$1.00, for non-members \$3.00. The many interesting exhibits will be open to all conference registrants. Banquet on the evening of November 4. Hotel accommodations may be arranged by contacting Mr. G. R. White, Bendix Radio Div., Bendix Aviation Corp., Towson 4, Md.

AIEE Fall Meeting Papers

The Committee on Television and Aural Broadcasting Systems, AIEE, announce the following technical papers program for Oct. 14-15 at the Morrison Hotel, Chicago, Ill., during the AIEE Fall General Meeting (Oct. 11-15):

THURSDAY—HIGH FIDELITY AND MAGNETIC RECORDING

"A New High-Fidelity High-Powered Amplifier and Speaker Reproducing System."—Frank H. McIntosh, Consulting Engineer.

"General Problems of Standardization in the Electronic Industries with Reference to the Definition of High Fidelity."—Frank H. Slaymaker, Stromberg-Carlson Co.

"A Survey of Magnetic Recording."—S. J. Begun, Clevite-Brush Development Co.

FRIDAY—COLOR TELEVISION AND INTERNATIONAL BROADCASTING

"Differential Phase and Gain Measurements in Color Television Systems." (With demonstration)—Hugh P. Kelly, Bell Telephone Labs.

"Recording Color Television Programs." (With color movie demonstration)—E. Dudley Goodale, National Broadcasting Co.

"The Engineering Development of the Voice of America."—Edgar T. Martin, Julius Ross, and George Jacobs, U.S. Information Service.

"Very-High-Powered Long-Wave Broadcasting Station."—Carl E. Smith, Consulting Engineer, John R. Hall, and James O. Weldon, Continental Electronics Mfg. Co.

Perfect Balance!



**SMOOTHER, EASIER
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**NEW
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Perfect balance makes the big difference in the smooth new Houston-Fearless Cradle Head! No matter how the camera is tilted, it is always in absolute balance... resulting in wonderful new ease of operation and remarkable new smoothness never before achieved.

This perfect balance is made possible by the cradle action of the head. When the camera is tilted up or down, the cradle rotates around a constant point of gravity, maintaining positive balance at all times. Added weight, such as long lenses and camera accessories, is easily compensated for by simply moving the camera and the top plate of the head forward or back by means of a lead screw. This adjustment does not require loosening the camera's balancing screws.

The Cradle Head rides on four precision-ground ball-bearing rollers for smooth, quiet, easy tilting. Tilting is also smooth and easy, accomplished by two precision ball bearings in the base. Drag adjustment and lock are provided on both pan and tilt.

FOR MONOCHROME AND COLOR TV CAMERAS!
The new Houston-Fearless Cradle Head was available in two types: Model MCH for monochrome and color cameras; Model CH-1 for the RCA Color TV camera.

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Sprague can provide you with the best capacitors for your requirements. And when it comes to ceramic capacitors, large plants with adequate production and tooling facilities offer prompt delivery for small or large production runs.

In the East, Sprague ceramic capacitors are made at North Adams, Mass., and Nashua, N. H. The Midwest is served by Sprague's wholly owned subsidiary, the Herlec Corporation of Grafton, Wis.

Some of Sprague's newest developments are shown at right. For future developments in ceramic capacitors, look to Sprague for the ultimate in performance, miniaturization, and reliability.

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Sprague, on request, will provide you with complete application engineering service for optimum results in the use of ceramic capacitors, and printed resistor-capacitor networks.

NEW! 'RING' CERAMIC CAPACITORS to clean up chassis



Designed to fit around 7-pin miniature tube sockets, these capacitors may contain 2, 3, or 4 sections. They result in a neat physical layout while reducing space to a minimum. Positive positioning of the ultra short leads between the capacitor and socket terminals eliminates lead dress problems and, consequently, allows "hot" circuit designs. Voltage ratings from 100 to 500 d-c. Write for Engineering Bulletin 610.

NEW! FLAT 'PAN' CERAMIC CAPACITORS simplify circuit design



Mounted flat against a chassis with a screw or rivet, these miniature capacitors provide a highly secure mounting. 1 to 4 sections in the shallow pan are insulated and moisture-protected by a phenolic resin. Ideal for military electronics. These units have an unusually high self resonant frequency, and eliminate lead dress problems when mounted adjacent to a miniature tube socket. Available in ratings from 100 to 500 volts d-c. Write for Engineering Bulletin 611.

WIDELY-USED CERAMIC CAPACITORS for electronics, radio, and TV



Shown at left are a few of the many other types of ceramic capacitors available from Sprague. These include:

- Buttons • Discs • Hi-Voltage Moldeds
- Precision Ceramic Trimmers • Plates
- Printed resistor-capacitor networks
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For complete details on any type of ceramic capacitor — it pays to ask Sprague. Write for catalog data on the types in which you are interested.

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TELE-TECH

& Electronic Industries

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

Electronic Future — Fact and Fantasy

People's attitudes on scientific advancements are often curious to observe. The astounding we take for granted. The near-impossible we take in our stride. Such sophistication appears to be the outgrowth of the increasingly rapid rate of technological growth. Every day new ideas and inventions come thicker and faster.

The human imagination is quickly inspired to probe the many avenues of scientific achievement, and to paint a picture of the great things—possible and impossible—still to come. So the credible and incredible often intertwine, becoming individually unrecognizable. Consequently the science fiction enthusiasts have a field day, shouting their glib predictions to all who will listen.

On the other hand, the capable scientist usually remains silent. He understands the difficulty involved in predicting the future. And he also knows that even with an element of speculation, there are only a very select few who are qualified to voice their forecasts. These are the men who have pioneered the electronic art since its inception, have been its active leaders, and have proved in the past the accuracy of their visions.

Therefore it is with understandable pride that we note the article, "The Years Ahead," in this issue, written by just such an authority, the renowned electronic scientist, Dr. Alfred N. Goldsmith.

Electronic-Social Aspects

While appreciatively nodding our heads at the myriad of new electronic devices, we often lose sight of the future social impact. The best indications of things to come are the trends already established, combined with the insight and far reaching plans of industry leaders.

STANDARD OF LIVING: Increased productivity made possible by improved machines and electronic controls, labor saving devices for the home, and better medical electronic equipment promise a higher and healthier standard of living for all. The millenium is not necessarily in the offing, but more

leisure and many new electronic goods and services are certainly forthcoming to fill man's eternal desire for greater comfort.

SOCIAL INTEGRATION: With faster transportation and rapid communications spreading across the world, even into the remotest regions, people in the different areas will continue to grow more and more familiar with each other's culture. The interaction of the various social groups will be heightened by the growing complexity of our technology, which will integrate the specialized functions of each, making different peoples more mutually dependent. And the growth of radio and TV in the home could easily provide the informational stepping stones to knowledge of distant regions.

THE INDIVIDUAL: The status of each individual person in the years to come is nebulous. On the one hand, the increasingly complex social structure coupled with pin-point specialization would seem to indicate movement by highly organized groups of people, with the individual as such playing a secondary role. In sharp contrast with this is the growing fund of knowledge made available to the common man, his greater awareness of current events and how they affect him, and the broader opportunities for creative leisure made possible by a higher living standard. These latter factors augur well for fuller participation in social activities and a deepening appreciation of democracy.

TRANSITION: Revolutionary technological changes are invariably accompanied by a realignment of work effort. Just as the automobile replaced the blacksmith by many more auto mechanics, the Electronic Age will replace a number of skills, inaugurating in their stead fabulous new industries. And since we're right in the middle of this transition now, it looks like transitional confusion should be at a minimum. The benefits to be reaped are almost unlimited.

RADARSCOPE

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

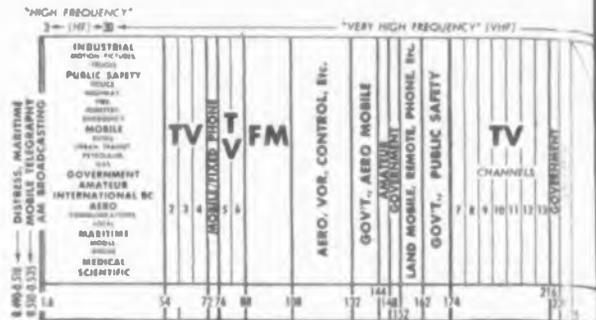
IONIZATION TRANSDUCER ELEMENT which will measure any phenomenon that can be resolved into changes of capacitance, resistance or inductance scheduled for announcement. Development promises to be one of major steps in applying electronic techniques to mechanical functions for better measurement and control. This includes such basic functions as acceleration, linear and angular displacement, temperature, liquid quantity, liquid level, conductivity, humidity etc. More details in TELE-TECH next month.

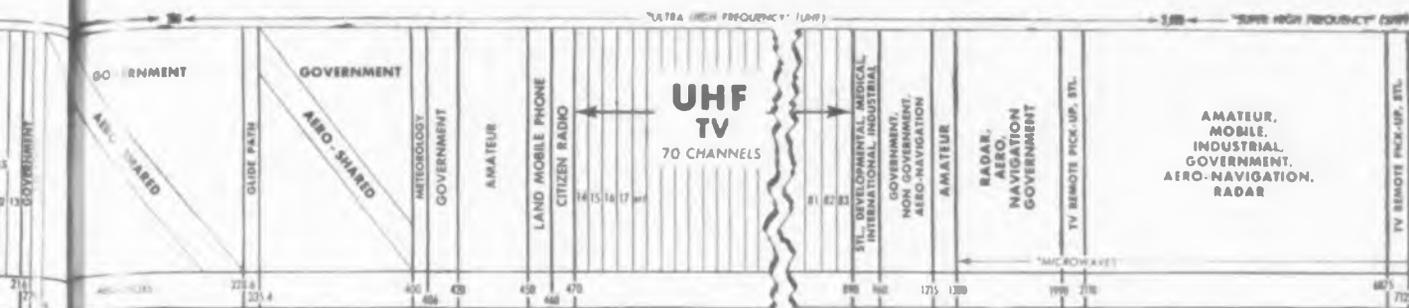
LONGER PLAYING magnetic tape is starting to catch on. About 50% extra playing time is achieved by using thinner tape and coating, allowing 50% more tape to be wound on a standard reel. Already "Scotch" extra-play 190A tape and "Soundcraft" Plus 50 mylar tape are on the market.

UHF TRANSISTORS



Dr. J. M. Early, Bell Telephone Lab. scientist, tests oscillation frequency of new UHF transistor he is credited with inventing. The new "intrinsic barrier" transistor now in the experimental stage is capable of operation at 440 mc. Frequencies as high as 3000 mc are theoretically possible. Extensive use of this unit is envisioned for portable radios, radio relays, submarine telephone and TV cable repeaters, and military equipment. See page 9 for further details





following policy decisions that electronic investments will appreciate, and be a good base for product diversification.

COLOR TV cameras are often left running for a day or more before a big color show. Experience has shown that after a successful rehearsal, the camera chain will remain stable if it is not turned off before the actual performance. Improved circuitry should overcome this costly technique.

EXPERIMENTAL COLOR pick-up tube being worked on by several firms would eliminate all color splitting presently done by filters, prisms or mirrors. The color division is accomplished by the phosphor itself, but many bugs still remain to be ironed out. If successful prototype is developed, it will be a welcome step toward simplifying studio equipment.

CITIZENS RADIO SERVICE—The possibility that the FCC will set up a centralized record file of licensees in the citizens radio service—something lacking at present—and institute a closer check on the identity of the citizens licensees has cropped up at the Commission's headquarters in Washington as a result of a look into the citizens operation by Commissioner Robert E. Lee and his assistants. Commissioner Lee explained that he does not propose any radical departure from the current citizens radio set-up, but feels that in as free a field as the citizens service, where virtually any US citizen may be authorized to use a frequency, the FCC should at least know who its licensees are and in what activities they are engaged. He said that the matter would be brought before the full Commission for discussion within the next several weeks.

TELEVISION

ONE YEAR FROM NOW, TV service will be available to almost everybody in the United States. In the short span of eight years, TV has grown from a novelty to a basic communications medium. The 400 stations presently on the air already cover 88% of the population, but not all of these folks have TV receivers—yet. Booster stations and community systems could go a long way toward filling in the dead spots.

MICROWAVES

LONG HOP MICROWAVE relay systems are being seriously considered by several foreign countries. By making jumps as long as 200 miles, the number of relays required can be cut down to one-quarter of those used in standard systems. This is an obvious advantage in

areas where trained technicians and power sources are at a minimum. Chief drawbacks to quick acceptance of the plan are pioneering novelty of the projected system, and limited availability of certain specialized equipment necessary.

SOVIET TECHNOLOGY

WE'LL HAVE TO GET INTO HIGH GEAR if we expect to maintain our slim technological lead over the Soviet Union. In last month's editorial, "Stop Wasting Engineers," we pointed out three ways in which we're fumbling the ball on engineering manpower. We also indicated how the Russians are catching up with us. Recent reports reaching us show that the situation is worse than we first suspected. For example, about 53,000 Soviet engineers were graduated this year—an increase of 10,000 or more over last year. In comparison, engineering graduates in the United States fell this year to well under 20,000. In addition, Soviet grade and high school curricula have been revised to give greater emphasis to chemistry and physics. All of which may have been a factor in prompting the statement of a top government official that our lead in the military field has been whittled down from 50 years to two or three years.

TV ABROAD



If you've ever wondered how people react to TV abroad, take a look at part of the typical crowd which turned out for an open air TV showing in Japan. In several countries where TV receiver cost is above the average man's means, a central set is installed in the village or town hall. Some have mobile sets for different areas. Photo courtesy Unitel, Inc. See "TV Around the World," page 114

Variable Toroidal Inductors—New



By LEWIS G. BURNELL
Chief Engineer
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Inc.
Yonkers 2, N. Y.

CIRCUITS to provide variable resonant frequency, impedance, or phase at low frequencies require variable inductive or capacitive elements of large value. The impracticability of variable capacitors of very large values has stimulated the development of magnetic-cored variable inductors. There are two basic types currently in use. In the first, a gap in the core is varied. In the second, a biasing magnetic field is produced within the magnetic circuit of the inductor, thereby reducing the incremental permeability of the core material, and consequently reducing the inductance of the inductor. Each of these methods has had certain drawbacks.

Variable toroidal inductors, termed "Rotoroids" represent a new and entirely unique approach in variable inductors. They provide a continuous three-to-one maximum-to-minimum inductance range with 180° shaft rotation with any value of inductance available in conventional toroids. "Rotoroids" are hermetically sealed, employ no mechanical resistance contacts or variable gaps, and require no DC saturating current.

The variable-gap type of inductor employing a laminated core is generally limited to the lower audio frequency range due to Q considerations.

A biasing-field type of inductor may have either of two disadvantages, depending upon the means used to produce the biasing field. In the past three methods of obtaining the biasing field have been suggested. These include: the use of a direct current in the windings of the inductor, the use of an external electromagnet, and the use of an external permanent magnet. Either of the first two methods requires an external dc supply to provide a variable direct current, which adds considerably to the complexity and cost. The

New circuit elements, termed "Rotoroids", employ two permanent magnets in conjunction with toroidal coil to produce continuously adjustable biasing field. Units find extensive application in audio oscillators, filters, equalizers, telemetering devices, servo systems, controls etc

de saturating type usually is practical only with the saturable types of core material that provide low Q.

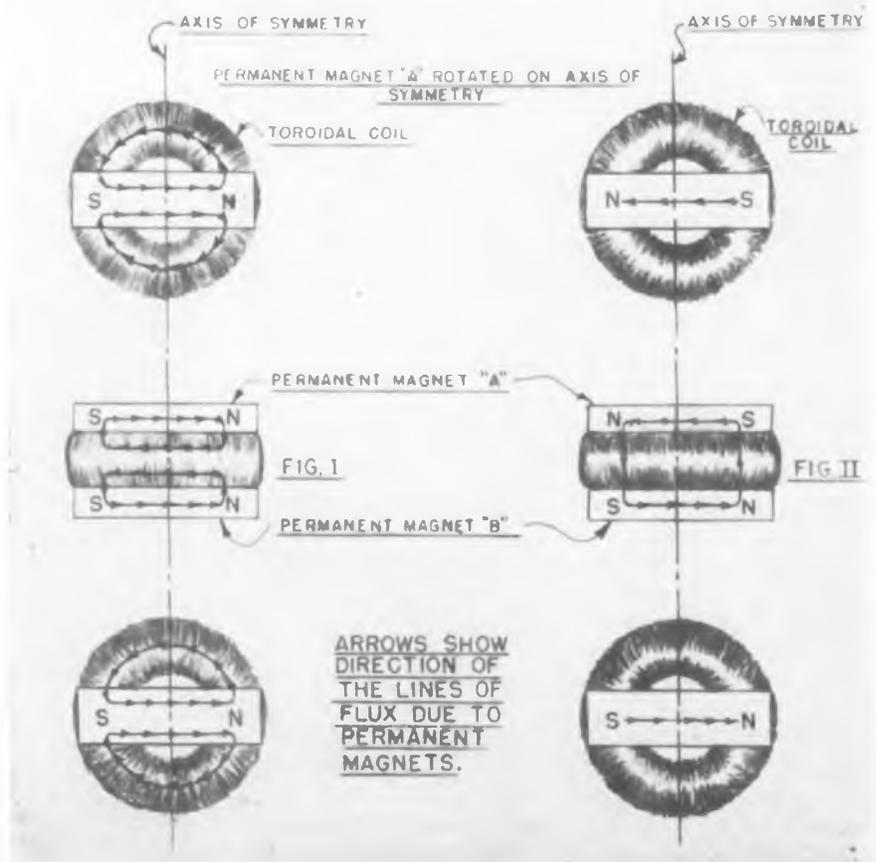
Biasing-Field Inductors

In inductors using one permanent magnet as the source of biasing flux, the effect of the magnet is changed by varying the distance between the permanent magnet and the core of the inductor. This arrangement is both simple and economical, but it has several disadvantages. First, in addition to offering mechanical problems, the field strength of a magnetic pole is inversely proportional to the square of the distance from the pole and the biasing flux

varies sharply with the size of the gap between the core and the magnet, thus making it difficult to get accurate adjustments. Second, the leakage field of the permanent magnet increases as the magnet is moved from the shunting effect of the core and this field often will affect other components of the equipment into which the inductor is connected.

The "Rotoroid" is the first to employ two permanent magnets to produce the biasing field in such a way that variable leakage is reduced and accurately reproducible adjustments can be made. The method is applicable to toroidal coils and allows variable toroids to be made.

Fig. 2: (Right) Toroidal coil and bar magnets placed so that long dimensions are perpendicular to its axis. Fig. 1: (Left) Change in flux patterns that result when upper magnet is rotated 180°



Electronic Components

incorporating the advantages previously available only in toroids of fixed inductance.

Two magnets or sets of magnets are used and positioned so that the windings of the inductor are between them. One of the magnets is fixed with respect to the windings and the other is rotatable. The amount of biasing flux produced within the windings of the inductor depends upon the relation between the poles of the magnets.

Magnet-Coil Relation

In one application of the principle, two bar magnets are used. The magnets are so placed with respect to the toroid that their long dimensions are perpendicular to the axis of the toroid and the magnets are on opposite sides of the coil. One of the magnets is made rotatable on the axis of the toroid. Fig. 2 shows a top, a side, and a bottom view of this arrangement with unlike poles of the two magnets in line, together with an indication of the direction of the lines of flux due to the magnets. In this case, as the lines of flux pass through the toroid, they are perpendicular to the lines produced by the toroid itself; hence they have little effect on the incremental permeability of the core. Some of the lines of flux between the poles of each individual magnet do pass through the toroid along paths approximately parallel to the lines of flux in its core and reduce the incremental permeability slightly. However, with the magnets positioned as shown in this figure, the inductance of the toroid is nearly

the same as it would be without the magnets.

When the upper magnet has been rotated 180°, the paths of the lines of flux would be as shown in Fig. 1. Here, the field of each magnet forces a substantial portion of the field of the other magnet to pass through the core of the toroid in such a way that the lines of flux are parallel to the paths of the lines of flux set up in the core by the toroid itself. Hence, the incremental permeability of the core and the inductance are substantially reduced.

Inductance Range

The ratio between maximum and minimum inductance is a function of coil design, the properties of the core material, and the number, size, shape, and strength of the permanent magnets employed. The inductance of the coil is varied by changing the incremental permeability of the core material, by biasing the core with a magnetic field whose lines of flux pass through the core in a circumferential direction. It is theoretically possible to vary the biasing field from zero (magnets cancelling each other out completely) to maximum (core material saturated). Accordingly, it is theoretically possible to vary the inductance from maximum (biasing field zero) to ostensibly zero or the air inductance of the toroid (core material saturated).

Practically, extremely large ratios of maximum to minimum inductance never are obtained. It is impractical to use magnets with sufficient

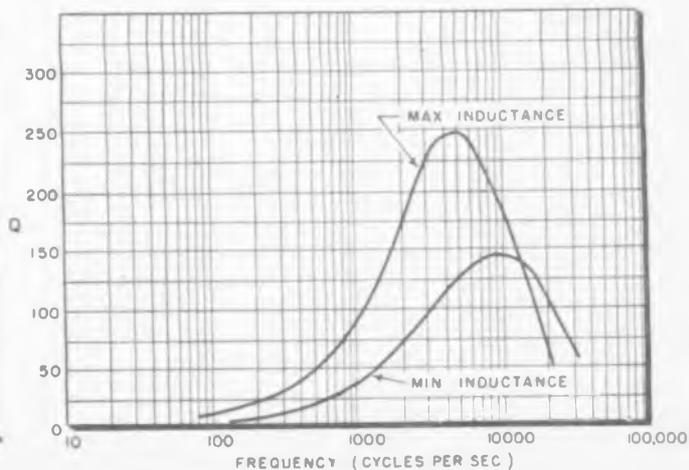
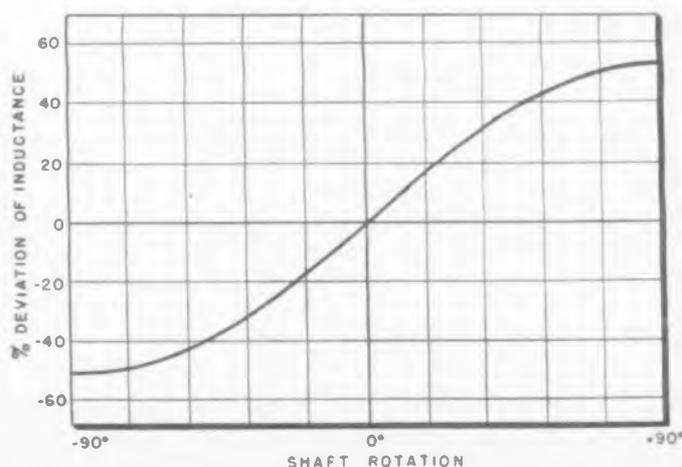


Fig. 3: Physical appearance of "Rotoroid", new variable toroidal inductor component

field strength to saturate core material of high permeability; also, as saturation is approached, the harmonic distortion introduced by the coil increases. Furthermore, some air gap is necessary between the core and the magnet; this reduces the effective field at the point of minimum inductance (where like poles of the magnets oppose each other) and maximum circumferential flux is produced. Finally, even where unlike poles are aligned to produce minimum biasing flux, some circumferential components are present, thus slightly reducing the maximum inductance obtainable with the coil. However, ratios as high as 10 to 1 between maximum and minimum inductances are readily obtainable and a ratio of 3 to 1, which is convenient for much circuit work, is normally furnished in current production.

Fig. 3 is a cross-section drawing of a typical "Rotoroid." The upper magnet and the toroidal coil are fixed in position, while the lower magnet rotates on the shaft. Backlash has been minimized by special
(Continued on page 128)

Fig. 4: (l) Inductance variation as function of shaft rotation for VTI-A and VTI-B units. Fig. 5: (r) Q vs. frequency for VTI-A.20. Mean inductance is .20 henrys



Tube Selection Increases Signal

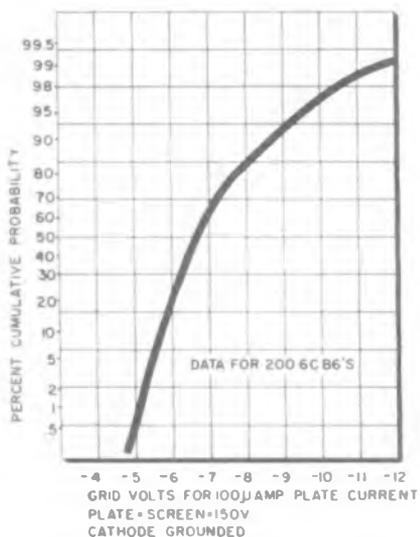


Fig. 1: Distribution of cut-off, 6CB6's

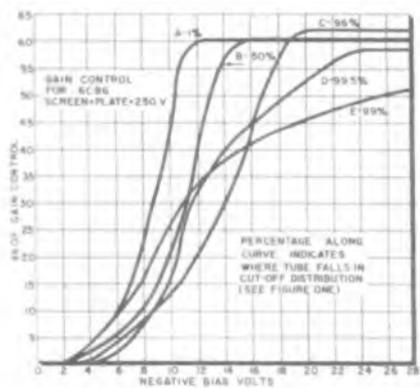


Fig. 2: Db of gain control vs bias, 6CB6's

By **ROBERT G. HORNER**
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3400 47th Avenue
Long Island City, N. Y.

TELEVISION receivers must operate satisfactorily under a wide range of signal conditions. If we assume for the vast majority of receivers the signal limits to be from rated sensitivity of approximately 20 μ v to 100,000 μ v, we have a range of 74db. Within this range of signal we want no degradation of the tuner noise figure due to excessive bias applied to the r-f amplifier; nor is any sync stretch, white compression or audio buzz desired due to r-f or i-f overload. The receiver's AGC system provides the means to meet these requirements.

Unfortunately, the TV designer generally cannot guarantee that the

Quality check of i-f tubes for chassis in production enables a thirty-fold increase in signal handling capacity. 100 tube test station provides sufficient three-stage i-f tubes to accommodate production of 700 receivers daily

vast majority of the sets will satisfy these conditions due to the many variables. (As listed below.)

Overload Variables

1. Cut-off of I.F. Tubes
2. Gain of I.F. Strip
3. Gain control of tuner
4. Gain of tuner
5. Tolerance of resistors in AGC network
6. B supply voltage
7. Gain of video amplifier

There is some interdependence among these items (i.e., sharp cut-off and high gain have some correlation). Most of them could (within their allowed tolerance) cause extreme variations in the r-f delay and in the receiver signal handling capabilities. It should also be noted that with present methods of obtaining delayed r-f bias, the desired bias is the difference of two larger voltages, namely, the output of the AGC generator and a bucking positive voltage. Such a system is inherently sensitive to variation.

The biggest single problem in AGC system, variations in cut-off of the gain controlled tubes (6CB6's in almost all present receivers) is not affected by changing this method of obtaining delayed r-f, even if a less sensitive system were developed.

First, let us see why the cut-off of 6CB6's is so important. Fig. 1 shows the distribution of cut-off among 6CB6's. The plate and screen voltages were fixed at 150V. Cathodes were grounded, and the bias necessary to reduce the plate current to 100 μ amps was measured. The measurements were originally made on approximately 100 6CB6's representing six manufacturers. They were repeated several months later on another 100 tubes representing the same six manufacturers. The two results were very similar, and Fig. 1 represents an average of the 200 tubes tested. Note that the average bias for 100 μ amps cut-off under the measured conditions is 6.7 volts; the cut-off voltage that includes 99% of the tubes is 12 volts and the voltage covering only 1% of the tubes is 5.2

volts. We can therefore say that the cut-off of 6CB6's is 6.7 volts (plus 5.3V, minus 1.5V) or 6.7 volts (plus 79%, minus 22%). This covers 98% of the tubes. Obviously the cut-off varies much more than any of the other parameters affecting the signal handling capacity of the receiver.

Fig. 2 shows db of gain control of 6CB6's vs. bias, taken with screen and plate at 250 volts. The sharpest cut-off tube is A and the widest E. Note that gain control is very slow at first and rises rapidly as the region of complete cut-off of the tube is approached. At -10V of bias, tube A has 42 db of gain control, while E has 25 db and C has 14 db, a difference of 25 db from A. If we gain-controlled two receiver i-f stages and used two average tubes (such as B) that had a bias overload of -10 volts, we would get 2 x 21 or 42 db of gain control at overload. (This writer has for some time used the signal level which just causes a 20% stretch in sync amplitude as the overload point of a receiver. This measurement is made at the video detector.)

Minimum Handling

The last i-f stage to be gain controlled will tend to overload first. Assume the first stage has wide cut-off tube, C, and the second a sharp one, A. This is the condition for minimum signal handling. The sharp cut-off tube in the 2nd i-f will overload at a lower bias than the -10 volts assumed for the average tubes. In this case, it was approximately -7.8V. At -7.8 volts tube A has 20 db, but tube C has only 7 db of gain control. The total amount of gain control at the overload point is therefore 27 db. This compares to the 42 db of gain control obtained from the same two stages with average (or bogie) tubes. This is a 15 db gain control loss, or 5.6 times loss in signal handling.

The r-f AGC bias at overload is also appreciably reduced from what it was when the average tubes were gain controlled. This noticeably in-

Capacity of TV Receivers

creases the variations in the overload signal of TV receivers due to the cut-off spread of tubes used in the gain controlled stages. If the set with the average tubes could handle 100,000 μ v, the second set could only handle 17,800 μ v before overload due to the 15 db loss in gain control of the i-f alone. Actually the second set would overload well below 17,800 μ v because of the lower r-f AGC bias at overload.

Since all tubes except for the widest few per cent are within most manufacturers' specifications, circuit designers must "live" with this condition. The circuit designer may take four avenues of approach with this problem:

1. Take the variations, and let the chips fall where they may.
2. Use a tube other than the 6CB6 in the gain controlled stages.
3. Use a switch or a potentiometer to change the r-f delay, and thereby try to compensate for the variations due to tube cut-off.
4. Use a tube selection process, so that those tubes that will be gain controlled will fall in certain specified cut-off limits. In this manner the maximum variations in gain control due to tube cut-off can be controlled.

The first approach is of course not satisfactory, as the data presented herein shows. However, many designers still take wide variations in set overload because they feel any other approach would be too costly.

When this investigation was undertaken, there were no other practical tube choices for a 40 MC i-f

other than the 6CB6. Recently, two tubes—the 6CF6 and the 6DC6 have appeared. These tubes are selected 6CB6's. Both tubes are higher in cost than the 6CB6. The designer can now utilize these pre-selected tubes in present designs.

The third approach, of a switch or potentiometer to vary the r-f AGC delay is relatively costly. Varying the r-f AGC delay is not really a direct approach to the cut-off problem. Proper setting of r-f delay is always difficult in the field. The varying of the r-f AGC delay bias is therefore not feasible.

The fourth method, tube selection, is very inexpensive, (approximately \$0.02 per chassis) and is used by many TV manufacturers in coping with this problem.

All Tubes Used

In considering tube selection, we must first remember that all tubes received must be utilized. That is, those tubes not used in the gain controlled stages, must be used in the non-gain controlled stages. Since the majority of tubes not meeting the requirements for the gain controlled stages are still within manufacturers' specifications, they must be utilized in the set. In a three stage i-f, conventionally controlling the first and second stages, one-third of the tubes are not gain controlled (i.e., those in the third stage). The question now arises as to which third of the tubes should be rejected—the very sharpest or the very widest.

It is generally known that remote cut-off tubes are more desirable for

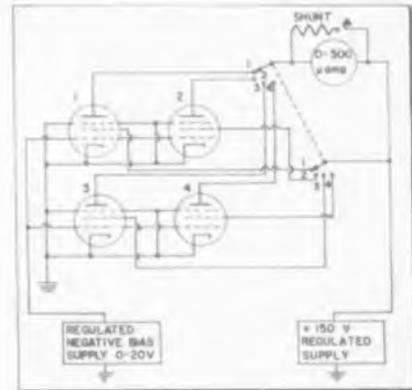


Fig. 5: Circuit for testing i-f tubes

gain control. This is true because the rate of change of their gm characteristic (or the second derivative of their gm characteristic) is more gradual than in sharp cut-off tubes. It is precisely this characteristic which causes overload effects in the gain controlled stages of TV i-f systems. Therefore, it would seem that without giving the situation any further thought, we should reject the sharpest one-third of the tubes for gain control. There is one mitigating point, however. The distribution of tubes with regard to cut-off is highly unsymmetrical. (Fig. 2)

Yield Volt Change

The yield per volt change in cut-off is much greater at the sharp cut-off end of the scale. If the widest one-third of the tubes were rejected tubes with cut-off variations from 5.2V (1% point) to 7.9V, a cut-off variation of 2.7V would be left. If the sharpest one-third of the tubes were rejected tubes with varying cut-off from 6.4V to 12V (99% point) would have to be utilized, a range of 5.60V or more than two to one greater variation than rejecting the wide tubes. However, the wider cut-off tubes are more desirable to gain control. An investigation was undertaken to determine whether enough of an increase in signal handling was obtained by rejecting the sharp cut-off tubes. It was found that rejecting the sharpest one-third of the tubes gave the desired results.

Fig. 3 shows improvements in minimum signal handling capacity of a three-stage i-f receiver obtainable by rejecting the sharpest one-third of the tubes. The first i-f stage was a very wide cut-off tube, D. (The condition for minimum signal handling would occur with a wide cut-

(Continued on page 133)

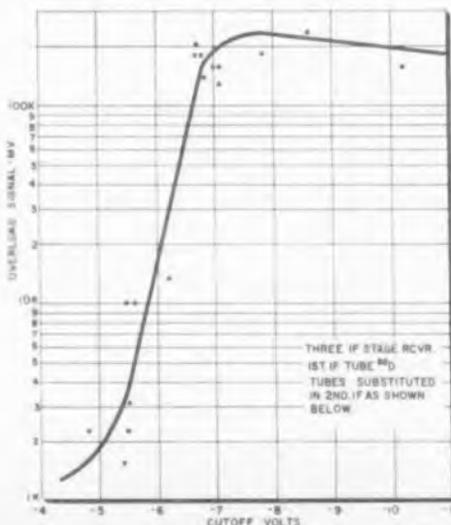
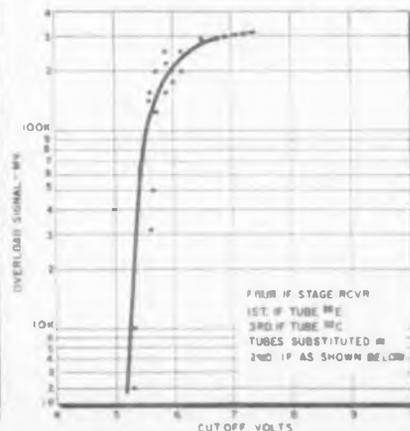


Fig. 3: (l) Improvements in minimum signal handling by rejecting sharpest one third of tubes

Fig. 4: (r) Cut-off vs overload for four stage i-f.



Preview of 1954



Dr. R. M. Soria
 Director of Engineering
 American Phenolic Corp.
 President, 1954 National Electronics Conference

AIEE, Illinois Inst. of Tech., IRE, Northwestern U., U. of Illinois. Participating sponsors are Michigan State College, Purdue U., U. of Michigan, RETMA and SMPTE.

In addition to displays by over 115 companies, and a very broad selection of technical papers presented in 21 sessions (see complete program below), luncheons on Oct. 5 and 6 will feature addresses by Dr. A. N. Goldsmith, famous electronic scientist and editor, and Dr. J. W. McRae, President of Sandia Corp. A banquet will be held on Oct. 6.

For further information, write to National Electronics Conference, Inc., Executive Secretary, 84 E. Randolph St., Chicago 1, Ill.

LIST OF EXHIBITORS

EXHIBITOR:	BOOTH NO.
Aerovox Corp., New Bedford, Mass.	71
Airtron, Inc., Linden, N. J.	80
Allied Radio Corp., Chicago, Ill.	56-57
American Phenolic Corp., Chicago, Ill. ...	86
Arco Electronics, Inc., New York, N. Y. ...	25
The Arnold Engineering Co., Marengo, Ill. 72	
Automatic Electric Sales Corp., Chicago, Ill.	63A
Ballantine Laboratories, Inc., Boonton, N. J.	132
The Barry Corp., Watertown, Mass. 114-115	
Beebe Associates, Glenview, Ill.	69
Bendix Aviation Corp., Red Bank Div., Eatontown, N. J.	75
Bendix Aviation Corp., Scintilla Div., Sidney, N. Y.	70
Berkeley Div. of Beckman Instruments, Inc., Richmond, Calif.	103
Beta Electric Corp., New York, N. Y.	127
Bomac Laboratories, Inc., Beverly, Mass. 78	
Boonton Radio Corp., Boonton, N. J.	94-95
Browning Laboratories, Inc., Winchester, Mass.	120
Brush Electronics Co., Cleveland, O. 133-134	
Burroughs Corp., Electronic Instruments Div., Philadelphia, Pa.	51
The Calidyne Co., Winchester, Mass.	135
Central Scientific Co., Chicago, Ill.	83
C. P. Clare and Co., Chicago, Ill.	22
The Clough-Brengle Co., Chicago, Ill.	46
Coil Winding Equipment Co., Oyster Bay, N. Y.	21
Collins Radio Co., Cedar Rapids, Ia. 72A-72B	
Alfred Crossley Associates, Chicago, Ill. 52	
Dage Electronics Corp., Beech Grove, Ind. 100	
Dee Electric Co., Chicago, Ill.	6
Allen B. DuMont Lab., Inc., Instrument Div., Clifton, N. J.	53-54
Eitel-McCullough, Inc., San Bruno, Calif.	63-64
Elastic Stop Nut Corp. of America, Union, N. J.	79
Electra Manufacturing Co., Kansas City, Mo.	16

THE tenth anniversary meeting of the National Electronics Conference convenes in Chicago's Hotel Sherman on Oct. 4, 5 and 6, 1954. The meeting is sponsored by the

Technical papers program for the 10th National Electronics Conference

SUNDAY, OCTOBER 3
 4:00 P.M. to 8:00 P.M.—REGISTRATION
 Lobby

MONDAY, OCTOBER 4
 8:00 A.M.—REGISTRATION
 Lobby

9:00 A.M.—9:00 P.M.—EXHIBITS
 Displays of electronic equipment components and new developments
 Exhibitions Hall and Mezzanine

9:45 A.M.—12:15 P.M.—TECHNICAL SESSIONS

1. MAGNETIC AMPLIFIERS I

- Program prepared in cooperation with the AIEE Magnetic Amplifier Committee
- Application of Magnetic Demodulator in Magnetic Amplifier Circuits by J. L. Behr, Vickers Electric Division, St. Louis, Missouri
 - A 400 CPS Magnetic Amplifier for A.C. Servo Application by R. O. Decker and W. F. Horan, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania
 - A Miniature Amplifier for Aircraft Applications at 400° F. Ambient Temperature by R. H. Bell, General Electric Co., Schenectady, New York
 - Magnetic Amplifier Provides Automatic Gauge Control on Sendzimir Cold Rolling Mill by Edgar V. Weir, Magnetics, Incorporated, Butler, Pennsylvania

2. MICROWAVES

- Siriplines by E. G. Fubini, Airborne Instruments Laboratory, Inc., Mineola, New York
- Siriplines Excitation Methods by F. S. Coole, Sperry Gyroscope Company, Great Neck, New York
- Microwave Components for Double Ridge Waveguide by L. Swern and K. Tomiyasu, Sperry Gyroscope Company, Great Neck, New York
- Determination of the Operating Performance of Waveguides of Arbitrary Cross-Section by Hypercubic Analysis by Wayne B. Swill and Thomas F. Higgins, University of Wisconsin, Madison, Wisconsin
- Determination of the Characteristic Impedance of UHF Coaxial Rectangular Transmission Lines by James I. Skiles and Thomas J. Higgins, University of Wisconsin, Madison, Wisconsin

3. INFORMATION AND STATISTICAL THEORY

- Effectiveness of Cross-correlation Detectors by Samuel F. George, Naval Research Laboratory, Washington, D. C.
- Optimum Linear Filtering of Nonstationary Time Series by A. H. Kochmans, University of Minnesota, Minneapolis, Minnesota and J. C. Truxal, Polytechnic Institute of Brooklyn, Brooklyn, New York
- On the Reliability of Networks by G. M. Weale and M. M. Kleinerman, U. S. Naval Ordnance Laboratory, Silver Spring, Maryland
- Designing Reliability into Electronic Circuits by A. H. Benzer and B. Metzdorf, Radio Corporation of America, Camden, New Jersey

12:30 P.M.—LUNCHEON IN THE BALLROOM

Dr. J. E. Hobson, Director, Stanford Research Institute, Stanford, California, and the Chairman of the first Executive Committee of the National Electronics Conference will keynote the 1954 Conference at this Tenth Anniversary birthday luncheon. The title of his address will be "The Day and the Meas of Creation."

2:30 P.M.—TECHNICAL SESSIONS

4. MAGNETIC AMPLIFIERS II

- Program prepared in cooperation with the AIEE Magnetic Amplifier Committee
- A Two-Stage Low-Level Magnetic Amplifier with Negative Voltage Feedback by F. Gourash, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania
 - Magnetic Switching Network for Data Handling Systems by L. P. Gieseler, U. S. Naval Ordnance Laboratory, Silver Spring, Maryland
 - Single Phase Magnetic Amplifiers with Decyclic Response by Leo J. Johnson, Huford Machine Works, Los Angeles, California and S. E. Rauch, Santa Barbara College, Santa Barbara, California
 - Rectifiers in Magnetic Amplifier Circuits by Bruce Seddon, Jr., General Electric Company, Schenectady, New York

5. CIRCUIT THEORY I

- Program prepared in cooperation with the IRE Professional Group on Circuit Theory
- A New Approach to the Potential Analogue Method of Network Synthesis by Edward W. Schwarz, University of Illinois, Urbana, Illinois
 - An Introduction to a Qualitative Synthesis of Linear Passive Networks in the Time Domain by F. Resz, Massachusetts Institute of Technology, Cambridge, Massachusetts
 - Parallel Ladder Realization of Transfer Admittance Functions by Ernest B. Kuh, Bell Telephone Laboratories, Murray Hill, New Jersey
 - Traps for Removing Transient Overshoot in Filters by Murlon S. Corbridge, Radio Corporation of America, Camden, New Jersey

6. MICROWAVE INSTRUMENTATION

- Measurement of Very High Dielectric Constant Materials at Microwave Frequencies by Ildoro Body, Signal Corps Engineering Laboratory, Fort Monmouth, New Jersey
- A Cavity Perturbation Technique for Studying the Permeability Components of the Ferrites by R. W. Brown, U. S. Naval Ordnance Laboratory, Silver Spring, Maryland
- A Method for Measuring the Loss of Waveguide Components Having Small Losses by I. Tatsuzuki and L. H. Scheibel, University of Wisconsin, Madison, Wisconsin
- Wide-Range SWR Indicator by G. O. Thorgesen, Airborne Instruments Laboratory, Inc., Mineola, New York
- An X-Band Phase Plotter by Jack Bacon, Ohio State University, Columbus, Ohio

7. COMMUNICATIONS

- Modulation Sideband Splitter of VHF and UHF Transmitters by William Frestone Angus Macdonald, and Henry Magnuski, Motorola, Incorporated, Chicago, Illinois

- Transmission of Quaternary Pulses Over Band Limited Wire Line Facilities by Samuel D. Bedrosian and Alfred Mocht, Signal Corps Engineering Laboratory, Fort Monmouth, New Jersey
- Detection of PCM Signals by the Integration Method by Henning F. Hornum, Signal Corps Engineering Laboratory, Fort Monmouth, New Jersey
- The Application of a Positive Grid Beam Multiplier as Frequency Modulation Broadcaster by John J. Metzner, New York University, New York, New York

TUESDAY, OCTOBER 5

8:15 A.M.—REGISTRATION
 Lobby

9:00 A.M.—9:00 P.M.—EXHIBITS
 Displays of electronic equipment components and new developments
 Exhibitions Hall and Mezzanine

9:30 A.M.—12:00 P.M.—TECHNICAL SESSIONS

8. CIRCUIT THEORY II

- Program prepared in cooperation with the IRE Professional Group on Circuit Theory
- Application of the Ohio State University Filter Analysis Chart by Harold R. Dawkins and Edward E. Damon, Ohio State University, Columbus, Ohio
 - The Impulse Function in Electrical Network Theory by Myril B. Reed and Sundaram Seshu, University of Illinois, Urbana, Illinois
 - Pulse Response of Nonlinear Circuits by George I. Cohn, Illinois Institute of Technology, Chicago, Illinois and Bernard Saltzberg, American Machine and Foundry Company, Chicago, Illinois
 - All Pass Amplifier by H. J. Wall, Radio Corporation of America, Camden, New Jersey
 - A Technique for Solving Certain Networks Containing a Nonlinear Element by Wm. L. Hughes, Iowa State College, Ames, Iowa

9. INSTRUMENTATION I

- An Ocean Wave Power Spectrum Analyzer by S. S. L. Chang, New York University, New York, New York
- Direct Reading Probability Distribution Meter by Henry L. Davis, Capt. USAF, and George R. Cooper, Purdue University, Lafayette, Indiana
- An Instrument for the Precise Comparison of Impedances and Dissipation Factor by M. C. Holte, H. P. Hall and J. G. Easton, General Radio Company, Cambridge, Massachusetts
- A New Sweep for Displaying the True Parameters of a Network by Richard W. Sosnowski, Radio Corporation of America, Camden, New Jersey

10. MANAGEMENT OF SMALL R AND D ORGANIZATIONS

- Program prepared in cooperation with the IRE Professional Group on Engineering Management
- Engineering Management in Electronics by J. G. Bold, Jr., ACT Electronics, Alexandria, Virginia
 - Engineering Management in a Growing Laboratory by R. E. Samulson, Motorola, Inc., Phoenix, Arizona
 - Management of a Small Research and Development Organization by Gomer L. Davies, The Davies Laboratories, Inc., Riverdale, Maryland

National Electronics Conference

Tenth anniversary meeting and exhibition in Chicago, Oct. 4-6, features 21 technical paper sessions and displays by over 115 companies

Electro-Measurements, Inc., Portland, Ore.	42
Electro Products Laboratories, Chicago, Ill.	41
Electronic Associates, Inc., Long Branch, N. J.	76-77
Elgin Metallformers Corp., Elgin, Ill.	18
Everetts Associates, Inc., Chicago, Ill.	131
Fairchild Camera and Instrument Corp., Hicksville, N. Y.	89
Federal Telephone and Radio Corp., Clifton, N. J.	9-10
T. R. Finn and Company, Inc., Hawthorne, N. J.	26
Freed Transformer Co., Inc., Hawthorne, N. J.	65
Fusite Corp., Cincinnati, O.	15
General Electric Co., Schenectady, N. Y.	106-107
General Radio Co., Cambridge, Mass.	87-88
Gertsch Products Inc., Los Angeles, Calif.	32-33
John Gombos Co., Inc., Irvington, N. J.	37
Green Instrument Co., Inc., Cambridge, Mass.	113
Harry Halinton, Chicago, Ill.	3
The A. W. Haydon Co., Waterbury, Conn.	19
Heath Co., Benton Harbor, Mich.	81A-81B
Helipot Corp., South Pasadena, Calif.	111-112
Hermetic Seal Products Co., Newark, N. J.	108
Hewlett-Packard Co., Palo Alto, Calif.	44-45
Hughes Aircraft Co., Culver City, Calif.	23-24
The Indiana Steel Products Co., Valparaiso, Ind.	81
I.R.E., New York, N. Y.	12-13
International Resistance Co., Philadelphia, Pa.	23A

Kalbfell Laboratories, Inc., San Diego, Calif.	22A-22B
Kay Electric Co., Pine Brook, N. J.	61-62
Keithley Instruments, Cleveland, O.	17
Kellogg Switchboard and Supply Co., Chicago 2, Ill.	74
Kepeco Laboratories, Flushing, N. Y.	129-130
Ketay Manufacturing Corp., New York, N. Y.	67-68
The James Knights Co., Sandwich, Ill.	85
Laboratory for Electronics, Inc., Boston, Mass.	136
G. H. Leland, Inc., Dayton, O.	34
Erik A. Lindgren and Associates, Chicago, Ill.	73
Magnetics, Inc., Butler, Pa.	143-144
Magnuson Associates, Chicago, Ill.	118
Mark Products Co., Morton Grove, Ill.	14
Hugh Marstrand and Co., Chicago, Ill.	96
Measurements Corp., Boonton, N. J.	1
Mepeco, Inc., Morristown, N. J.	117
Midland Mfg. Co., Inc., Kansas City, Kan.	66
William Miller Instruments, Inc., Pasadena, Calif.	97
Millivac Instrument Corp., Schenectady, N. Y.	93
F. L. Moseley Co., Pasadena, Calif.	47
Mycalex Corp. of America, Clifton, N. J.	38
New London Instrument Co., New London, Conn.	27
North Electric Mfg. Co., Galion, O.	55
John Oster Mfg. Co., Racine, Wis.	11
Panoramic Radio Products, Inc., Mount Vernon, N. Y.	116
Photocircuits Corp., Glen Cove, N. Y.	110

Polarad Electronics Corp., Brooklyn, N. Y.	48
Polytechnic Res. and Dev. Co., Inc., Brooklyn, N. Y.	82
Potter and Brumfield, Princeton, Ind.	75A
Radio-Electronic Eng., New York, N. Y.	20
Radio Receptor Co., Inc., New York, N. Y.	35
Raytheon Manufacturing Co., Newton, Mass.	58-59-60
Reeves Instrument Corp., New York, N. Y.	121-122
The Rex Corp., West Acton, Mass.	23B
Robinson Aviation, Inc., Teterboro, N. J.	84
Rutherford Electronics Co., Culver City, Calif.	8
Sanborn Co., Cambridge, Mass.	43
Servo Corp. of America, New Hyde Park, N. Y.	36
Servomechanisms, Inc., Garden City, N. Y.	23C-23D
Shallcross Mfg. Co., Collingdale, Pa.	109
Sigma Instruments, Inc., Boston, Mass.	99
Sola Electric Co., Chicago, Ill.	139-140
Sorensen and Co., Inc., Stamford, Conn.	141-142
Southwestern Industrial Electronics Co., Houston, Tex.	28-29
Sperry Gyroscope Co., Great Neck, N. Y.	145
Sprague Electric Co., North Adams, Mass.	90-91-92
R. Edward Stemm, Chicago, Ill.	30-31
Strat-O-Seal Mfg. Co., Chicago, Ill.	4
The Superior Electric Co., Bristol, Conn.	123-124-125-126
Surprenant Mfg. Co., Boston, Mass.	137-138

(Continued on page 137)

which will be presented at the Hotel Sherman in Chicago Oct. 4-6

- (d) "Opportunities Presented to an Engineer by a Small R and D Organization with Good Management" by Arthur Macassewski, ARF Products, Inc. River Forest, Illinois.
- 11. RADAR AND NAVIGATION**
- (a) "Oceanography and Electronics Meet at the Surface of the Sea" by Allen H. Schooley, Naval Research Laboratory, Washington, D. C.
- (b) "Radar Interference Caused by Atmospheric Reflections" by George Opatyke and Peter Keady, Westinghouse Electric Corporation, Baltimore, Maryland.
- (c) "An MTI Evaluator" by J. R. Wilkerson, Airborne Instruments Laboratory, Inc., Mineola, New York.
- (d) "Subminiature Airborne Communications and Navigation Equipment" by Paul D. Rockwell, Bendix Radio Division, Baltimore, Maryland.
- 12.30 P.M.—LUNCHEON IN THE BALLROOM**
- Luncheon Address: "The Importance of Technical Symposia" by Dr. A. N. Goldsmith, Editor Emeritus, I.R.E., New York, New York.

- 1.30 P.M.—TECHNICAL SESSIONS**
- 12. TELEVISION**
- (a) "A New Method of Eliminating the Transient Distortion Associated with Vestigial Sideband Systems of Transmission" by Tom Murchison and Richard W. Seasefeldt, Pacific Corporation of America, Camden, New Jersey.
- (b) "A Linear Color Television Receiver" by C. Howard Jones, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania.
- (c) "CRT Deflection System Using Transistors" by John W. Taylor, Jr. and Thomas M. Moore, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania.

- 13. ELECTRON TUBES**
- (a) "Characteristics and Structural Features of Developmental Low-Noise Traveling Wave Tubes for S and C-Band Operation" by Paul R. Weisbach, Radio Corporation of America, Harrison, New Jersey.
- (b) "New Developments in the Raytheon Recording Storage Tube" by R. C. Bergsma, A. Luffman, and C. Sawyer, Raytheon Manufacturing Company, Waltham, Massachusetts.
- (c) "A Closed Form for the Transit Time of Electrons With Initial Velocities Traveling Between Two Parallel Plane Electrodes" by M. Javid, Illinois Institute of Technology, Chicago, Illinois.
- (d) "The Transient Conduction of Current in Very Low Pressure Xenon-Filled Hot-Cathode Diodes" by John C. Schuder, Purdue University, Lafayette, Indiana.

- 14. INSTRUMENTATION II**
- (a) "Measurement of Dielectric Absorption in Quality Capacitors Required for High Accuracy RC Timing Circuits" by H. E. Ruehlmann, U. S. Naval Ordnance Laboratory, Silver Spring, Maryland.
- (b) "Coating Thickness Measurements Using Pulsed Eddy Currents" by Donald L. Wadswick, Argonne National Laboratory, Lemont, Illinois.
- (c) "Improved Electronic Apparatus for Measuring Depression Induced Physiological Changes" by Homer I. Dana, Claude C. Barnett, and Deza R. Denison, State College of Washington, Pullman, Washington.

- (d) "Broadband Automatic Attenuation Recorders for Microwave Frequencies" by R. E. Henning and H. W. Hunt, Sperry Gyroscope Company, Great Neck, New York.
- 15. COMPUTERS**
- (a) "A Formal Procedure for the Logical Design of an Optimum Counter" by Bernard Cohen, Raytheon Manufacturing Company, Newton, Massachusetts.
- (b) "Accuracy and Speed in Analog Computer Dividing Circuits" by C. D. Morrill, Goddard Aircraft Corporation, Akron, Ohio.
- (c) "Electromechanical Analogue Simulates Transient Phenomena and Governor Action in 10 kc Network Analyzer Generators" by C. M. Davis, Iowa State College, Ames, Iowa.
- (d) "The Electronic Aspects of the Canadian Sorting of Mail System" by M. Levy, Post Office Department, Ottawa, Ontario, Canada.

6.00 P.M.—HOSPITALITY HOUR

7.00 P.M.—N.E.C. TENTH ANNIVERSARY BANQUET IN BALLROOM
(Ladies invited. Dress Informal)

WEDNESDAY, OCTOBER 6

8.30 A.M.—REGISTRATION
Lobby

9.00 A.M.—9.00 P.M.—EXHIBITS
Displays of electronic equipment components and new developments.
Exhibition Hall and Mesonette

9.30 A.M.—12.00 P.M.—TECHNICAL SESSIONS

- 16. ELECTRONIC CIRCUITS**
- (a) "Electronic Filter for High Voltage Power Supplies" by Victor Wouk, Beta Electric Corporation, New York, New York.
- (b) "Integrating Amplifier" by R. M. Close, Airborne Instruments Laboratory, Inc., Mineola, New York.
- (c) "A New High Quality Audio Amplifier Output Circuit" by D. J. Tomcill and A. M. Wiggins, Electro-Voice, Inc., Buchanan, Michigan.
- (d) "Universal Power Supplies for Vehicular Radio" by Ken Backman, Motorola, Incorporated, Chicago, Illinois.

- 17. SOLID STATE DEVICES AND CIRCUITS**
- (a) "Power Output of a Diode Amplifier" by Stanley Zisk, U. S. Naval Ordnance Laboratory, Silver Spring, Maryland.
- (b) "A New Microwave Detector Using a Cadmium Sulfide Thin Film" by Gese Strull, Northwestern University, Evanston, Illinois.
- (c) "Voltage Punch-Through and Its Effect on the Maximum Operating Voltage for Junction Transistors" by H. Scheibel, Raytheon Manufacturing Company, Newton, Massachusetts, and H. Stata, Raytheon Manufacturing Company, Waltham, Massachusetts.
- (d) "A Single Junction Transistor Bistable Flip-Flop Circuit" by W. D. Rowe, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania.
- (e) "Design Considerations of Junction Transistors at Higher Frequencies. Based upon an Accurate Equivalent Circuit" by Ernest Guillemin, Massachusetts Institute of Technology, Cambridge, Massachusetts, and Herman Stata and Robert Pucel, Raytheon Manufacturing Company, Waltham, Massachusetts.

- 18. ANTENNAS**
- (a) "Coastal Omnidirectional Slat Antenna Arrays" by Stanley I. Cohn and Alfred J. Moehn, Armour Research Foundation, Chicago, Illinois, and George J. Cohn, Illinois Institute of Technology, Chicago, Illinois.
- (b) "Microwave Images" by J. R. Paffy and B. M. Hurlbut, U. S. Naval Ordnance Laboratory, Silver Spring, Maryland.
- (c) "A Magnetic Radio Compass Antenna Having Zero Drag" by Alfred Hamphill, Bendix Radio Division, Baltimore, Maryland.

12.30 P.M.—LUNCHEON IN THE BALLROOM

Luncheon Address: "Engineers in Society" by Dr. J. M. H. Raa, President, Sandia Corporation, Albuquerque, New Mexico.

2.30 P.M.—TECHNICAL SESSIONS

- 19. ELECTRON TUBE RELIABILITY**
- Program prepared in cooperation with the AIEE Subcommittee on Electron Tubes of the Committee on Electronics
- (a) "Development of the Premium Triode RCA 6J4WA" by George W. Barclay, Radio Corporation of America, Harrison, New Jersey.
- (b) "Vacuum Tube Reliability in the Univac" by Louis D. Wilson, Remington Rand, Incorporated, Philadelphia, Pennsylvania.
- (c) "Experience With Tube Reliability in the Industrial Control Field" by E. H. Disner, General Electric Company, Schenectady, New York.
- (d) "Reliable Voltage Regulator Tube" by R. E. Lynch, CBS-Nytro, Danvers, Massachusetts.
- (e) "Factors Affecting Tube Life in Present Day Military Applications" by J. R. Gortola, Aeronautical Radio, Incorporated, Washington, D. C.

- 20. SERVOMECHANISMS AND CONTROL**
- (a) "An Appraisal of Nonlinearities in Servomechanisms" by Donald C. McDonald, Cook Research Laboratories, Skokie, Illinois.
- (b) "A New Simple General Criterion for Determining the Stability of Servomechanisms" by Thomas J. Higgins and Edward M. Michalek, University of Wisconsin, Madison, Wisconsin.
- (c) "Addition to Sampled-Data Theory" by G. V. Logo, University of Missouri, Columbia, Missouri.
- (d) "A Simplification of Aircraft Automatic Antenna Tuning" by David T. Gaiser, Sprague Electric Company, North Adams, Massachusetts.

- 21. MATERIALS AND COMPONENTS**
- (a) "Low Power Pulse Transformers Utilizing Ferrites" by Michael Gerardo and Lawrence Hobson, Sprague Electric Company, North Adams, Massachusetts.
- (b) "A Wide-Band High-Frequency Transformer Using a Ferrite Core" by T. R. O'Meara, University of Illinois, Urbana, Illinois.
- (c) "Noise in Composition Resistors" by G. T. Conrad, Jr., National Bureau of Standards, Washington, D. C.
- (d) "Automatic Production of Water Coil Inductive Components" by A. Zack and T. Wroblewski, Sylvaco Electric Products, Incorporated, Ipswich, Massachusetts.

Thermoplastic Insulated Tri-Axial

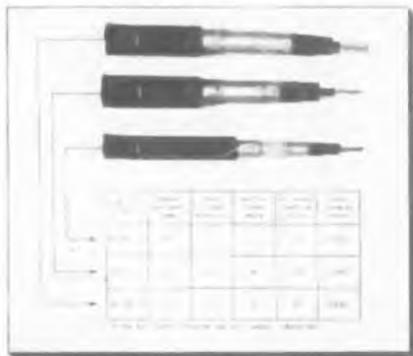


Fig. 1: Cables now meet 3 power requirements

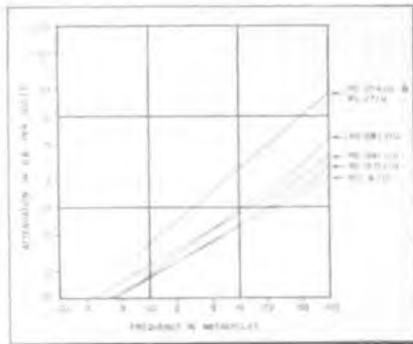


Fig. 2: Lower line losses with new cable

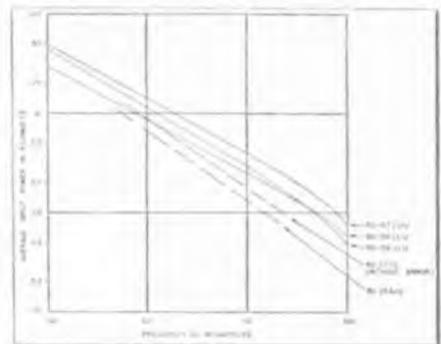


Fig. 3: Power rating is increased 100% at 10MC

Power handling capabilities up to 40 megawatts are in sight with this new cable which employs a polyethylene dielectric and an additional shield to minimize noise.

By **JACK SPERGEL** and **MILTON TENZER**
Signal Corps Engineering Labs
Fort Monmouth, N. J.

THE primary function of a pulse cable is to transmit a continuous train of short, high voltage dc pulses from a modulator to a magnetron for modulating the r-f energy. The maximum peak power output of a "soft tube" line type modulator is obtained when the characteristic impedance of the pulse cable and the pulse forming network are the same and equal to half of the optimum "impedance" of the hydrogen thyatron (ratio of peak plate voltage to the peak current) used for switching purposes. Since half of the peak plate voltage of the thyatron is developed at the pulse cable, it should be capable of operating at a voltage slightly above this value without the initiation of corona. Pulse cables should also be capable of transmitting pulses for lengths up to 200 ft. with reasonable fidelity of the pulse shape; and at their rated power levels, they should not radiate spurious noises which may interfere with nearby sensitive communication receivers. Furthermore, the cable must transmit the average power of the modulator at high ambient temperatures without causing undue heating which will deteriorate the dielectric and shorten the service life of the cable. Pulse cables are required to be flexible over the temperature range of -40°C to $+85^{\circ}\text{C}$, and in certain applications where the r-f



J. Spergel

M. Tenzer

section of the transmitter is affixed to the movable part of the antenna system, the cables must withstand continuous flexing and bending.

The increasing output powers of modulators require cables of higher peak voltages and lower impedances. To meet the needs of these modulators with a reasonable number of cables, the military services agreed in Mar. 1950 to base all future development activities about standard impedance levels of 50, 25, and 12.5 ohms. Practically, it has been found desirable to have cables of more than one peak operating voltage at any impedance level to allow for greater flexibility in designing modulators. Accordingly, requirements exist for cables at the 6-10 kv and 12-15 kv voltage levels at impedances of 50 and 25 ohms, and at 12-15 kv and 25-30 kv at the 12.5 ohm level. Standard pulse cables such as

the RG-25A/U and RG-27/U have been designed about the 50 ohm impedance range. This paper is limited to three medium power cables (2 to 16 megawatts peak) designated as RG-156()/U, RG-157()/U and RG-158()/U which have recently been developed by the Signal Corps Engineering Laboratories in conjunction with the Federal Telecommunication Labs., Inc. Fig. 1 illustrates the general construction of these cables and their electrical ratings. The higher power cables (9 to 40 megawatts peak) at impedance levels of 25 and 12.5 ohms are currently under development.

These new cables differ most significantly from the current standard rubber pulse cables in that they utilize polyethylene as the primary dielectric in lieu of rubber, and they incorporate a braided copper shield insulated from the normal coaxial structure. (This construction has been termed "triaxial"). Polyethylene was selected due to its extremely low loss characteristics and low permittivity at high frequencies, and for its excellent dielectric strength and corona resistance. The "triaxial" construction was employed to minimize the noise radiation from these cables which becomes more significant as the cables are required to operate at higher and higher peak powers.

Cable Characteristics

The limitation on the peak power rating of a pulse cable is determined by the highest pulsed voltage it can transmit without the initiation of corona. The high coefficient of thermal expansion of polyethylene has heretofore served as a detriment for use in high voltage cable due to the formation of voids between the con-

Pulse Cables

ductors and the dielectric after thermal cycling. Laboratory measurements on carefully manufactured polyethylene coaxial cables of similar size revealed that corona is first established at the interface between the dielectric and the braided outer conductor as the applied voltage is increased. These voids were eliminated by employing a high coverage braid design which also optimizes maximum tightness and minimum dimensional changes after successive expansion and contraction of the cables. Further improvement and greater reproducibility were obtained by incorporating a thin semi-conducting layer between the dielectric and the first braid on all three cables. This semi-conducting layer with a resistivity in the range of 100 to 1000 ohm/cm comprised a mixture of polyethylene, polyisobutylene and carbon black, and adhered well to the dielectric under various conditions of handling. It appeared that by the use of a semi-conducting layer for voltage stress relief at the inner conductor of the RG-157()/U and RG-158()/U, a 20 kv rating could be achieved. Table I summarizes the 60 cps peak corona levels achieved on a limited number of experimental samples. It illustrates the high degree of corona stability in these cables after thermal cycling from -55° to -85°C , and at a pressure equivalent to an altitude of 50,000 ft., and -55°C .

An analysis of the equivalent circuit of corona discharge in the cable established that for unidirectional voltages, the very high resistivity of

the polyethylene dielectric permits a corona level of approximately twice the peak 60 cps corona level (i.e. at 60 cps, the full "peak to peak" voltage develops across an ionized void in the dielectric). Rubber dielectric pulse cables are limited to approximately $1\frac{1}{2}$ times this value. This was verified by the measurement of corona levels of half wave rectified 60 cps voltages on the RG-156()/U cable and by continuous pulse operation at 20 kv peak (twice its rated value) for 1000 hrs., without any evidence of detrimental corona on the cable. Accordingly, the nominal pulse ratings indicated in Fig. 1 are considered to be conservative and could possibly be revised upward with long time operational ex-

periences where the RG-156()/U may be safely rated for 20 kv, and the RG-157()/U and RG-158()/U may be safely rated for 40 kv.

Attenuation and Power Rating

The attenuation characteristics of these cables are of particular interest with respect to their effect on the average power handling capacity and pulse distortion for long runs of cable. Fig. 2 compares the measured voltage attenuation with frequency for the three polyethylene pulse cables under consideration, standard rubber insulated pulse cables (RG-25A/U and RG-27/U) and a general purpose polyethylene r-f cable (RG-8/U) of comparable size. The polyethylene pulse cables exhibit an attenuation of approximately 50% of the standard rubber pulse cables at 1 mc and about 25% of the standard cables at 10 mc. They are within 0.05 db/100 ft. at 1 mc and within 0.3 db/100 ft. at 10 mc of the attenuation of the standard RG-8/U cable. Beyond 10 mc the losses in the semi-conducting layers becomes a significant factor, and the attenuation of the polyethylene pulse cables starts to increase rapidly although it is still appreciably less than the RG-25A/U and RG-27/U at 100 mc.

The lower attenuation of the polyethylene insulated cables results in a lowered heating loss within the cable and consequently permits the transmittal of higher average powers for the same center conductor temperature rise. Fig. 3 compares the average input power for the poly-

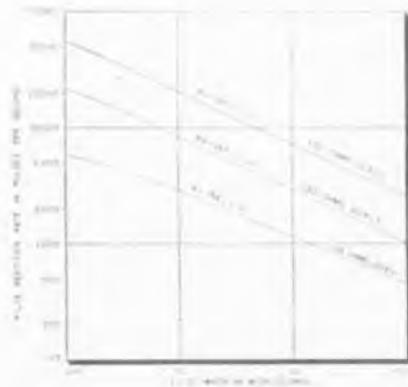
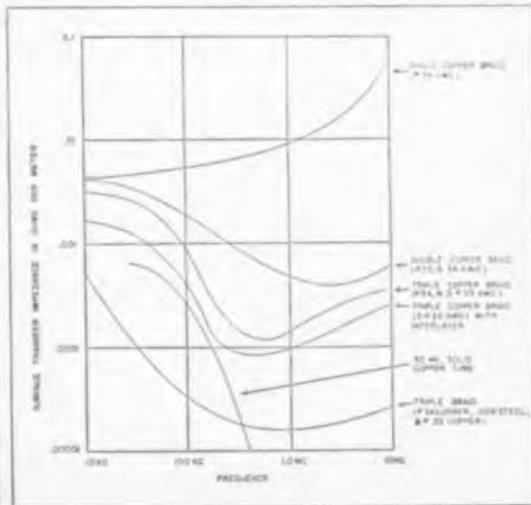
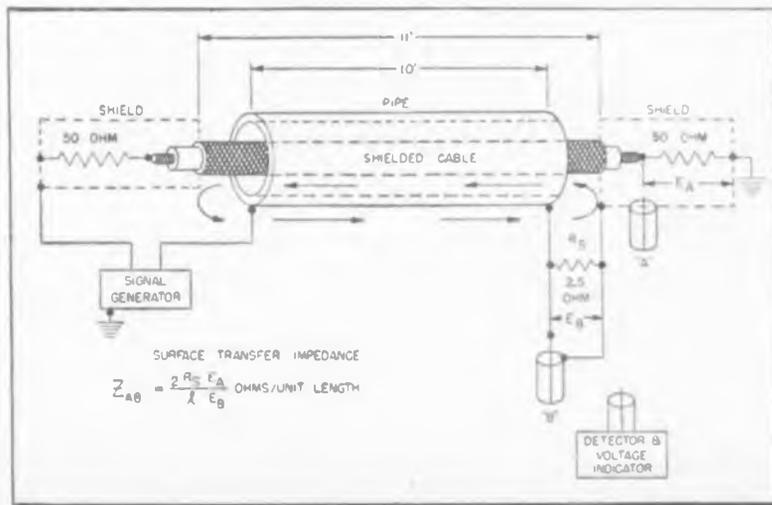


Fig. 4: Pulse ratings at maximum voltages

perience. This property of polyethylene also makes these cables very useful for high voltage dc applica-

Fig. 5: (l) Test set-up for measuring shielding efficiency. Fig. 6(r) Efficiency of various braid constructions as on a 0.285 in. core



Tri-Axial Cables (Continued)

TABLE I
Corona Test *Voltage Data (KV Peak)

Conditions	Cable Types		
	RG 156() U	RG 157() U	RG-158() U
Initial Room Temp. and Pressure	15.5	26.8	26.2
At -55° C and 50,000 ft	9.5		
After Five Thermal Cycles	15.3	17.0	25.4
At -55° C and 50,000 ft		19.0	20.2
After Five Thermal Cycles			
After Twenty-five Thermal Cycles	16.1		

* 60 Cycle

ethylene cables and their rubber equivalents based on a maximum center conductor temperature of 80°C and a 40°C ambient. The RG-156() U cable shows an increase in power rating of approximately 33% at 1 mc and approximately 100% at 10 mc over that of the RG-25A U. The increase of power rating of the RG-157() U over that of the RG-27 U (without armor) is approximately 50% at 1 mc and 120% at 10 mc. These curves were computed from the attenuation data of Fig. 2 and temperature rise measurements using 60 cps ac power to heat the center conductor.

Of more concern to the design engineer are the power ratings under pulsed conditions which have been illustrated in Fig. 4. These curves represent computed values of the pulse repetition rate and pulse widths at which the cables may be safely operated within both their thermal and voltage limitations. Curves are shown for the rated peak voltages for each cable. All combinations of repetition rate and pulse widths above the curve result in an excessively high duty cycle so as to exceed the average power rating of the cables; conversely, the cables may be safely operated at any combination of pulse repetition rate or pulse width below the curve at a given operating voltage and stay within their thermal limitations. For operation at any lower voltage, a similar curve can be drawn which will be above and parallel to the rated voltage curve. At a given pulse width and reduced voltage, the repetition rate can be increased proportionately to the square of the ratio of the rated voltage to the reduced voltage. The pulse ratings of the thermoplastic insulated cables are

again significantly higher than their rubber dielectric counterparts, particularly for the narrower pulse widths.

For ease of comparison, the ratio of the average power, or the equivalent maximum duty cycle for various pulse widths have been tabulated in Table II. Although the RG-157() U is rated for 20 kv, the comparison with the RG-27 U is based on a 15 kv peak operating voltage for a truer picture of their relative average powers. (It should be noted that when RG-157() U is operated at 20 kv, the permissible duty cycle is reduced by approximately 44%.)

Another factor which may be of considerable interest is the distortion of pulses (particularly of narrow pulse widths) when long lengths of cable are required. Visual comparisons were made of the output pulses obtained from lengths of RG-25A U, RG-156() U and a 50 ohm resistor

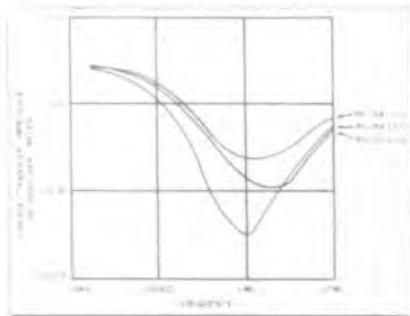


Fig. 7: Measured surface transfer impedance

for various pulse widths. A reasonably faithful reproduction of the pulse shape was obtained; however, the amplitude of the pulses below a $\frac{1}{4}$ μ sec. was markedly greater for the polyethylene cable. The measured attenuation of the RG-25A U as compared to the RG-156() U was approximately $2\frac{1}{2}$ times as great for a 0.12 μ sec. pulse and $4\frac{1}{2}$ times as great for a 0.03 μ sec. pulse.

Noise Radiation

In view of the higher peak powers these cables can transmit, greater emphasis was placed on the efficiency of shielding and means of reducing radiated noise, particularly in the region from 10 kc to 5 mc. The effectiveness of shielding was measured at low power levels in terms of surface transfer impedance (expressed as ohms meter) which is defined as the ratio of electrical intensity (volts/meter) of the cylindrical TE leakage

wave to the total current (amps) flowing in the cable conductor.

The surface transfer impedance was measured by supporting the cable in a solid brass pipe as shown in the schematic diagram of Fig. 5. The cable was terminated at both ends in its characteristic impedance and an r-f signal was impressed between the braid of the cable and the pipe. The current in the pipe was measured by the voltage drop (E_{II}) across a low impedance resistor (R_s) at the output end, and compared with voltage induced in the length of cable, which can be closely approximated by half of the voltage (E_A) developed at one of the terminating resistors. (By the reciprocity theorem, this transfer impedance function is also a measure of the voltage per unit length developed in the pipe or free space for a unit current flow in the cable conductor.) This measuring technique provided excellent correlation with computed values of various thickness of copper tubes up to 5 mc.

At the present time no limit has been established as an acceptable level of surface transfer impedance nor has any correlation been established with conventional noise figures. Fig. 6 illustrates the large variation in surface transfer impedance which can be obtained from various combinations of shielding materials. Above 100 kc the shielding effectiveness of multiple copper braids in electrical contact improve almost directly as the total thickness of the copper at any cross section. Any indication of effectiveness of copper braids may be obtained by comparing the data for a 30 mil tube with the 27 mils thickness for the double copper braid and the 40 mil thickness of the triple copper braid. The substitution of a steel wire in lieu of copper for the second braid of a three braid shield results in even a higher degree of isolation (i.e. a lower surface transfer impedance)

(Continued on page 146)

TABLE II
Comparison Of Rubber And Polyethylene Pulse Cable Under Pulse Conditions

Pulse Width (μ sec)	Ratio Of Average Power** (duty cycle)	
	RG-156() U RG-25A U	RG-157() U RG-27 U*
0.04	2.0	2.3
0.1	1.7	2.0
0.4	1.3	1.55
1.0	1.2	1.35

* RG-27 U without armour

** average power at +80° C center conductor and +40° C ambient temperature

Transistor Reliability in Low Power Audio Uses



By F. M. DUKAK
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IN ORDER to report on the reliability of any component in an application two requirements first must be satisfied.

- (1) There must be a large number of units in service for a length of time that approaches reasonable expectation of service.
 - (2) There must be a systematic plan for the recovery and analysis of all service failures.
- In order to evaluate how the component fits into the more general reliability picture, two more requirements should be added.
- (3) The electrical and mechanical environmental conditions of the application have to be known and defined.
 - (4) What constitutes an electrical "failure" has to be described.

These four requirements have been met in the first mass application of transistors, namely the hearing aid application. In the case of (1) Raytheon now has in this service about one million diffused junction PNP transistors with plastic encapsulation and leads sealed in glass. As far as (2) is concerned, it is particularly fortunate that the field service given by hearing aid manufacturers is of such a nature that practically all field failures are eventually available for count and analysis. The electrical and mechanical environment and required performance in the application is well established.

In the case of mechanical environ-

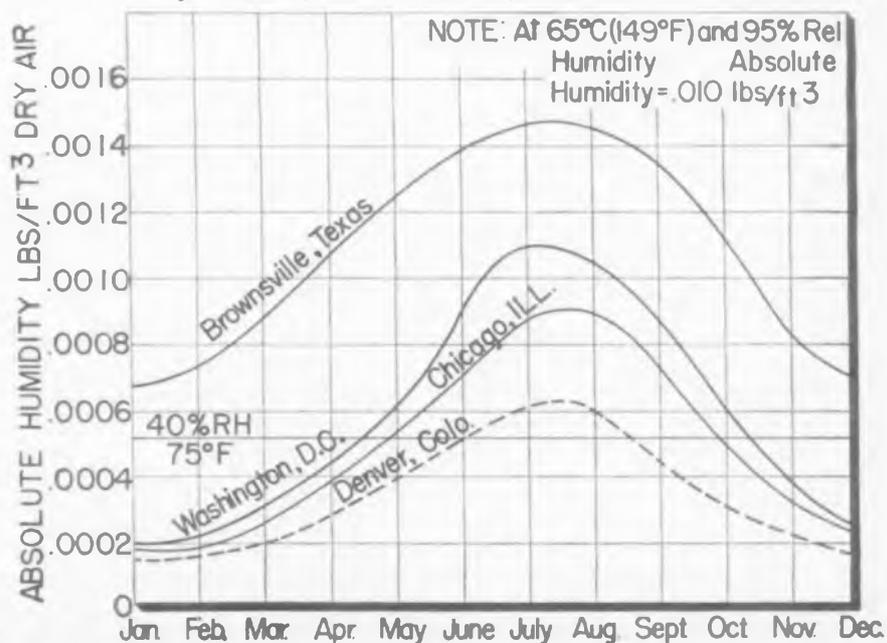
An analysis of field failures in quantity produced transistors for their first year of service in hearing aids. 2% predicted as realistic industry reliability figure

ment, we are mostly concerned with temperature and humidity. The maximum temperature at which the hearing aid may be expected to operate is probably not very much greater than body temperature, 40°C being a reasonable figure. Of course, in some instances direct sunlight may increase the temperature to 60°C. Generally speaking, there are few instances where the lower temperature end will drop below freezing. Absolute humidity, rather than relative humidity is probably a better measure of the effects of moisture, as it more nearly approximates the ability of water vapor to penetrate a plastic.

Fig. 1 is a plot of the average absolute humidity in selected cities of the United States. This information is calculated from Weather Bureau averages of temperature and relative humidity. On this basis, Denver, Colorado appears to have the least

humid conditions, while Brownsville, Texas has the opposite distinction. A line has been drawn on this plot at .0005 pounds of water vapor per cubic foot dry air absolute humidity. This represents a temperature of 75°F and approximately 40% relative humidity, a condition where even non-encapsulated units normally are satisfactory in all respects. It will be noticed that "normal" cities like Chicago are above this line during the summer months but integrate out to an average over the year that is somewhere around the critical point. However, Brownsville and other Gulf cities are above the line throughout the year. Despite this there has been no indication within our year's experience that shows an observable difference in the failure rate between very humid and dry cities. This fact has been verified many times by our hearing aid customers. It would be well to

Fig. 1: Seasonal plot of absolute humidity at selected cities in USA



Transistor Reliability (Continued)

**TABLE I:
ELECTRICAL ENVIRONMENT**

	Low	Usual	Range	High
Collector Voltage	.5	.8-1.8		6
Collector Current (μ a)	100	300	2000	5000
Collector Dissipation (mw.)				12

add that the absolute humidity number for the commonly used 65°C "95%" relative humidity test conditions is .010, which is almost 20 times above the average absolute humidity for this country as a whole. Furthermore, there are indications that with relative humidities above 80% that the normal diffusion laws for water vapor no longer hold and penetration through films is accelerated. These factors account for the successful operation, despite high humidity.

An intangible factor is how the humidity environment is affected by the fact that the hearing aid is being worn on the body. In that connection, we can only describe measured comparisons of ambient humidity and actual humidity close to the body. These indicate that at high ambient temperatures, the more humid the ambient condition the less the body increases it. For example, on a hot summer day with the temperature at 85°F and the humidity at 50% (absolute humidity .0009), absolute humidity under clothing and close to the body was .0015, or an increase of 67%. Thus, we might say that the effect of the body increased the climatic conditions from those of mid-summer Washington to those of mid-summer Brownsville, Texas. We were also able to generate artificially in a large test chamber an absolute humidity at 90°F of .0017—a condition somewhat worse than that of Brownsville, Texas. Although our subject objected rather violently to the experiment, we found that the effect of body proximity now increased the absolute humidity by only 6%. These experiments indicate that we should peak the lower curves more sharply in Fig. 1 when the body effect is included.

As far as other mechanical environment factors are concerned, we can dismiss them rather rapidly because even the severest shock to which a hearing aid can be subjected and still remain in one piece will not damage a plastic encapsulated trans-

istor with secure connections inside and outside the transistor.

Electrical Environment

Table I shows the usual range of electrical operating conditions. Note that the voltages, currents, and attendant dissipations are generally low. It is important to comment here that a great many hearing aids have been manufactured that do not use the so-called stabilized circuits, and these aids would be particularly susceptible to cutoff current creep if such did occur. The usual hearing aid uses no heavily degenerated circuits that might tend to compensate for variation of transistor gain on life.

Performance Requirements

The usual transistor aid consists

**TABLE II:
RELIABILITY FIGURES**

	%/year in first year	%/1000 hrs. in first year	Years to attain
Transistor (Hearing aid service)	1	.50 ¹	1.5
Electron Tubes (Hearing aid service)	2	.5 ²	15
Electron Tubes (Reliable)		1.5 ³	6
Electron Tubes (Television)	5 ¹		15

Note 1. 1953 report of one large TV mfr.
2. Assuming 4000 hrs./year of service
3. Various ARINC reports.

of three transistors with an overall electric gain of 70-100 db, depending on the model and the severity of the hearing loss it is built to correct. The writer understands that most users can detect a gradual deterioration in the gain of their instrument of 10 db. Some critical cases may detect a 3 db drop. The noise factor of the first stage is important. In tube aids the usual noise factor was about 12-15 db, and transistor aids now easily meet this figure. If the NF increases 10 db above this, it will generally be noticeable. Microphonics has always been a problem in tube aids, but this is not so with transistors. It is also important to note that hearing aids build up many hours of service with the average aid probably being used 10-12 hours a day.

Having covered environments and performance requirements, let us now consider field experience. First, we should clear up some early problems that arose in transistor manufacture.

In the manufacture of a reliable

component, the component manufacturer and his customer, the equipment manufacturer, do everything to develop a reliable end product. However, it is not common to achieve complete reliability immediately. Usually the need of certain corrections has to be pointed out by field results and this information fed back into the manufacturing processes.

Some of the early Raytheon transistors developed a mechanical problem having nothing to do with the transistors per se, which had to be corrected in production. The problem was one of opening connections which incidental to their opening developed rather bad noise characteristics. The noise was felt by some engineers to be due to moisture penetration through the plastic. Their position in that regard was to a certain extent justified, when we consider that a very excellent paper¹ had been presented at the IRE Convention of March 1953 which showed that moisture and transistors under certain conditions were not

**TABLE III:
RETURN ANALYSIS***

In order of test:	
Leads Broken	.134
Opens	.0000161
High Cutoff Current	1.06
Drifting Cutoff	
Current	.108
Gain	.244
Noise	.452
*In percent of total shipped.	

compatible. However, the authors of that paper were careful to note that "we believe that for many purposes completely adequate reliability can be obtained at lower cost from proper plastic encapsulation." Our field experience to date has now proved this statement to be completely true. The open problem was in itself very serious, but the corrections were relatively simple and control tests established to preclude a recurrence now show less than 1 transistor in 10,000 which is open in the outgoing product. The field return figures which we will now present will be given from May 1, 1953, the date this correction was effective.

Field Results

The first of these transistors are now completing a year of service, but it will not be until May 1955 that this will be true of all the transistors shipped during the May 1953 to May 1954 period. Thus, at this time we have reached only slightly beyond the half way mark, and the percent return figure at this time can not be

precisely stated. However, it is possible to examine the rate of shipment versus rate of return curves at this time and make some reasonable estimates of the expected reliability. There were initial indications that the failure rate would be about 1%, but this did not take into account certain large shipments during the first quarter of 1953 that did not make their presence felt in the field returns until several months later. It now appears that 2% is a more realistic figure for the industry as a whole with at least two large hearing aid manufacturers currently below 1%.

Compare this with other known or generally quoted reliability figures which are given in Table II. It is thus seen that transistors in the space of one and a half years have equalled the reliability figures for hearing aid tubes. However, the figures given are those for the last two years of hearing aid tube production after over fifteen years of development. It is not entirely proper to compare the hearing aid service with reliable tube service, but in any case, the generally quoted 1.5% figures per 1,000 hours is included as a number that is considered as satisfactory for some of the most highly regarded tubes.

Returned Transistor Breakdown

Table III gives a breakdown of faults in returned transistors, actually found defective. A mitigating circumstance that in effect reduces the total transistors found defective should be mentioned. Actually, over the year, as production improved, there has been a steady tightening of production limits for cutoff, gain, and noise. Cutoff limits have been tightened almost 2:1, gain limits by 4 db, and NF reduced by 6 db. Average noise factor has improved 10 db. However, in determining whether or not a returned transistor was in fact defective, the same limits as the then current production limits have been employed. Thus, it is possible and probable that many units found defective were defective because they did not meet current limits. They actually may have been good to the limits to which they were originally manufactured. In the interest of accurate reporting, this situation is unfortunate.

From Table III it is apparent that cutoff current characteristics account for the major portion of the field failures—closely followed by noise. These defects are all due to changing conditions at the surface of the transistor as far as we know, and it

(Continued on page 130)

AUTOMATIC PRODUCTION OF TV SETS

Photos show steps of Admiral's automatic assembly using a printed circuit which approximates one half of the vertical TV chassis



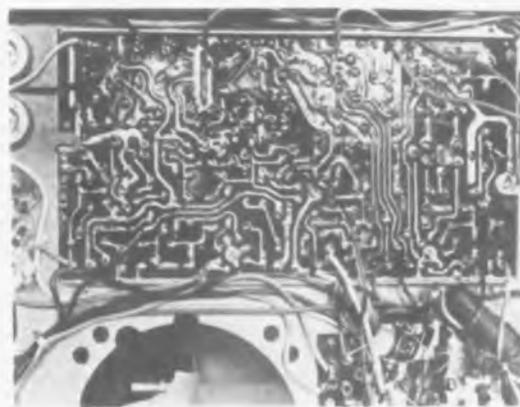
Employee holds printed circuit assemblies showing front and back. Robot I in background was constructed by Admiral Corp. engineers. It is 30 ft. long, places components on printed boards



Large drawing of circuit layout is photographed and reduced to sharp actual sized negative. "Picture" is printed on aluminated plastic sheet one side of which is covered with copper foil



Printed circuits for TV are produced 12 on a sheet. Here employee does any retouching needed. Boards are later cut, trimmed and punched



Close-up shows a printed circuit installed on TV chassis. 69 parts and components and 8 tubes comprise this printed circuit design



Larger components are inserted into printed circuit board by hand, but Robot I inserts 50 assorted resistors, and wire jumpers automatically



Dip soldering completes assembly. Robot I success has caused company to build two other larger machines scheduled for early 1955

Communications
 - transoceanic 10-1
 - mobile 10-2

Sound Broadcasting
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+ relation to power industry

Sound movies
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Television
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Electric phonograph
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 - metering



DR. ALFRED N. GOLDSMITH

AN ELECTRONIC PROPHET WITH HONOR IN HIS INDUSTRY

Twenty-five years ago this month, long before there was an electronic industry or even the word electronics, Dr. Alfred N. Goldsmith sketched out the above notes to visualize an extemporaneous prediction regarding the future growth of this industry. The present publisher of TELE-TECH, who conceived the idea of an engineering publication to be called "Electrons," interviewed Dr. Goldsmith to secure data as to the potential for engineering readers. Dr. Goldsmith, who is ambidextrous, took a fountain pen with black ink in his right hand and a fountain pen with red ink in his left hand and, on several sheets of notepaper, drew up the advantages and disadvantages of such a publication, the period needed for development of electronic end products, the potential audience, etc. It is noteworthy that his prophecy on the growth of the various branches of the industry was not only correct in its volume ratios but the industrial applications which he predicted were actually rated last in his extrapolation.

The Years Ahead

Dr. Alfred N. Goldsmith

It was less difficult in 1929 to look into the future of electronic developments than it is in 1954. Presumably, it will be even more difficult late this century to foresee the further and complex trends of electronic progress. Some reasons for the increasing difficulty of prediction in this field are its steady and vast expansion, the extraordinary diversity of the devices utilizing electronic techniques, and the widening perspective of the many and broad possibilities continually appearing. He who ventures to predict the amazing electronic future must steer a careful middle course between a dull and inadequate conservatism and an unbridled flight of imagination verging on the field of science fiction.

The electronic future is definitely assured however, because of certain fundamental human characteristics. Man has always had an understandable and apparently an irresistible urge toward an easier life. Electronics is a basic art capable of simplifying man's tasks, reducing the strain of carrying them out, and speeding up their accomplishment.

Then, too, man is an ambitious creature, ridden by curiosity, and desirous of extending the scope of his senses indefinitely. Man's senses, however, are limited in the distance they can cover, their precision, and their speed of perception and response. Electronics offers the fundamental means of vastly increasing the limited capabilities of human senses.

ELECTRONIC IMPACT ON HUMAN LIFE

Any glimpse into the electronic future requires first a brief recapitulation of some presently known methods of applying electronics to the advantage of humanity, and the benefits which thus result.

In the field of communications, electronic agencies have known extraordinary versatility and scope. Mass communication, or broadcasting, whether of sight or sound, has become world-wide. Its influence on human activities and reactions is incalculable. More recently, a limited sort of mass communication (which might be termed "narrowcasting") has been proposed in various forms of transmission for tolls. Such transmissions or programs must be paid for by the recipient. Necessarily, their reception must be controlled either by coding or by the use of restricted channels as in community systems.

CENTERCASTING

Up to the present, mass communication has been a one-way proposition. That is, in broadcasting the messages travel outward to the recipients. But the response of the recipients or their reactions must presently be gathered by other and fairly primitive recording means. In the future there may well be a complementary system whereby the viewing and listening audience also becomes instant respondents, conveying their reactions or questions to a central point for appropriate analysis and action. Such a system might be termed "centercasting." It might in time become a powerful instrument of developed democracy.

WORLD-WIDE COMMUNICATIONS

In addition to mass communication, electronics has provided person-to-person communication on a large scale, both between fixed points and mobile vehicles. Indeed, in the ultimate, there is little reason to doubt that substantially the entire population of the world will

carry communication means associated with an international network, thus enabling any person anywhere to reach any other person at any time. This possibility presents both attractive and worrisome possibilities.

ELECTRONICALLY CONTROLLED MANUFACTURE

But the scope of electronics extends far beyond communications. Manufacture, in particular, will draw heavily upon electronics in the future. Electronic equipment and controls will handle much of the routine labor in the extraction, fabrication, quality checking, and transportation of raw materials. The manufactured articles may be stored systematically and inventoried accurately by electronic means. And it is already clear that the routine steps in commerce, such as accounting, billing, and collection are capable of electronic handling with high speed and accuracy.

EXPANDING ELECTRONIC SERVICES

A different but equally significant application of electronics is in the services it can render in many different branches of science. Practically every part of physics and the related areas of applied physics will benefit. Precise mechanical measurements and recordings become possible. Accurate thermal studies on a large scale are feasible. In the optical field, as one characteristic example, the computation of complex reflective or refractive systems can be carried out by electronic computers so rapidly and dependably that hitherto impracticable studies become easily realizable. The entire field of acoustics from supersonics to zone silencing will draw upon electronics.

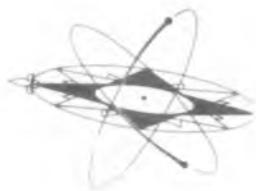
Of great human importance will be the utilization of electronics in the fields of biology and medicine. Diagnosis and prognosis will draw upon a myriad of measurements made by electronic devices or dependent upon electronic controls and records. Computers, in analyzing diagnostic data with thoroughness and clarity, will give the practicing physician most valuable tools. Medicine can even utilize electronic effects directly as methods of treatment. Diathermy, supersonic energy-focusing, elec-

"The Years Ahead"

tronic volumetric scanning to locate abnormal conditions, and many other applications can readily be foreseen. The electron microscope has already shown great promise. Indeed, one of the difficulties of so powerful a tool is the problem of interpreting the pictures which it produces. The extraordinarily high magnifications yielded by this instrument open a new world in which all is strange and unfamiliar. But in the years ahead the interpretation of electron microscope pictures will be a well-developed art.

ELECTRONIC UNIVERSE

Passing from the extremely small to the unimaginably large, the entire universe will be studied with increasing scope and accuracy through electronic means. Electronic light amplifiers will not only broadly improve the vision of man but, in the field of astronomy, will add to his knowledge of far distant galaxies. Already radio telescopes are adding markedly to our knowledge of stellar physics by indicating the existence and nature of certain "dark stars," and conditions existing in the great spaces between the stars and galaxies. It will probably take centuries to build up wholly acceptable explanations of the formation, evolution, and present condition of the cosmos. But when that task is well advanced, the workers in that field will owe much to electronics.



ELECTRONIC VISTAS

Any fairly complete listing of the electronic devices and methods for the years ahead would be in the nature of an encyclopedia rather than a broad analysis. Accordingly, some of the devices and systems to be mentioned below are intended solely as hints of the lines progress may take.

TRANSCIVERS

Extremely compact and wholly portable personal transceivers will become available. As a minimum, these will supply color television and sound, possibly with tridimensionality included. The wrist-watch forms may be intended for one-way operation; slightly larger pocket models for two-way systems, with selective calling. These, however, may require a highly desirable cut-off switch.

PORTABLE RADAR

Portable radar equipment will be widely used, with automatic guidance attachments indicating, by sound or tactile means, the desirable direction of travel of the user. These may be employed by the Military Services, policemen, watchmen, and blind people. (One may even imagine inebriates locating keyholes by radar, the key insertion being handled by an appropriate servo motor!)

ENGINEERING APPLICATIONS

The utility of electronics in the various fields of engineering is obvious. Electronic devices enable instant and accurate measurement. They permit the storage of vast amounts of information. They permit carrying out exact and elaborate computations at hitherto impossible speeds. Even today's airplanes are designed and "flown" electronically, so to speak, within the designers' offices. Simulated flights are carried out, defects appear and are diagnosed, and remedies are devised and tested. In hours or days, and at minimum expenditure of effort and funds, airplanes and/or guided missiles, existing only in data record form, are put through their paces and accepted or discarded.

ELECTRONIC WEAPONS

Not only in the arts of peace but also in the grim field of war electronics plays a master part. Radar, sonar, loran, and shoran, radio guidance and control, television, infra-red detection and viewing, and a host of electronic applications are basic parts of modern military techniques. Indeed, there has been talk of a "push-button war"—and somewhat indignant rebuttal of its likelihood. But it is at least certain that in the years ahead electronics will add increasingly to the scope and deadliness of the weapons and the effectiveness of the defenses devised by man. It is to be hoped that this branch of electronics, despite its effectiveness, may ultimately play a diminished part in the affairs of men.

There has been considerable speculation as to forms of broadcasting or communication-carrying messages discernible by human senses other than sight and sound. Such methods are at least abstract possibilities, of presently unknown human attractiveness and desirability. They include teletactile transmission of solid forms or pressures. Such devices would be very helpful to the blind. And even persons with normal vision could be taught various forms of construction, metal working, and model making more readily by devices which, through three-dimensional scanning and surface formation, display solid objects.

MOVIES WITH 3-D COLOR-TV

In an allied field, large-screen three-dimensional color television would be an attractive addition to theater presentations. In years ahead these will likely be available to audiences not requiring such visual aids as polarized glasses. It may even be possible to replace stereoscopic images by panoramagrams—which show a fully solid and different aspect from every viewpoint in the auditorium and thus fully simulate the three-dimensional continuum of a legitimate-theatrical performance.

TELESENSORY COMMUNICATIONS

Telolfactory transmissions of odors or perfumes are also a possibility. Assuming that any desired odor can be simulated by a combination of a smaller number of "basic odors," such transmission might be an interesting addition to color pictures of rose gardens—but not of subways.

Telegustatory transmissions, simulating a wide variety of tastes may also be developed through the discovery of a limited number of basic taste stimuli.

Telethermal transmissions, giving a sense of the tem-

perature of a viewed object, may be simulated by control of radiant heat from a local source. Thus, a burning building or a forest fire would be given added realism through telethermal reception.

However, sight and sound remain the fundamental channels of human communication; the remaining types of transmission mentioned above will be of distinctly secondary importance and probably used only for special purposes. Indeed, unless men become more discriminating and demanding in their communication requirements, such methods may be left in abeyance for decades or even centuries.

Electronics can create as complete a simulation of the physical surroundings and aspects at the pick-up point as may be specified. Only desirability and economic limitations will control the use of these methods. In other words, electronics has the amazing capability of broadly providing "telesensory communication," and almost without restriction.

THE ELECTRONIC ROBOT

An overall view of the complexity of the human brain is rather discouraging to the electronic researcher. It includes about 100 billion cells, each of unknown complexity, and widely interconnected by a myriad of trunk lines and plexi. Practicable vacuum-tube constructs might include 1,000 or perhaps even 10,000 tubes. Transistorized assemblies might include 10 or 100 times as many elements. Yet the brain, utilizing molecular relays is a million times more elaborate in its structure. Further, its individual "relays" are so delicately poised that one might say that they are responsive to thought itself.

It should not be inferred, nevertheless, that the modern electronic computer, despite its small-scale simplicity as compared to the brain, is free from some of the behavior patterns of human beings. A cold computer, when first turned on, requires time to reach a stable thermal and electrical condition. In the interim, its behavior is hesitant or erratic. In crude analogy, one might say that heat has a function in the post-dormant computer analogous to hot coffee for human beings!

Everyone is acquainted with the distressing mental weakness known as a "fixed idea." Such an idea, no matter how frequently it is suppressed, recurs in "circular" fashion in the mind of the victim. There is here a process broadly reminiscent of the circulation of an impulse around an electrical network, with somewhat greater amplification than is desirable. In the human analogue, the idea may become too strong, and completely and uncontrollably dominate its victim. In the electronic analogue, the amplification may become so excessive that the entire system breaks into steady and uncontrolled oscillation.

The human patient may be cured by shock treatment or by the severing of nerve trunks (the operation being known as prefrontal lobotomy). The electronic patient may be cured by judiciously applied potentials or pulses, or alternatively by the opening of critical connection channels. While these analogies should not be pressed far, they do indicate significant resemblances.

MICRONIZATION

Several goals must be achieved in the years ahead before an adequate electronic robot can be constructed. In the first place, it is clear that the "mammoth tran-

sistor" is far too large and bulky for inclusion in any manageable robot having a large number of highly differentiated functions. Super-miniaturization will be required. Indeed, what will be needed is "micronization."

The controllable on-off relay required for an effective electronic robot must be far smaller in proportion to a transistor than that device is in relation to a vacuum tube. Another difficult requirement of such relays is a super-sensitivity. In the case of the brain of man, the sensitivity is down perhaps to the level of thought control of physical action. But in any case, at present, the engineer cannot do better than to replace the mobile armature of an electromechanical relay by the controlled motion of electrons in tubes, or of electrons or holes in transistors. What is needed is the controlled shifting of a chemical radical in large organic and labile molecules. That is, a portion of a complex molecule must be shifted one way or the other, with corresponding electrical changes in the environment, as the result of excitation. Science in 1954 barely recognizes the existence of the problem and the method used by the Creator to solve it. The remote future may see man partially duplicating some of these super-sensitive and controllable molecular structures.

Another necessary element for the construction of an adequate electronic robot is a highly-excitabile electromechanical transducer. In human beings, the nerve pulses carried from the brain stimulate peculiar molecular aggregates in the muscles causing constrictions and relaxations. Indeed, the muscles may be regarded as living organic servo-mechanisms. Analogous structures will be needed to respond readily to the minute electrical changes in the basic relay elements of the electronic robot. Whether magnetostriction vastly elaborated and enhanced will be adequate for this purpose cannot be foretold.

It may be judged from the foregoing that electrochemical processes, which are an extension of electronic techniques, will play an increasing part in technology. At least such possibilities enable the imaginative scientist to envisage the possibility of quite capable electronic robots.

Under what circumstances will robots really become feasible and desirable? The electronic robot—or "elec-

(Continued on page 152)

Front and back views of the Founder's Award Medal (top) and Medal of Honor (below) from the Institute of Radio Engineers. Dr. Alfred M. Goldsmith is only scientist to have been awarded both



Designing

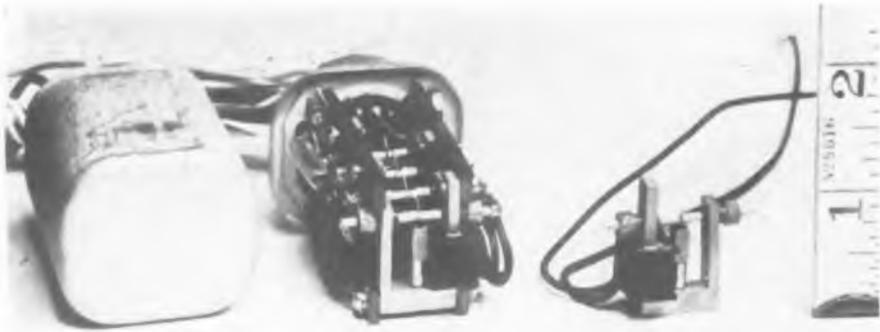


Fig. 1: Relay, uncased, occupies less than 0.4 cu. in. Operating time is adjustable from 50 to 300 μ sec

Development of this impulse type polarized relay hinged on the design of a simple armature capable of high speed, bounce-free operation at 5,000 CPS

IN recent years there has been an ever increasing need for a high speed relay either to work in conjunction with vacuum tubes or to replace them. GE was confronted recently with just such a problem. A production equipment required a relay which would operate in substantially less than one millisecond and still provide good reliability and life. As the particular application could not be met by presently available devices, it was decided to meet the existing need and provide for other applications by the development of a high speed relay. Since one millisecond relays were commercially available, to make a notable improvement the design goal, for speed of operation, was set at 100 μ sec.

In designing the relay, early emphasis was placed upon high speed operation and small size, with little or no attention to the practical problems common to relays. Once speed had been achieved these problems were overcome with little difficulty with the exception of contact bounce which required extensive effort.

The development resulted in an impulse type polarized relay having an operating time adjustable in the range 50 to 300 μ sec. The complete relay, uncased, (see Fig. 1) occupies less than 0.4 cu. in. and operates on less than 50×10^{-6} watt-seconds of energy. After considerable effort the contacts are essentially bounce free. Life tests indicate a life of more than 20 million switching operations at 300 vdc and 5 ma. Higher speeds and contact ratings are anticipated.

Having set a goal of 100 μ sec. operating time based upon what was needed rather than on what could be obtained, it was necessary to make



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some calculations to determine if there were any practical limitations to the attainment of this goal.

Magnetic Speed. The magnetic lag of the iron delays the flux build-up in the magnetic circuit and hence the effect of the driving impulse is also delayed. Flux is built up in the pole pieces in accordance with the following expression:

$$\text{time, } t' = \frac{2 \pi R^2 B_s}{p H (10)^9}$$

where R is the radius of the pole, B_s is the saturation magnetization in gauss, p is the resistivity of the magnetic path in ohm-cm., and H is the applied field in oersteds. Insert-

ing typical values in the above formula, the time required for flux build-up in the iron is 20 μ sec.

Armature Transit Time. The time required for the armature to traverse the gap between the pole pieces was calculated to be equal to:

$$t = 10 \sqrt{\frac{d l}{B B_s}} \quad (\text{approx})$$

where t is time in seconds, d the distance traveled, l is the length of the armature, B the flux density in the poles, and B_s the flux density in the armature. Assuming a relay configuration as shown in Fig. 2, and an armature 0.1 in. long, half of the mass of which is moved through a contact gap of 0.002 in. by a flux density of 15,000 gauss and substituting these values in the above equation the armature transit time is approximately 34 μ secs.

Current Build-Up in the Coil. Assuming a relay coil inductance of 50 millihenries in a critically damped circuit, the time necessary for the coil current to build up to 70% of its crest value was calculated to be 9.5 μ sec.

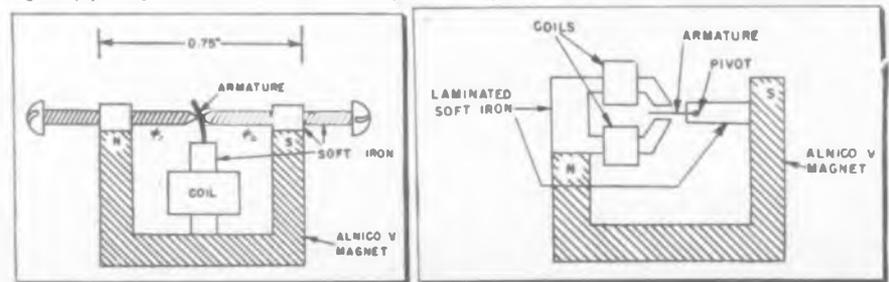
Feasibility. Even if these delays are sequential, which is not the case, the total delay is still less than 65 μ sec. This makes an operating time of 100 μ sec theoretically feasible. It will be shown later that some of the parameters assumed to obtain these figures have been bettered and that faster operating times are possible.

Eye to Future

The first relay was made to coincide as closely as possible with the parameters assumed in the speed calculations. In addition it was of a physical configuration, size, shape and weight, compatible with logical future demands of the relay.

First Relay. This relay illustrated

Fig. 2: (l) Relay 1—too stiff for 5000 CPS operation. Fig. 3: (r) Pivoted armature reacted in 500 μ sec



a High Speed Relay

Fig. 2, was made less than 1 in. sq. The main structure of the relay was a U shaped Alnico magnet. A soft iron, high resistivity armature of 0.002 in. stock was securely fastened to the supporting piece so that it acted as a cantilever beam. It was necessary for the armature element to bend in order to make contact. The Alnico magnet causes magnetization differentially with respect to the moving armature, providing a polarizing force, so that the armature stays where it is thrown without being held by the activating coil. This feature greatly reduces energy consumption and makes possible the

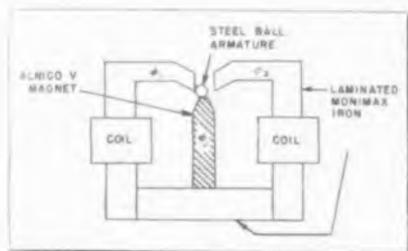


Fig. 4: Ball armature adjustment was critical

use of high peak currents without excessive heating of the activating coil.

The armature of this relay had an activation time of approximately 900 μ secs. It was determined that the speed limitation was due to not obtaining saturation flux in the armature during the driving transient. Examination of the magnetic circuit showed that the transient flux did not have an adequate magnetic path due to the inclusion of the low permeability Alnico in the transient flux path. Dynamic tests indicated that the armature had a natural mechanical resonance in the vicinity of 100 cps. Since operation at greater than 5000 cps. was anticipated, it was evident that an armature with a satisfactory natural resonant frequency would be so stiff that it could not be deflected with the forces available. The cantilever armature construction was therefore abandoned.

Second Relay. The second relay, shown in Fig. 3, was designed to overcome the two major difficulties encountered in the relay of Fig. 2. A complete soft iron path, broken only for the contact gap, was furnished for the transient flux. To

avoid the effects of the mechanical resonance, the armature was pivoted.

With a supply voltage of 24 v, operating time for this relay was approximately 500 μ sec. Tests indicated that a stronger transient flux was required to improve the operating time. Mechanically, this was difficult to obtain because of the small size, less than $\frac{3}{8}$ in. of the transient flux iron. The basic idea, however, was considered successful. Criticalness of the armature pivot indicated that there was considerable frictional loss at this point and it was decided that a better method of holding the armature should be found.

Third Relay. To provide more space for the activating coils, Relay 3 (see Fig. 4) interchanged the positions of the Alnico magnet and the soft iron. Doubt as to the adequacy of the polarizing force holding the armature was dispelled when it was found that the holding force was approximately 3000 times the mass of the armature. In accordance with theory and contrary to experience, the transient flux iron path was made of 0.004 in. laminations of Monimax iron cemented together.

Ball Armature

In a search for a better armature, calculations showed that the ideal armature should have a minimum length to thickness ratio. The physical shape that best met this requirement was a ball, hence a ball armature was tried. It was decided to try holding the ball in place only by magnetic forces. Since the holding force was large and the force field was so shaped as to keep the ball in the desired position, no difficulty was encountered with the ball straying from the desired location. Using the ball armature and convex pole faces, armature bounce time was longer than armature transfer time. A study of the bounce problem resulted in hollow grinding the pole pieces to fit the contour of the ball armature. This afforded a cushioning layer of air between the ball and the pole piece which quite effectively dissipated the energy of the transfer. Whereas the ball was originally considered ideal from the standpoint of minimizing the importance of mechanical adjustments, the necessity of aligning the concave pole pieces with the ball curvature

to get proper ball seating, made mechanical adjustment of the relay critical.

Using a supply voltage of 24 v, this relay showed a switching time of 175 μ secs and a bounce time of 225 μ secs. With concave pole pieces and proper adjustment, bounce was eliminated.

A very thin piece of soft iron sheet was substituted for the ball armature. This very simple armature operated so successfully that it appeared that a solution to the bounce problem could be obtained with the expenditure of much less time and effort than for the ball armature. Since time was of the essence, it was decided to place development emphasis on the thin sheet armature.

Fourth Relay. Being quite confident that the fundamental design necessary to give the desired performance was established by Relay 3, considerable thought was given to

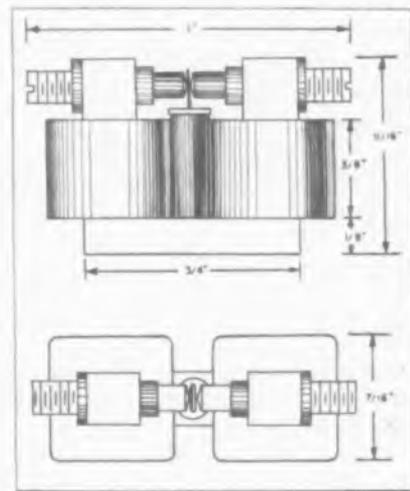
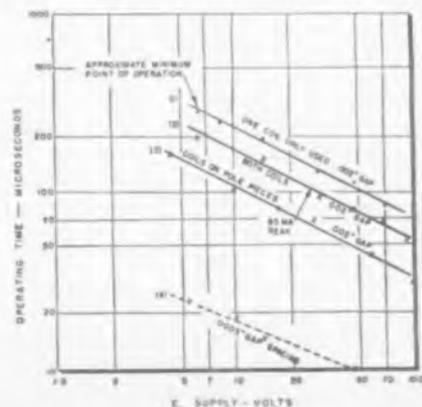


Fig. 5: Armature of Relay 4 is thin iron sheet

Fig. 6: Operating time and voltage for Relay 4



High-Speed Relay (Continued)

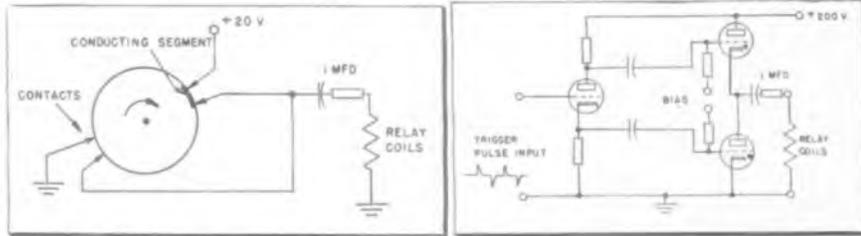


Fig. 7: (l) Commutator action assures maximum relay speed. Fig. 8: (r) Thyatron activating circuit

characteristics, other than speed, that are essential to a relay. Fig. 5 shows the resultant relay.

In general, the configuration is similar to Relay 3 except for several practical features. Since no apparent gain in speed was obtained from the use of the laminated iron structure, solid Nicaloi was used for the transient flux path. The pole pieces were made adjustable by making them of soft iron studs which could be screwed through a threaded nylon bushing. This bushing afforded the necessary contact insulation. A tendency for the armature to move about on the top of the Alnico magnet was curbed by the use of a slotted brass cup which was cemented to the top of the magnet. To provide for lower contact resistance and longer life, the pole pieces and armature were silver plated.

Fig. 6 shows the relationship between operating time and supply voltage for this relay. Three curves are shown for a contact spacing of 0.002 in. and one for a spacing of approximately 0.0005 in. No contact bounce or contact arcing was encountered within the range of the curves. It should be recognized that the data for these curves was taken under laboratory conditions and with optimum adjustment of parameters.

Leakage Flux

Curve #1 of Fig. 6 was made with only one 1000-turn driving coil mounted on the Nicaloi frame while Curve #2 was made with two coils. The fact that the relay is voltage limited and shows no magnetic saturation over the range explored is indicated by the almost exact two-to-one relationship between the two curves. The presence of a large amount of leakage flux in the design is exemplified by Curve #3 which was made by placing the two driving coils directly on the pole pieces and close to the contact gap. Data for Curve #4 was prompted by engineering curiosity to see just how fast a switching time could be ob-

tained by decreasing the contact gap in the relay used to obtain Curve #3. It was impractical because of the composite armature used, to measure the contact gap but it was estimated to be 0.0005 in. or less. With the smallest usable air gap, switching time was 5 μ sec. with a plus and minus 2 μ sec. time jitter.

Because of the requirements of the immediate application of the relay, the contacts have been designed to handle only 3 ma. at 300 v. Since a higher current rating would materially increase the usefulness of the relay, a project is now under way to improve the contact surfaces. Although the theoretical maximum operating rate of the relay is in excess of 10,000 operations per second, the practical requirement of post-transfer holding force, limits the maximum operating speed to 6500 per second in the present design.

Production Relay. The customer's specification required a four pole double-throw relay with an operating time of one μ sec. or less when operated from an energizing source of 24 vdc and capable of switching 3 ma. at 300 vdc for at least 15 million operations. The production units were built similar to Relay 4 but since maximum speed of operation was not required several simplifications were incorporated.

As shown in Fig. 1, four complete units were mounted in a standard relay can, 1 $\frac{5}{16}$ in. x 1 $\frac{1}{2}$ in. x 2 in. high, with plug in base using 14 pins. Two of the pins were used for the four relay coils connected in parallel and the other twelve pins for the four poles and eight contacts. The can was hermetically sealed and filled with dry nitrogen at one atmosphere pressure.

Damping

The inductance of the four coils in parallel was 0.018 h. at 1000 cps. and the resistance was 15 ohms. When driving the relay with a commutator from 24 vdc, it was found

that 4 μ fds. and 100 ohms in series with the four relay coils in parallel give a differentiated driving pulse with practically no overshoot. The damping thus obtained was approximately critical and gave adequate drive from a source of 17 v. The duration of the exponential drive pulse was approximately 2 milliseconds.

In a polarized relay, pick-up and drop-out times are equal. The nominal operating time for this relay with a contact gap of 0.002 in., was 250 μ sec. With a supply voltage of 100 v. this relay will operate in approximately 100 μ sec.

Contact Bounce Problem

It would be unjust to belittle the armature bounce problem as approximately one half of the total development effort was devoted to this problem. A mathematical analysis was made to determine the ideal armature, hence the desirable physical constants of the armature were known. To transform these physical constants into a piece of

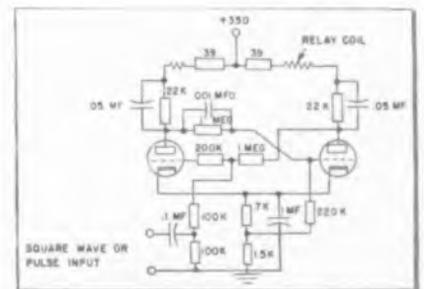


Fig. 9: High peak currents from flip-flop circuit

mechanical hardware was a real challenge to the ingenuity.

Armature bounce in the relay is effected by several parameters: driving pulse shape, amplitude and duration; pole piece shape; contact spacing; transfer time; and armature shape, composition, and configuration. It is obvious that in order to obtain fast switching time that the velocity of the armature during its travel, and hence its terminal velocity, must be high. Since the stored energy in the armature is proportional to the square of the terminal velocity, fast switching speeds are not conducive to low stored energy.

Holding Force

This stored energy is the cause of contact bounce and its effects must be overcome. Two methods of attack were used. The electrical circuit was tailored to provide high holding force when the armature
(Continued on page 134)

Page from an Engineer's Notebook

No. 28 — Squashed RF Coils Save Space

By I. GOTTLIEB, Calif. Reg. Electrical Engineer
15282 Mills Ave., San Lorenzo, Calif.

PROGRESS in development of a mass produced radio frequency device was bottle-necked by a not uncommon conflict between electronic design and mechanical layout groups. The latter found it necessary to modify the previously accepted arrangement of components on the chassis. In particular, this imposed a vexing problem with regard to placement of an RF coil. These coils, which had been purchased in great quantity, would no longer fit into the intended mounting space. Frustration permeated the engineering conference until one member of the group, motivated more by a desire to inject humor, than by serious intention, remarked how fine everything would be if only the coils could be squashed. Contrary to his expectation, the light-hearted suggestion provoked a determined investigation to examine the effect upon electrical characteristics produced by distorting the shape of the coil.

Form distortion

The coils had been wound to resonate at 2.2 mc with a 100 μ fd. capacitor. They consisted of fifty turns of #32 E. wire closely wound on a wax impregnated laminated paper form having an outside diameter of $\frac{7}{8}$ in. In order to comply with the new space requirements, the circular form had to be distorted into an approximate rectangular shape in which the ratio of long to short side was no less than two.

It was found that the "Q" of the inductor had been degraded only by about 10%, this being primarily the result of decreased inductance. Because of loading by inevitable circuit losses, the percentage reduction in "Q" was even less when the coil was connected in its circuit than that indicated by the "Q" Meter. A brass mandrel and the application of heat to promote flexibility made it a simple matter to change the shape of the coils.

Although the problem at hand was solved, it was decided to investigate further the effect of squashing the form. The results of these experiments are depicted graphically in Fig. (1). Note that when the coil has

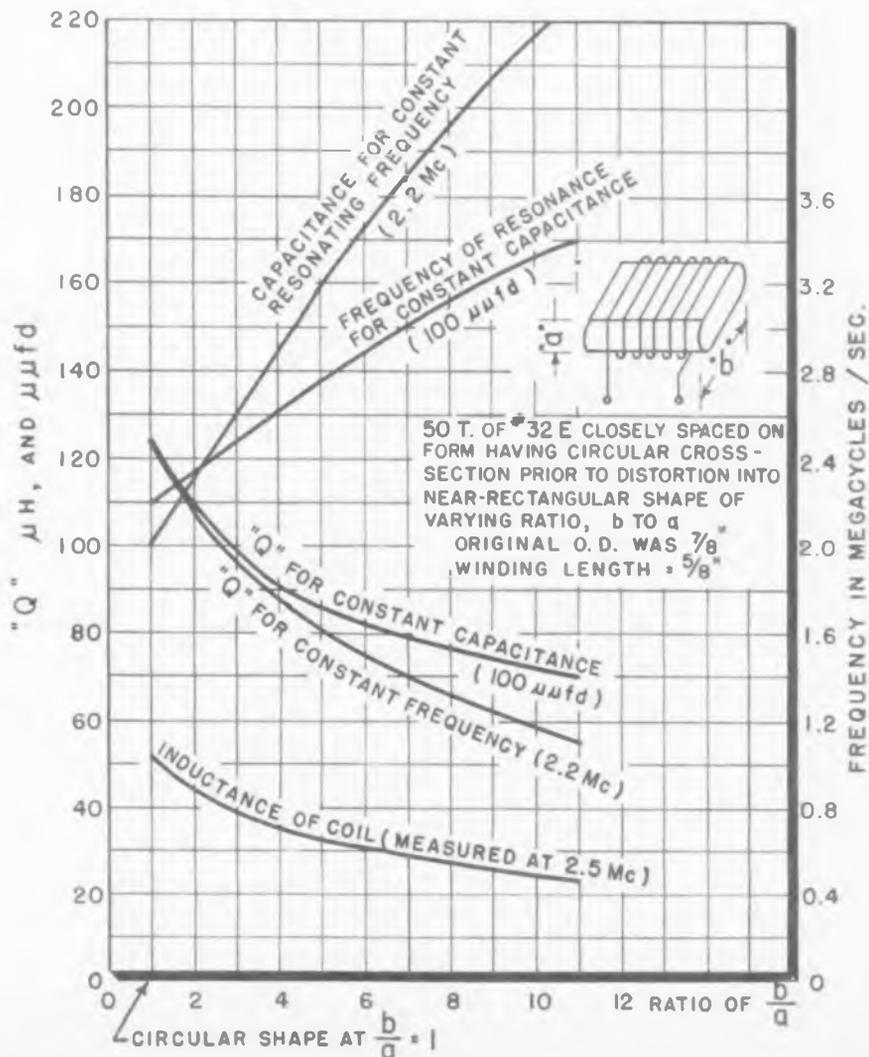
been completely flattened (Corresponding to a ratio of $b/a = 11$) its Q is about one half the value for the circular shape. Of course, the resonating capacitor must be increased in value to compensate for the diminished inductance. Another effect of distorting the original cylindrical shape is a slight increase in the effective distributed capacitance of the coil.

Conclusion

For ratios of b/a greater than about three to one, it is probable that a conventional coil wound on a

smaller circular form would begin to compete as an alternative to squashing. That is, if a coil is physically too large, a smaller version of it may be made by winding finer wire on a smaller form. The "Q" will then be lower than that of the larger coil. In some cases the squashed coil will show a higher figure of merit. This will depend upon the ratio b/a together with the economic, technical, and mechanical factors involved. In any event, the conventional cylindrical shape need not be used if space considerations dictate a more favorable geometric configuration

Fig. 1: Electrical behavior resulting from distortion of coil shape



CUES for BROADCASTERS

Practical ways of improving station operation and efficiency

Calculating Line Costs Quickly

GENE RIDER, Chief Engineer,
WQAM, Miami, Fla.

IN budget conscious medium operations, people like to know how much remote loops are going to cost before the lines are ordered. It is simple to lay out a large scale map (showing streets) of your metropolitan area with concentric circles spaced in quarter miles with the control room at the center, and number them off at each line.

From your telephone company rate letter, figure out the cost to each quarter mile zone, both equalized and non-equalized, permanent, and minimum billing, including installation and equalization costs. Type it up and attach to the circled map, turn it over to sales and use the time you would spend getting quotes on lines to better purpose!

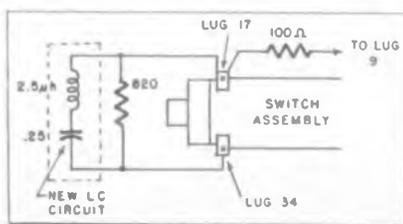
Tape Recorder Modification

W. E. BRADFORD, KSST,
Sulphur Springs, Texas

THE small Eicor tape recorder is very useful in the broadcast field. Unfortunately many broadcasters have found that material shows poor high frequency response when played back on the larger, "professional" machines. This lack of high frequency response is the result of design characteristics of many of the smaller recorders. Most small units compensate for gap size and tape characteristics in both the recording and playback characteristics of the machine. Most "professional" models do all high frequency compensation while recording and keep the high frequency response of the playback channel comparatively flat.

A simple modification of the Eicor makes it very adaptable to playback on professional studio equipment. The Eicor uses a RC network,

Tape recorder high frequency modification



\$\$\$ FOR YOUR IDEAS

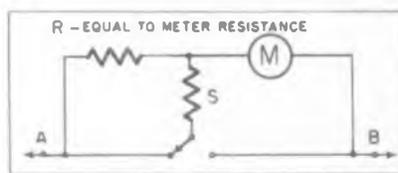
Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is requested. Our usual rates will be paid for material used.

R-14 and C-17 in series with the recording head to give a small amount of high frequency pre-emphasis. This consists of an 820 ohm resistor and a .05 MFD condenser. Replace the .05 condenser with a series LC network resonated at about 7000 to 8000 cycles per second. An ordinary 2.5 millihenry RF choke in series with a .25 condenser will hit close enough for practical purposes. This simple modification requires only a few minutes and provides within ± 5 DB between 50 and 6000 cycles when played back on a Presto PT-900. Although this modification gives excessive high frequency response when played back on the Eicor it does not seem to be objectionable and merely contributes to the crispness and cleanliness of the recorded material.

Constant Resistance Meter Circuit

A. C. HUDSON, Microwave Section,
National Research Council,
Ottawa, Canada

M is an ammeter and S is a shunt which can be switched across



Circuit providing constant meter resistance

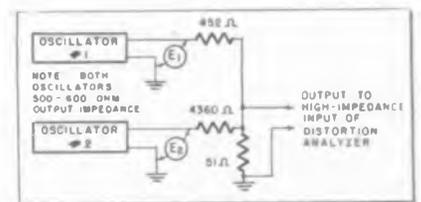
the meter to provide a second current range. The circuit shown may be used when it is important that the resistance of the current measuring circuit be unchanged as the meter range switch is operated. R is equal to the meter resistance, and a single-pole, double-throw switch connects the shunt across R when not in use across the meter. By inspection it may be seen that the resistance from A to B will not change as the switch is operated.

Checking Distortion Analyzers

T. A. PREWITT, Test Equipment
Engineer, Delco Radio Div.,
Kokomo, Ind.

DISTORTION analyzers such as the Hewlett-Packard 330 may easily be checked for accuracy by the application of a test signal which contains an accurately known percentage of distortion. Such a signal may be produced by mixing the outputs of two audio-frequency oscillators in the resistance network shown in the figure. Oscillator 1, which is set to the desired test frequency, must have good waveform if measurements of very low distortion percentages are desired.

Oscillator 2 is tuned to approximately 2-1/2 times the frequency of the test signal to simulate second and third-harmonic distortion. Avoid settings which are nearly exact multiples of the test frequency as these produce undesirable beats. When voltage E_1 is set at 10 volts, the percentage of har-



Test set-up for checking distortion analyzers

monic distortion in the output of the network will be the same as the voltage indicated on a voltmeter connected across E_2 (i.e., 6 volts-6% distortion). The required resistor values may be obtained by using series or parallel combinations of standard values.

Equipment Trouble Lights

F. H. FRANTZ, SR., 610 College
Drive, Starkville, Miss.

NEON lights provide excellent monitors for voltages in excess of seventy volts (AC or DC). The NE₂ neon bulb has pigtail leads and can be soldered into the circuit. The NE₁ has a bayonet base. A resistor of one meg or more should be wired in series with the lamp and the voltage source being monitored. With a neon lamp across all D supply leads, stage failure due to loss of B supply is immediately in-

icated by the extinguished neon lamp or lamps. A neon lamp placed near an RF circuit will glow if sufficient excitation is present.

Judicious placement of trouble lights will save trouble shooting time, and enable the engineer to make his equipment operational in the least time possible.

Field Strength Meter Support

BY V. R. DRENNER, *Engineer, KGGF, Coffeyville, Kansas*

KGGF utilizes a broomstick, a screw-in ferrule, and a piece of plywood as a support for the instrument. Here in Kansas—where the wind blows—this simple one-legged "tripod" gives that little bit of extra stability, and supports the meter for rotation. An adjunct for night-time readings is a "headlight"—one of those gadgets in which the light is worn on a strap around the head, and the batteries carried in a can fastened to a belt. The light can be focused on the meter and the hands thus left free.

Wireless "Third Line"

BY JOHN F. CLEARY, *WFBL, Syracuse, N. Y.*

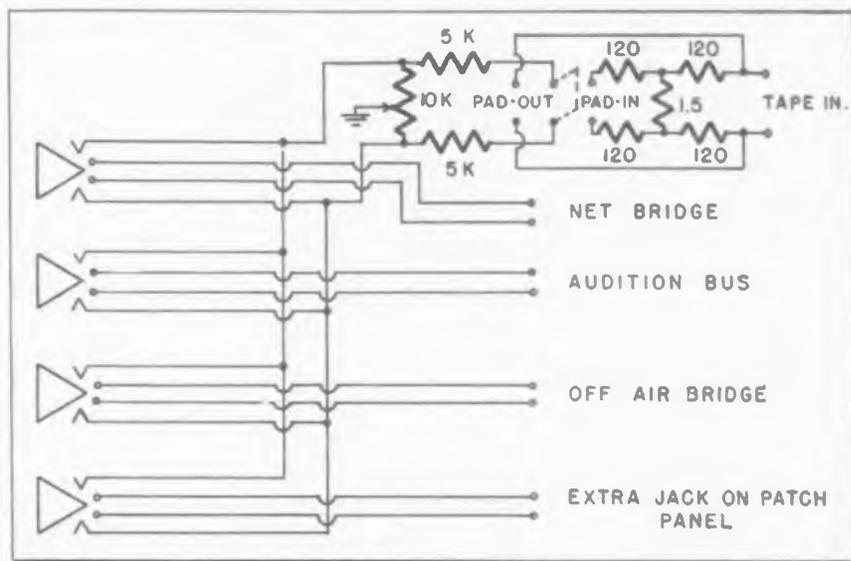
WFBL utilizes remote broadcast equipment to transmit program from studio to transmitter to eliminate excessive lost air time, and embarrassment, in case both program lines should fail at the same time. At the studio program is patched to a 15 watt, 153.35 megacycle Link fm transmitter feeding a high gain beam; a receiving high gain beam located at the transmitter feeds the companion receiver which is patched to the speech input equipment.

Remote Cue System

BY HARLES K. CHRISMON, *Chief Engineer, WFLO, Farmville, Va.*

THIS remote cue system permits the remote operator to call in any time even though he is receiving a cue feed at the same time, and on the same line. The advantages are obvious and many. The remote point is not isolated at any time prior to the air show since the operator may call in last minute changes or other information without the necessity of operating two lines to the remote point.

The heart of the system is a balanced bridge with the remote line across one branch. Cue is fed two points, with the listening



Bridged inputs for multiple tape recorder input eliminates rotary switches

amplifier taken from the opposite side. With the line connected and the bridge balanced the cue is therefore not heard at the speaker. Cue voltage developed across R4 is fed to the remote line. When the operator calls in, the voltage developed across R4 is out of balance with the input terminals of the listening amplifier and he is heard at the speaker. A linear wirewound potentiometer is used at R4 for balance under varying line conditions.

Multiple Tape Recorder Input

BY DONALD M. WHEATLEY, *Chief Engineer, WJOY, Burlington, Vt.*

IT was found, at WJOY, that a variety of different inputs was needed to feed our two tape recorders. Rotary switches with each input lead matched and padded

were not very satisfactory as feed on one position would be picked up on the tape as the switch passed through that position; also mismatches occurred when some other input was fed into the jack strip where the inputs appeared. Therefore we tried its circuit shown.

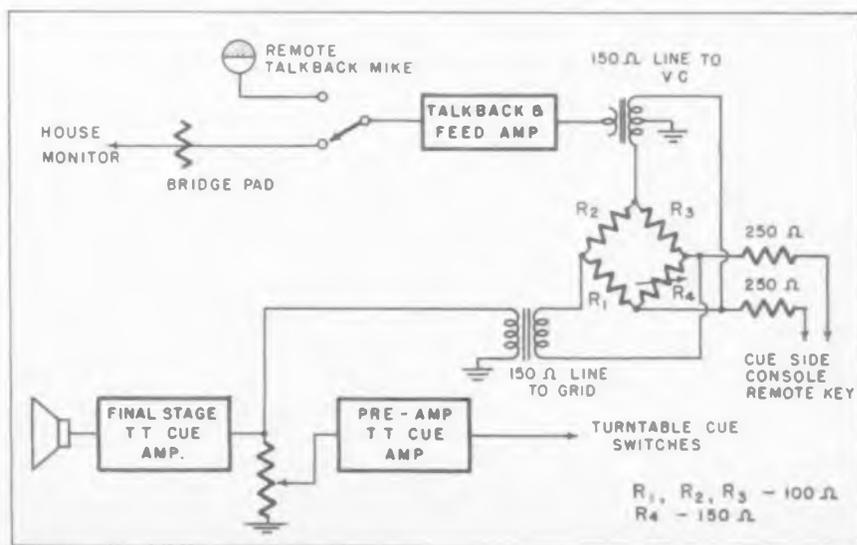
As we have two tapes we used two switches (Mallory type 2164 button) and paralleled the bridged inputs. The 10K pot was put in to help balance some unbalanced conditions we had run across.

Remote Record Start Device

BY JAMES S. NEWLAND, *WLOU, Louisville, Ky.*

AT WLOU we needed a remote start device for our PT-6 Magnecorder. To keep 110 v. ac off the remote start line a selenium bridge (Continued on page 100)

Remote operator can call in on same line while receiving cue with new cue system



Designing Scale Model Aircraft

Accurate predictions of antenna performance depend on precise duplication of the physical contours and electrical characteristics of the aircraft



Fig. 6: 7-ft. long 1/12 scale model of Douglas RB66 has flame sprayed copper surface and weighs 33.5 lbs. Fabrication time 6 weeks

By **ROBERT F. BLAINE**
Creative Engineering Corp.
10816 Burbank Blvd.
N. Hollywood, Calif.

Part One of this article, published in the Sept. 1954 issue of *TELE-TECH & ELECTRONIC INDUSTRIES* discussed basic model problems, equipment required and types of models generally used.

Most generally used model construction is the hollowed out wood model with any of several metal surfaces applied. Certain medium hard woods of fine even grain and no pitch content are excellent to work, dimensionally stable, and strong to withstand all reasonable handling. Some selected domestic basswoods are particularly good. For medium thin wings and empennage surfaces, or for helicopter blades and missile fins, lamination of the wood is recommended for strength and stability. Very thin elements are frequently shaped from aluminum or brass. Solid metal elements of course, add appreciably to time and cost.

Wood models are usually constructed of "half shell" fuselages to facilitate hollowing out. (See Fig. 7) Occasionally ribs and spars covered with thin aircraft plywood form large wing and tail surfaces to speed construction and keep weight down.

Metallizing Wood

A recently developed process requiring a regular commercial metallizing gun makes possible the very

satisfactory bonding of a sprayed-on coating of metal directly to the wood. (Fig. 6) It has been found that the regular operators of these guns, expert though they may be at building up worn shafts, thickening eroded tank walls, and other non-electronic uses for the metallizing gun, do not have the skill required for the delicate job of applying a well bonded, reasonably constant, thin coat of metal on wood. A highly specialized technique is required because this metal "envelope" on the model is a very critical factor in obtaining good pattern measurement.

The relatively low melting temperature of zinc makes it excellent for a first coat with copper as a second and final coat. When carefully applied, the zinc does not even slightly burn good wood, but will bond extremely well. Then as the hotter copper is added over the zinc, the latter dissipates the heat, and even a substantial layer of copper, if skillfully applied, bonds very well to the zinc without undue heating or any tendency to blister or separate from the wood.

Flame Spray

If a model skillfully metallized by a trained operator should later need rework and have its skin removed, it is not surprising to find the bond so good as to practically defy one to peel the metal clean from the wood. This finish, sometimes called

"flame spray" may be applied in thickness from about .010" to .020" or greater, a total of the two metals

As prepared for metal spraying the surface of the wood should not be too smooth. A medium grit abrasive properly used in finishing the wood, helps make the metal bond excellent, and allows soldering with little if any separating or "blistering." Best soldering technique requires medium to low temperature solder and quick, clean soldering "touches" to avoid unnecessary heat concentration.

Surface Protection

It was found in Lockheed's antenna laboratory that a light but complete spray coat of a plastic surface protector such as Krylon acrylic spray, if applied immediately after copper is sprayed, will protect the virgin copper from rapid oxidation during early handling as the model antennas are installed.

There appears to be room for testing to determine the effect on patterns which might result from varying areas of oxidation or corrosion over the model's surface in view of the fact that conductivity is a major factor in obtaining accurate measurements, especially at higher frequencies where currents act closer to the surface.

Surface Conductivity

Perhaps the most outstanding trouble encountered on metallized

Fig. 7: (l) Lockheed 1049 to 1/7 scale with access sections open. Fig. 8: (r) Isolated tail cap



for Antenna Analysis

Part Two
of Two Parts

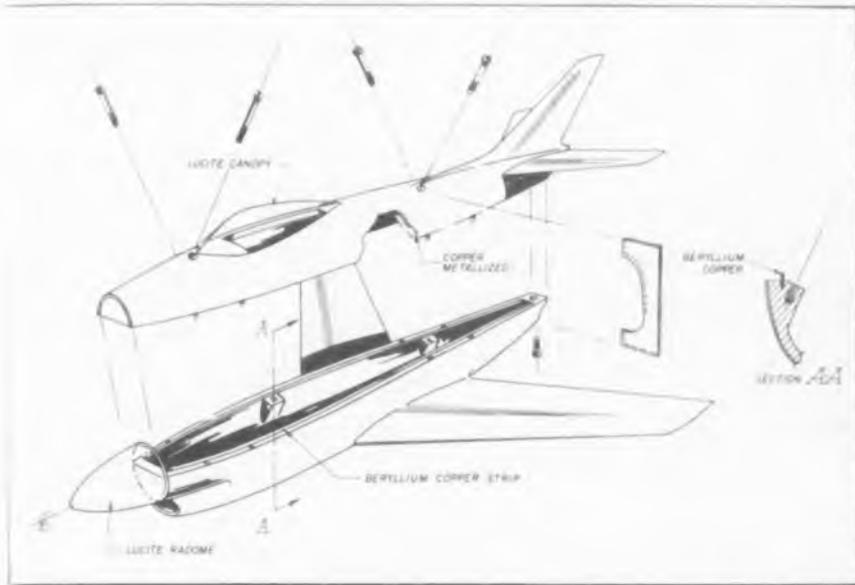


Fig. 9: (l) Method of providing access to hollow interior. Silver plated beryllium copper strip provides leak-free contact between shell sections. Fig. 10: (r) Douglas Aircraft's antenna range has elevated structure to minimize ground reflections. Nose section shown is movable along track

or flame-sprayed models is the tendency for the surface to exhibit different conductivity characteristics when checked between different sets of equidistant points over the surface of the model. Such difference in conductivity can cause current concentrations and dispersions which, depending on their magnitude, can cause noticeable inaccuracies in patterns.

In model measurements one generally considers that the surface of the aircraft is a continuous homogeneous surface except where obvious discontinuities exist such as wheel doors, windows, hatches, etc.

This assumption is satisfied as far as model studies are concerned as long as one is dealing with frequencies the wavelengths of which are very small compared to the model dimensions. This provides that skin currents flow a relatively short distance.

When making radiation patterns from antennas at points where the aircraft structure dimension is a portion of a wave length, it becomes important that the surface conductivity be uniform so that skin currents will take their natural path and not be shifted by non-uniform skin conductivity. This problem becomes particularly important when the aircraft structure becomes resonant.

Tests are in progress through cooperative efforts between C.E.A.

and the Lockheed antenna group, in which it is hoped to find improved consistency of conductivity by comparing patterns from a standard antenna and vehicle on which are mounted specially surface-treated "variables" in the form of transverse panels.

Because patterns showing the radiation, reflection, and shielding (shadow) effects in the high frequency ranges generally used in scale model pattern measurement are essentially functions of the shape and nature of the metal surfaces of the models, this matter of surface treatment is of great importance. "Skin effect" enters the problem at the higher frequencies because the depth of penetration of surface currents decreases while the smoothness of the surface, relative to the wavelength, decreases. Surface smoothness affects the total energy loss caused by heating, and it determines the nature of reflections.

From the foregoing, it follows that solid metal sheet or foil with constant conductivity characteristics should make a superior surface for scale models in antenna studies. Such surfaces are occasionally specified. One reason they are not more widely used is that the cost of a foil-covered or electroplated model may be as much as doubled, tripled—or more—because of the additional skilled labor involved in

applying sheet or foil to complex surfaces, and because the cost of electroplating complex surfaces is far greater than that of flame spraying. Furthermore, electrolyte tanks of sufficient size for larger models are not always available.

Movable elements such as control surfaces, tabs, and even landing gear and doors are often in critical areas and can be provided manually movable or positionable, flexibly bonded at hinge points. Again, such features reflect in higher time and dollar cost.

Generally speaking, the weight of flame-sprayed hollow wood models of, say 5 to 7 ft. in major dimension can easily be held to well under 40 lbs., and with some extra refinement in design and fabrication technique, can even be held to as little as 20 to 30 lbs.

Dimensional Stability

Where weather conditions are severe, and large diurnal temperature changes are a factor, hollow wood models should be designed with certain internal bracing features to assure dimensional stability.

Furthermore, proper design and location of the fastening method which secures access doors or removable sections to the main part of the model (for access to the interior) can help assure dimensional
(Continued on page 142)

New Technical Products for

VIDEO PROBE AMPLIFIER

The Model 60 video probe amplifier is designed to facilitate circuit examination with all types of oscilloscopes. Its use with any oscilloscope enables observation of the circuit without loading,



detuning, or other adverse effects. The unit system introduces no attenuation so oscilloscopes can be used at full gain for accurate observation of small signals. Frequency response is uniform from 5 cps to 12 mcps \pm 3db. The Model 60 also serves as a general purpose amplifier with a 40X gain and more than 12 v peak-to-peak output. **Donner Scientific Co., 2829 Seventh St., Berkeley 10, Calif.—TELE-TECH & ELECTRONIC INDUSTRIES.**

RELAYS

Snapper thermal time delay relays feature "snap-action" of contacts in inert gas-filled atmosphere. Units are S.P.D.T. and are available in 7 or 9 pin miniature or octal metal envelopes. De-



signed for ambient temperature operation ranges from 60° to 80° C., the relay operates on 6.3, 26.5, 115 v ac or dc, or as required. Time delay is from 2 seconds up. Withstands vibration of 30 G at frequencies from 5 to 55 cps. **Elly Electronics Corp., P.O. Box 395, Fair Lawn, N. J.—TELE-TECH & ELECTRONIC INDUSTRIES.**

AMPLIFIERS

Model BL-520 is a very high gain carrier amplifier that accepts signals from restive and inductive transducers. It will measure a wide range of physical phenomena on a direct-writing os-



cillograph. Maximum sensitivity is equivalent to $\frac{1}{2}$ μ v/ chart mm, or 0.25 micro-inches/inch for strain measurements. Model BL-530 will accept single-ended and differential signals with a 50 mv sensitivity and provide accurate calibration of recorded signals. Both units provide balancing voltages to 10 times full scale at input levels up to 500 v. **Bush Electronics, 3405 Perkins Ave., Cleveland 14, O.—TELE-TECH & ELECTRONIC INDUSTRIES.**

CRYSTAL

The JK-G3 miniaturized, high-stability crystal offers a high Q for maximum performance and a minimum aging drift. Frequency range is from 10 mc. to 100 mc. Vacuum sealing the unit in glass provides protection against shock and contamination. Because of



the glass insulation, there is no risk of wiring shorts even in the most compact assemblies. The JK-G3 was developed to help the trend toward compactness of equipment design and frequency assignments. **James Knights Co., Sandwich, Ill.—TELE-TECH & ELECTRONIC INDUSTRIES.**

RESISTOR

A wire wound resistor has been developed to meet the needs of the miniaturizing program taking place within the electronics industry. Built to customers' specifications, the hermetically



sealed unit is available in standard sizes down to $\frac{1}{4}$ by $\frac{1}{4}$ in. Designed to operate precisely in ambient temperatures ranging from -55 to 125° C. The unit features a low temperature coefficient of 20 ppm/degree C. and high stability. Resistance change with time is less than one-third the tolerance. **I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.—TELE-TECH & ELECTRONIC INDUSTRIES.**

COLOR MONITOR

The Model CD15 color monitor is specifically designed as a station monitor. Using a tri-gun 15 GP22 kinescope, it mounts in a standard 19 in. relay rack and occupies only 26 $\frac{1}{4}$ in. rack space. Use of a DC quadricorrelator type color sync circuit provides excel-



lent color stability and freedom from drift. Operates from composite video or video and separate sync. Employs 31 tubes in addition to the 15GP22. At present, the manufacturer is able to maintain 60-day delivery. **Conrac, Inc., Glendora, Calif.—TELE-TECH & ELECTRONIC INDUSTRIES.**

the Electronic Industries

TRANSMITTER-RECEIVER

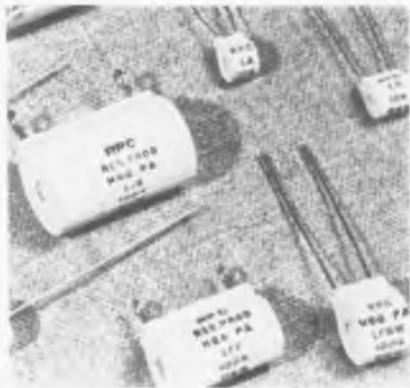
The AT99-44(D) export transmitter-receiver is a two-way crystal controlled unit on 3023.5. The receiver is tunable with two-band selection, 200 to 410 and 600 to 1,750 kc. Requires only one an-



tenna. Mike and phone jacks, built into the chassis, make audio cable unnecessary. The transmitter is on 3023.5 at all times when the small knob in the center of the panel is pulled out. When the knob is pushed in, the radio is on the tunable receiver that is capable of receiving up to 1750 kc. Decals on front panel are in English and Spanish. **Mitchell Ind., P. O. Box 17, Mineral Wells, Texas.—TELE-TECH & ELECTRONIC INDUSTRIES.**

RESISTORS

Type L encapsulated, precision, wire wound resistors are designed to perform accurately and withstand severe shock and vibration. Dimensional stability is assured by winding on steatite bobbins. Sealed in epoxy resin, they are protected against the elements. Have



withstood 30 humidity cycles of MIL-R-93A moisture resistance tests without deterioration, and temperature cycling in excess of the specification. The Type L also withstands the salt water immersion tests for characteristic A in JAN-R-93. **Resistance Products Co., 714 Race St., Harrisburg, Pa.—TELE-TECH & ELECTRONIC INDUSTRIES.**

VOLTAGE REGULATOR

The Type 1570-A automatic voltage regulator has a 6 KVA capacity, 0.25% accuracy, an efficiency of 98%. Output voltage is adjustable over a range of $\pm 10\%$ from a base value of 115 v 230



v for the model "H." Desired output voltage is maintained if the input voltage does not vary more than $\pm 10\%$ from the set value of the output voltage. A $\pm 20\%$ range connection is available on every instrument. Speed of response varies from 10 v/sec. to 40 v/sec., depending on the output voltage and variation range used. **General Radio Corp., 275 Massachusetts Ave., Cambridge 39, Mass.—TELE-TECH & ELECTRONIC INDUSTRIES.**

"RADA-NODE"

The "Rada-Node" includes i-f and micro-wave noise sources, 30 and 60 mc amplifiers, calibrated attenuators, and an indicating meter. Noise source has a frequency range with noise diode "A" of 5 to 400 mc, with noise diode "B" of 100 to 3,000 mc, and with gas



tubes of 1,200 to 26,500 mc in eight bands depending on wave-guide size. Noise figure is range 0 to 21 db. Its accuracy is to ± 0.25 db. IF amplifier frequency is (1) 30 mc (2) 60 mc. Amplifier gain is 75 db. Amplifier bandwidth is 14 mc. Input impedance is 50 ohms. **Kay Electric Co., Pine Brook, N. J.—TELE-TECH & ELECTRONIC INDUSTRIES.**

COLOR IMAGE ORTHICON

The 6474 1854 television camera tube is for use in color TV cameras utilizing the method of simultaneous pickup of the studio or outdoor scene to be televised. It has exceptional sensitivity



combined with a spectral response, and good resolution capability. With a color camera employing a suitably designed optical system and utilizing efficient color filters, commercially acceptable color pictures can be obtained with about 350 foot-candles of incident incandescent illumination and a lens stop of f5.6. **Tube Div., Radio Corp. of America, Harrison, N. J.—TELE-TECH & ELECTRONIC INDUSTRIES.**

PENTODE

The CK6485 is a heater-cathode type, high transconductance, sharp cutoff pentode of miniature construction. Designed for use as a wide band or i-f amplifier, it will maintain its emission and freedom from excessive cathode interface resistance even after long periods of operation under cutoff conditions. Otherwise it is identical with the



6AH6. Envelope, T-5½ glass. Base, miniature button 7-pin. Terminal connections, pin 1 grid #1, pin 5 plate; pin 2 grid #3, pin 6 grid #2; pin 3 heater, pin 7 cathode; pin 4 heater. JETEC designation 7CC. **Raytheon Manufacturing Co., 55 Chapel St., Newton 58, Mass.—TELE-TECH & ELECTRONIC INDUSTRIES.**

New Electronic Products

CONNECTOR

The Series 20 miniature connector is now available with turret terminals and a choice of 7, 8, 9, 11, 14, 18, 21, 26, 34, 41, 50, 75, and 104 contacts. Two #20 AWG wires can easily be soldered to



one contact. Aluminum hoods and polarizing screwlocks available with the series 20 connectors also fit the 20T. The series is available in mineral-filled Melamine, Plaskon reinforced (glass) Alkyd 440A, and Diallyl Phthalate with either mineral or Orlon filler insulating materials. The superior Orlon filler shows no moisture absorption after 24 hour exposure. **Electronic Sales Div., DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.**—TELE-TECH & ELECTRONIC INDUSTRIES.

TERMINALS

The Type A-4098 series of hermetic seal terminals are designed for plug-in applications. Headers are fitted with an oval plug which mates with a standard



octal socket. Constructed as present Triad terminals, these plug-in terminals meet MIL-T-27 requirements and feature gold alloy plated solid brass pins to promote easier soldering and prevent corrosion. Available with either rolled or flat flanges. The rolled flange will fit either 1 in. or 1½ in. O.D. round can available at **Triad Transformer Corp., 4055 Redwood Ave., Venice, Calif.**—TELE-TECH & ELECTRONIC INDUSTRIES.

RESOLVER SYSTEM

A new resolver amplifier has a 400 cps frequency and a voltage range of ¼—14 v. Power, B+, is 10 w (150 v). Filament, 9.5 w (6.3 v). Operative in two channels. Gain margin, 9 db—low and



high frequency. Phase margin, 35 degrees—low and high frequency. Typical operating characteristics for frequencies between 380 and 420 cps are input 14 v, phase shift + 0.3 minutes, magnitude variation + 0.0004. Input 0.25 v, phase shift + 2.0 minutes, magnitude variation - 0.003. Ambient temperature range -55°C. to +75°C, phase shift ±1.0, magnitude variation, ±0.001. **Ketay Mfg. Corp., 555 Broadway, New York 12, N. Y.**—TELE-TECH & ELECTRONIC INDUSTRIES.

TWO-WAY RADIO

The Model 400 VHF-FM mobile equipment is a universal 6/12 v unit. It consists of a crystal controlled receiver, transmitter, and vibrator power supply that requires only 13 x 11 x 5½ in. space. All that is required to change from 6 to 12 volts is to remove the



chassis from its mounting and reverse the double-ended voltage selector plug located in the power supply. The plug is color coded, matching the blue dot for 6 v operation, red for 12 v. No jumpers to be unsoldered and no tubes or vibrators to be changed. Available in either 20 or 40 kc models in the 25-50 mc band. **Communications Co., Inc., 300 Greco Ave., Coral Gables, Fla.**—TELE-TECH & ELECTRONIC INDUSTRIES.

COIL WINDER

The Model SM coil winding machine is capable of winding subminiature toroids with ⅜ in. ID, ¾ in. O.O.D. ½ in. H—depending to some extent on the cross-sectional form of the core. A shuttle



capable of winding down to ⅛ ID is now under test. Wire size range is #36 AWG through #46 AWG. With care, #48 can be used. Winding speed is adjustable from 0 to 600 turns/min. thereby enabling selection of the optimum speed for any winding problem. Controlled starting acceleration virtually eliminates wire breakage. **Boesch Mfg. Co., 45 River St., Danbury, Conn.**—TELE-TECH & ELECTRONIC INDUSTRIES.

TAPE RECORDER

The "VU Magnemite", battery-operated, spring-motor recorder incorporates a VU meter to act as a recording level indicator, output level indicator, and "A" and "B" battery. It is available in one, two, three, and four speed models that utilize consecutive speeds from



1/10 ips to 15 ips. Models employing speeds of 7½ and 15 ips meet primary and secondary NARTB standards and record or playback frequencies up to 15,000 cps. The unit measures 6½ x 9½ x 14 in. Weighs 19 lbs. Complete with 100-hour flashlight-type batteries. Speeds are quickly changed by changing capstans. **Amplifier Corp. of America, Magnemite Div., 398 Broadway, New York 13, N. Y.**—TELE-TECH & ELECTRONIC INDUSTRIES.

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CALIBRATOR, Model 3, by Northeast Electronics Corp., P.O. Box 425, Concord, N.H., provides calibrated ac output voltage from 0.50 mv to 7.50 v with rms accuracy of 1.5% or better over the frequency range 25-1,000 CPS.

COUNT RATE METER, scintillation Model CRM-550, by Nuclear Research and Development Co., 6425 Etzel Ave., St. Louis, Mo., features a linear amplifier, a pulse height discriminator, a high voltage power supply, a variable percent error, and a 25-100-500-2,500 and 10,000 counts/sec multiple scale.

CRYSTALS, Type 42, are comparable to millitary types CR-23/U and CR-32/U and are available for all frequencies from 15 to 100 MC. Complete unit measures only 0.455 x 0.420 x 0.175 in. exclusive of leads. By Standard Piezo Co., P.O. Box 164, Carlisle, Pa.

STAMPINGS. Over 1,000 different small electrical-electronic parts are available as standard items, including solder lugs, terminals, contacts, corona rings, etc., in brass, copper, beryllium copper, phosphor bronze, and steel at Malco Tool, Dept TMN, 4025 W. Lake St., Chicago 24, Ill.

UNIVERSAL INSTRUMENT BENCH, by Meyer-Opticraft, Inc., 39 W. 60th St., New York 23, N. Y., enables making thousands of instrumentation set-ups through the choice of 50 available components and their assembly in various combinations.

SWITCH "BUTTON", by Slater Electric & Mfg. Co., 37th Ave. and 56th St., Woodside, N. Y., is a patented set of movable contacts in a hermetically-sealed, helium-gas-filled-under-pressure enclosure that reduces arcing and pitting at any altitude—even in a complete vacuum.

TV MONITOR, a new, compact 17 in. tube unit, by Satchell Carlson, Inc., 330 Fifth Ave., New Brighton, Minn., for televising visualization, has an arrangement for the addition of audio and twin 6 in. P M speakers when required.

RESISTORS, Type EM, precision wire wound units announced by Eastman Pacific Co., Electronics Div., 2320 E. Eighth St., Los Angeles 21, Calif., are manufactured in accordance with MIL-R-93 by The Brown Corp., Ltd., San Diego, Calif. Sizes range from 7/16 x 1/4 in. to 1 1/4 x 1/4 in., Cap. 10-30,000 ohms.

SPAGHETTI TUBING, made of high temperature "Teflon" by The Polymer Corp. of Pa., 126 N. 5th St., Reading, Pa. has high dielectric strength and is completely stable at 525° F. Range of internal diameters correspond to AWG 24-8. In white, black, brown, red, green, blue, and yellow.

SHORT-INTERVAL-TIMER, Model 615-3, was developed by Masco Products Co., 2119 Sepulveda Blvd., Los Angeles 25, Calif., to complement the Model 437 interval timer line. Holds an electrical circuit open or shut for a preset time on momentary switch contact.

SOLDERING INSTRUMENTS. ORYX sub-miniature soldering instruments, imported from England by Television Accessories Co., P.O. Box 6001, Arlington 6, Va., have no mica or ceramic formers to break or flake. Require only 20 to 30 seconds to heat. Weight, 1/2 oz. Length, 6 in.

COMPRESSION TOOL, type MR8-23, designed to install ordnance type "Hysealug" compression terminations on Nos. 12 and 14 rubber-insulated wire and close the insulation grip, is ratchet controlled to obtain correct depth indent. Single-stroke operation. Burndy Engineering Co., Inc., Post Rd., Norwalk, Conn.

RELAYS, type RL-516, for plate circuit use and voltage sensing, by Joseph Pollak

Corp., 81 Freeport St., Boston 22, Mass., have snap switches to provide positive, instantaneous on-off switching action with only 1% drop-out of the pull-in current.

CAMERA. The series 400 "Utilivue", made by Diamond Power Specialty Corporation, Lancaster, Ohio, can be used with a video monitor or a standard TV receiver. Tunes to any channel from 2 to 6. Graybar Electric Co., distrib.

HIGH Q COILS by United Transformer Co., 150 Varick St., New York 13, N. Y. provide a Q of approximately 45 at 100 CPS, and a Q of approximately 20 at 20 CPS. Use a laminated structure in contrast with the Permalloy dust toroid structures normally employed in UTC high Q coils.

CONDUCTIVITY CELLS, designed for conductivity measurements under specific temperature requirements by Industrial Instruments, Inc., 89 Commerce Rd., Cedar Grove, N. J. Jacketed type for dip use now available for laboratory applications. Constants from 0.01 to 100.

TUBES. Seven new types of RCA electron receiving tubes (RCA-3BC5, RCA-3CB6, RCA-5AN8, RCA-5AT8, RCA-5J6, RCA-5U8, RCA-1216-GT) announced by the Tube Div. RCA, Harrison, N. J., operate with their heaters connected in a single "series string" electrical circuit.

DELAY LINES, miniature distributed constant type, by PCA Electronics Inc., 2180 Colorado Ave., Santa Monica, Calif., withstand vibration and shock requirements of MIL-T-27 and MIL-T-27 specs for humidity, temperature cycling, etc. Suitable for delaying trigger pulses.

YOKE WINDER, Model YW series, (patent pending) announced by Geo Stevens Mfg. Co., Inc., Pulaski Rd. at Peterson, Chicago 30, Ill., form winds complicated shapes such as 70°, 90°, color, and military deflection yokes.

EMBOSSED COIL FORMS being used in threaded coil forms to prevent stripping, breakage, and freezing due to cross threading, eliminate control problems and increase efficiency of iron ore production, according to Resinite Corp., 2035 W. Charleston St., Chicago 47, Ill.

CODAN SQUELCH UNIT, designed by Hammarlund Mfg. Co., 460 West 34th St., New York 1, N. Y., activates a normally silent Super Pro-600 receiver at a predetermined signal strength. Threshold of operation is adjustable to any level between r-f signal inputs of 0.5 to 100 μ v.

CRT TESTER, Model 101, by Authorized Manufacturers Service Co., 919 Wyckoff Ave., Brooklyn, N. Y., provides positive test indication for continuity and emission within 90 seconds. Size, 8 x 9 x 3 in. Weight, 5 1/2 lbs.

SYNCHROSCOPE, Model C-04, announced by T.L.G. Electric Corp., 31 West 27th St., New York 1, N. Y., is a circuit-by-circuit redesign of the basic "P-5" developed by MIT Radiation Labs. Has faster rising, shorter, higher power radar pulses.

AC DECADE BOX, called "Dekabox" by Electro-Measurements, Inc., 4312 S. E. Stark St., Portland 15, Ore., provides more than a million 1 ohm resistance steps from zero to 1,199,999 ohms. Has adjustable mounting base.

ATTENUATORS. Series V-250 video variable attenuators made by Daven Co., Dept. SY, 191 Central Ave., Newark, N. J., for wide band applications have zero insertion loss and constant input and output impedance. Frequency response is flat from 0 to 10 MC.

DC POWER SUPPLY, developed by Dressen-

Barnes Corp., 250 N. Vinado Ave., Pasadena 8, Calif., is a direct current tube type unit for powering transistors. The Model T-100-B meter-equipped regulated dual-voltage supply has two duplicate outlets each with three ranges.

POWER SUPPLY, Model UHR-220, provides 0-200 ma at 0-500 v. with 0.001% regulation and ripple less than 100 μ v. Transient response is 0.001 millisecond. Krohn-Hite Instrument Co., 300 Massachusetts Ave., Cambridge 39, Mass.

BATTERY CHARGER by Magnetic Precision Controls, Inc., 119 W. 63rd St., New York 23, N.Y. is all magnetic. Once fully charged it cuts off entire apparatus from the line within a cut-off voltage of $\pm 1\%$ of rated battery voltage. Approximate dimensions 8 x 10 x 12 in.

LIFT HAND TRUCK, Model 80, by E. J. Baughman Co., 350 South Central Ave., Los Angeles 13, Calif., elevates loads from 2 to 40 in. and handles loads up to 250 lbs. Rolls in upright position; hauls double deck loads.

AC INDUCTION SERVO MOTOR, Type DPJJD-764-38, are precision-built two-phase, two-pole units with double-ended shafts and low-inertia squirrel cage rotors designed to eliminate cogging at low speeds; 60 cps, 3 w output. Made by Electric Indicator Co., Inc., Springdale, Conn.

PRINTED CIRCUIT RECEPTACLE by Viking Electric, 1061 Ingraham St., Los Angeles 17, Calif., provides 20 contacts in space formerly containing 18. Made with either Melamine or Alkyd 40A body. With or without mounting-hole threaded insert.

CASTING RESIN, designated "Stycast 2850 GT," is a newly developed material for producing electronic embedments. Produced by Emerson & Cuming, Inc., 869 Washington St., Canton, Mass. Its useful temperature range extends from -100° F. to 400° F.

TV DYNAMIC MICROPHONE, 50D-TV, made by the Turner Co., 910 17 St., N.E. Cedar Rapids, Iowa, has a listed response of 50 to 15,000 CPS. Available in satin black finish with matching desk stand. Built-in shock mounting. Essentially non-directional.

CABLES. A complete, a new line of quality-controlled cables for audio, intercommunication, microphone, TV camera, and other applications has been announced by Federal Telephone and Radio Co., 100 Kingsland Road, Clifton, N. J.

POWER SUPPLY, developed by Perkin Engineering Corp., 345 Kansas St., El Segundo, Calif., rated 0-32 v. 25 amp. features a $\pm 1\%$ regulation and a ripple of 1% RMS. Designed for 115 v, single phase, 60 CPS ac input.

MICROPOT, series 930, by George W. Borg Corp., 120 S. Main St., Janesville, Wis. has a patented contact drive assembly that enables either or both mechanical stops to be used as phasing points. The 3-turn unit is available in 1 to 5 gang models. Single or double shaft.

"PORTAFLUX" magnetic-particle test unit has two heavy duty, oil resistant, renewable prods that carry 600 amps at 1.5 v maximum. Designed by Research & Control Instruments Div., North American Phillips Co., Inc. 750 S. Fulton Ave., Mt. Vernon, N. Y., to locate metal surface defects.

RESISTORS, Type J, wire wound, are 1/4 in. diam. by 1/4 in. long and have a maximum resistance of 125,000 ohms. Military power rating is 0.1 w. Type J C is 1/4 in. diam. by 1/2 in. long with a maximum resistance of 250,000 ohms. By Resistance Products Co., 714 Race St., Harrisburg, Pa.

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POWER SUPPLIES with electronically regulated and variable dc output voltages, made by Mohawk Electronic Research Laboratories, Inc., Box 126-A, R D 4, Amsterdam, N. Y., are independent of external load and line voltage fluctuations within instrument capabilities.

SHEET STOCK LAMINATE, "Insurok" XT-200 with glass fibers impregnated with thermosetting polyester resin, announced by The Richardson Co., 27th Ave. & Lake St., Melrose Park, Ill., is an insulating sheet with excellent structural and electrical properties.

ELECTRONIC SWITCH, Model 488, produced by Electronic Instrument Co., Inc., 84 With St., Brooklyn 11, N.Y., enables simultaneous observation of 2 separate traces on one scope screen. Unit also serves as a square wave generator over the switching frequency range.

DATA PRESENTATION YOKE, Type Y36- () () 15, is a new magnetic deflection yoke designed for 2-1/8 in. neck diam. tubes by Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill. Deflection angle is up to 70°.

SATURABLE REACTORS, called "Magnestats," have been announced by Snyder Laboratories, 601 Chapel Ave., Merchantville 10, N.J. Units are used to control pulse or sine wave power ranging from μ w to deciwatts at frequencies from 100 kc to 20 mc.

CATHODE RAY TUBE. A new 6-gun, 7 in. CRT developed by Electronic Tube Corp., 1200 E. Mermaid Lane, Philadelphia 18, Pa., displays up to six independent or related phenomena simultaneously on its 7-in. face. Designed for multi-channel oscilloscopes.

MAGNETIC TAPE made of thin mylar is called "Plus 50" because standard reel holds 50% more tape to increase playing time. 5-in. reel with 900 ft. is \$4.40; 7-in. reel with 1800 ft. is \$7.95. Reeves Soundcraft, 10 E. 52 St., New York 22, N.Y.

SPECIAL CRYSTAL, the Standard Piezo Type TV-1, is a low drift, 3579.545 kc crystal for sub-carrier oscillator circuits of color TV receivers. Made to a frequency tolerance of 0.003% over the temperature range 20°C to 65°C by Standard Piezo Co., P. O. Box 164, Carlisle, Pa.

TRANSISTORS. CBS-Hytron, Div. of Columbia Broadcasting System, Danvers, Mass., announced the HD-197, a new germanium construction P-N-P power junction transistor, as capable of 500 mw collector dissipation without use of a hot sink.

BROADCAST RECORDER, BR-1, designed by Berlant Associates, 4917 W. Jefferson Blvd., Los Angeles 16, Calif., includes a new "Unisync Drive" motor that employs a reversed field principle that results in quieter operation and only a 30° temperature rise.

"RIGID-TEX METAL", 1-ET, engine turn pattern presents moving highlights from any angle. A maximum pattern depth of 0.025 in. provides a prefinished surface that reduces glare, resists marring, and hides scratches. By Rigidized Metals Corp., 657 Ohio St., Buffalo 3, N.Y.

COPPER LOUVERS have been added to the established line of circular aluminum units made by Midget Louver Co., Norwalk, Conn. Made in 1, 1-1/2, 2, 2-1/2, 3, 4, and 6 in. sizes to solve corrosion and fungus problems.

INSULATING LAMINATE, a glass reinforced sheet of thermoset styrene copolymer, "Rexolite 2101" by Rex Corp., Hayward Rd., West Acton, Mass., has electrical properties that surpass those of thermosetting glass laminates and equal or surpass glass reinforced tetrafluoroethylene.

CUING ADAPTER, developed by Rek-O-Kut Co., 38-01 Queens Blvd., Long Island City 1, New York, N.Y., is designed to cue 7 in. 45's on either 12 in. or 16 in. transcription tables without wow-causing wobble or slip.

SERVO COMPONENTS—servo amplifier, summing amplifier, phase detector, and linear phase detector—comprise a complete line of precision electronic and mechanical units for servo and computer assemblies. Made by Link Aviation, Inc., Binghamton, N.Y.

RESISTOR, Type C-5, announced by Mepco, Inc., 37 Abnett Ave., Morristown, N.J., is a new miniature carbon-deposited unit for transistor and hearing aid circuits. Diam. 0.032 Length is 9/32 in. Meets MIL-R-10509A requirements.

TRANSFORMER KIT. Plug-in pulse transformer kit No. 2 described by PCA Electronics Inc., 2180 Colorado Ave., Santa Monica, Calif., contains 10 transformer plug-in hyper-sil core transformers to fit a standard 7-pin miniature tube socket.

FILTER UNITS, now available at Aerovex Corp., 740 Belleville Ave., New Bedford, Mass., are of single, double, and triple line types housed in steel casings with 1-1/4 in. countersunk mounting holes. Six standardized models have attenuation that equals or exceeds advanced screen room design.

CABINET RACK, designed by Premier Metal Products Co., 3160 Webster Ave., Bronx, New York, N.Y., is constructed of heavy-gauge steel. Welded throughout. Has detachable sides enabling bolting units together in multiple assemblies.

CHOPPER, said to be the smallest yet offered, was recently released by Airpax Products Co., Middle River, Baltimore 20, Md. Will handle signals levels from 100 μ v down to μ v region at 1 ma. Can be operated at any ambient from 65 to 100°C.

TUBE SPACERS. A new manufacturing technique enables American Lava Corp., Chattanooga 5, Tenn., to produce ceramic vacuum tube spacers with improved characteristics. Units give better dimensional control; higher mechanical strength.

SHIELDED ENCLOSURE, announced by Ace Engineering & Machine Co., 3644 N. Lawrence St., Philadelphia 40, Pa., employs galvanized iron sheet panels to obtain better suppression of r-f energy at lower frequencies. Measurements in accordance with MIL-S-4957. Unit employs Lindsay structure.

VACUUM GAUGE for instantaneous measurement of vacuums in the 1 to 1,000 microns Hg range are being offered in a panel-mounted model by Hastings Instrument Co., Inc., Hico Instruments Div., Warwick, Va.

AUTOMATIC WINDER, with oil-bath internal lubrication, the Model 220-M-AM, announced by Geo. Stevens Mfg. Co., Inc., Pulaski Rd. at Peterson, Chicago 30, Ill., is designed to wind fly-backs and other self-supporting lattice-wound universal coils to 1-1/4 in. wide by 3 in. O.D.

CERAMIC COIL FORM, developed and manufactured by Electro-Assemblies, 2835 W. Belmont Ave., Chicago, Ill., is available with one or two form-molded terminal collars. Standard winding space is 7/16 in., others available in production quantities. Popular diameters are 1.4 and 0.200.

POWER SUPPLY Dressen-Barnes Corp., 250 N. Vinedo Ave., Pasadena 8, Calif., provides interior accommodation for 2K39 2K41, 2K43, and 2K44 klystron tubes. Provides voltages for klystron reflection, beam, control, electrode, and heater.

CAN NEUTRAL BAR, recently announced by IlSCO Copper Tube & Products, Inc., Mariemont Ave., Cincinnati 27, O., has circuit bars forged into the main line connectors at a 20° angle for easy wire insertion of every branch circuit wire.

CAPACITORS. A new series of tiny capacitors was recently announced by the Sprague Electric Co., 233 Marshall St., North Adams, Mass. that employs tantalum as the anode. Trademarked "Tantalex," the new units are only 1/8 in. in diam. x 5/16 in. long.

SCREEN ROOM, "American 40", by Erik A. Lindgren & Associates, 4515 North Ravenswood Ave., Chicago 40, Ill., has 12-in. centers instead of 36 in. spacing of previous models. Floor is 3-1/4 to 1 in. plywood finished with 1/8 in. tempered "Masonite". Withstands 500 lbs./sq. ft.

PHENYLFLUORONE, a very sensitive and selective reagent for the determination of germanium, is available at the Jasonols Chemical Corp., 825 East 42nd St., Brooklyn 6, N.Y.

DELAY LINES, encapsulated and open styles lumped parameter, for use as color TV compensating delays, TV signal delays, synchronizing generators, and coupling elements for wideband distributed amplifiers are available at Shallcross Mfg. Co., 10 Jackson Ave., Collingdale, Pa.

IF STRIP. Allen D. Cardwell Electronics Productions Corp., Plainville, Conn., subsidiary of Chesapeake Industries, Inc., 105 East 106th St., New York, N.Y. have announced the development of a 40 MC printed circuitry i-f strip for monochrome TV receivers using inter-carrier sonic systems.

POT CORE. A new miniature pot core, made of Ferroxcube Type 3C ferrite material, enables the construction of very small coil assemblies having moderate inductance values with a relatively high Q. Made by Ferroxcube Corp. of America, Saugerties, N.Y.

RESISTORS available at the Daven Co., 191 Central Ave., Newark 4, N.J., are card wound for applications where space is at a premium. Length determined by the number of sections required for the application; 1/8 in. thick. 3/8 in. wide.

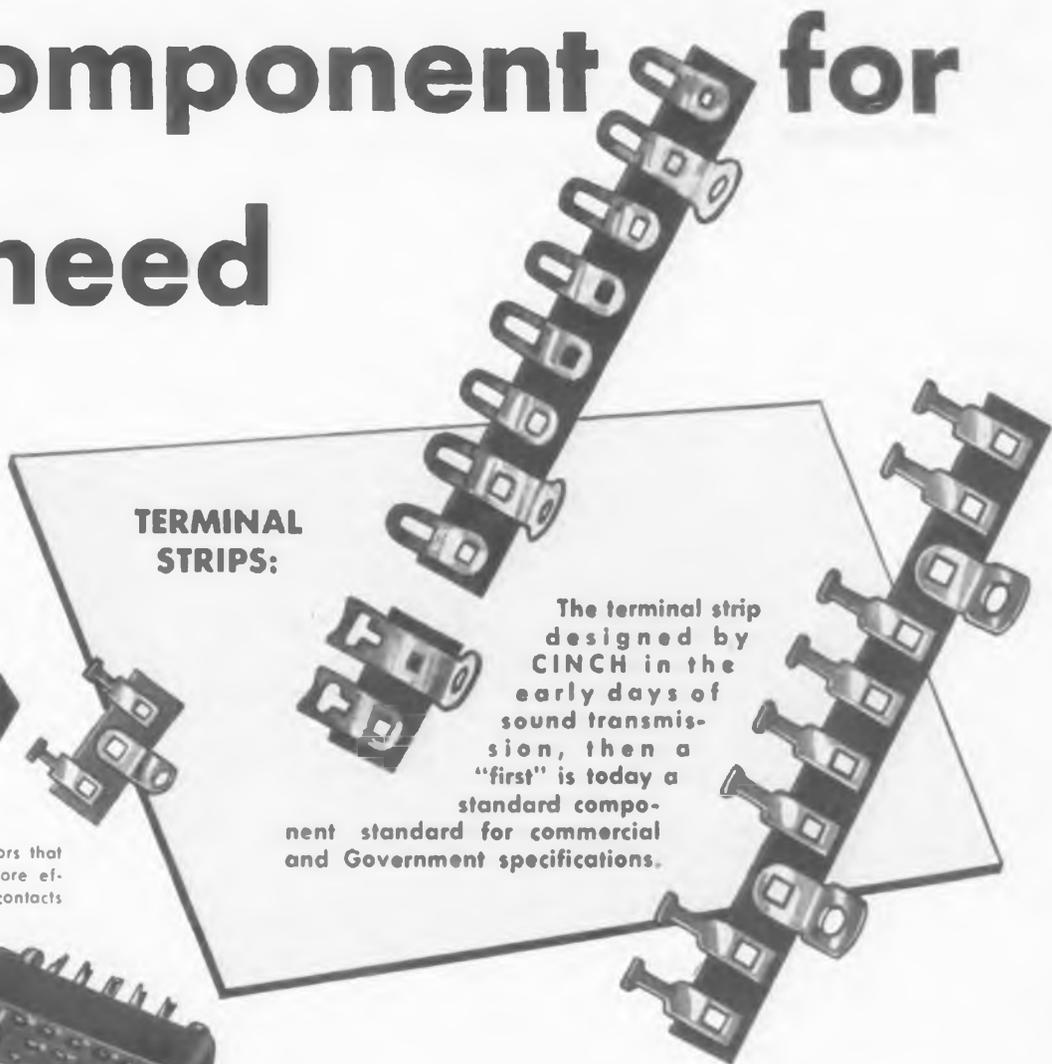
POLARIZED ARRAYS by Telrex Inc., Asbury Park, N. J. Model C-A-P 148 consists of a high-gain 10 element (twin-5), 1/2 wave spaced, vertically polarized array tuned to 148.2 MC. with an omni-directional broadband unity-gain dipole. For C.A.P. communication service.

CAPACITOR. The new subminiature metal-clad tubular capacitor, nicknamed "-R" unit by General Electric Co., 1 River Rd., Schenectady, N.Y. has leads welded to the silicone bushing stud at right angles rather than axially.

ELECTROMETER is basically, a battery or line operated dc vacuum tube type microammeter with a current measuring range from 10⁻¹⁰ -10³. Weighs 4-1/2 lbs. Made by Electro Nuclear Corp., 350 S. County Rd., Palm Beach, Fla.

PLASTIC, ETC-7, announced by Electro Tec Corp., 4 Romanelli Ave., S. Hackensack, N.J. as an insulation material for high temperature slip ring assembly applications, withstands -60 to +500 F. Has low water absorption and high surface resistance, etc.

CINCH produces the component for the need

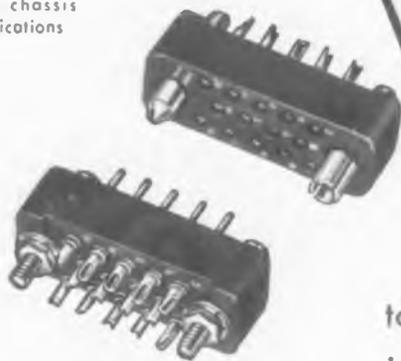


TERMINAL STRIPS:

"special miniaturized" strips available, actual size shown.

The terminal strip designed by CINCH in the early days of sound transmission, then a "first" is today a standard component standard for commercial and Government specifications.

(Below) Miniaturized Micro Connectors that save space, weigh less and are more efficient... 14, 21, 34 and fifty contacts available in low loss material for chassis mounting applications



CINCH components available at leading electronic jobbers—everywhere

The number of CINCH "firsts" that met the need and continue to serve year after year, even through industry changes, is an indication of engineering skill and production experience. It is an assurance that CINCH produces the component for the need.



CONSULT CINCH

CINCH MANUFACTURING CORPORATION

1026 South Homan Ave., Chicago 24, Illinois

Subsidiary of United-Carr Fastener Corporation, Cambridge, Mass.

WIDE-RANGE FREQUENCY METER 85-1000 MEGACYCLES

TS-175A/U

Government Approved

Calibration Accuracy:
.005%

Stability:
.0025%

Resettability:
.0025%



**IMMEDIATE
DELIVERY**

A VERSATILE PRECISION MEASURING INSTRUMENT

Recommended Applications:

- Precise Measurements of Frequencies
- Production Testing
- Alignment of Transmitters and Receivers
- Laboratory Testing
- Portable Field Testing
- A Secondary Frequency Standard
- Signal Generator Calibration
- U.H.F. and V.H.F. Television Alignment

Calibration: Each instrument is individually calibrated, without interpolation, at 50 Kilocycle intervals throughout its range.

Frequency Range: The unit covers the calibrated range of 85 to 1000 megacycles. The fundamental of the precision variable frequency oscillator is 85 to 200 megacycles.

Sensitivity: The Frequency meter can detect a radio frequency signal of 20 microvolts with an audio power output up to 50 milliwatts depending on the frequency.

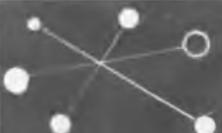
Internal Modulation: When desired, amplitude modulation of 1000 cycles in frequency can be employed. The modulation percentage is approximately 30%.

Radio Frequency Output: The output voltage from a 50 ohm source, varies from 300 to 100,000 microvolts, within the range of 85 to 1000 megacycles.

Secondary Frequency Standard: A 5000 Kc. oscillator incorporating a CR-18/U crystal can be used as a secondary frequency standard with harmonics of 5 megacycles up to 200 megacycles.

Territories for representation available.

We offer a complete automatic recalibration service on all frequency meters.



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Executive Offices: 400 Duffy Ave., Hicksville, Long Island

Studio 72

Interior views of CBS Television's New Color Studio in New York City



New studio at Broadway and 81st St. as it appears through control room windows



Theatre has 500 individual stage lighting fixtures controlled from organ-like console



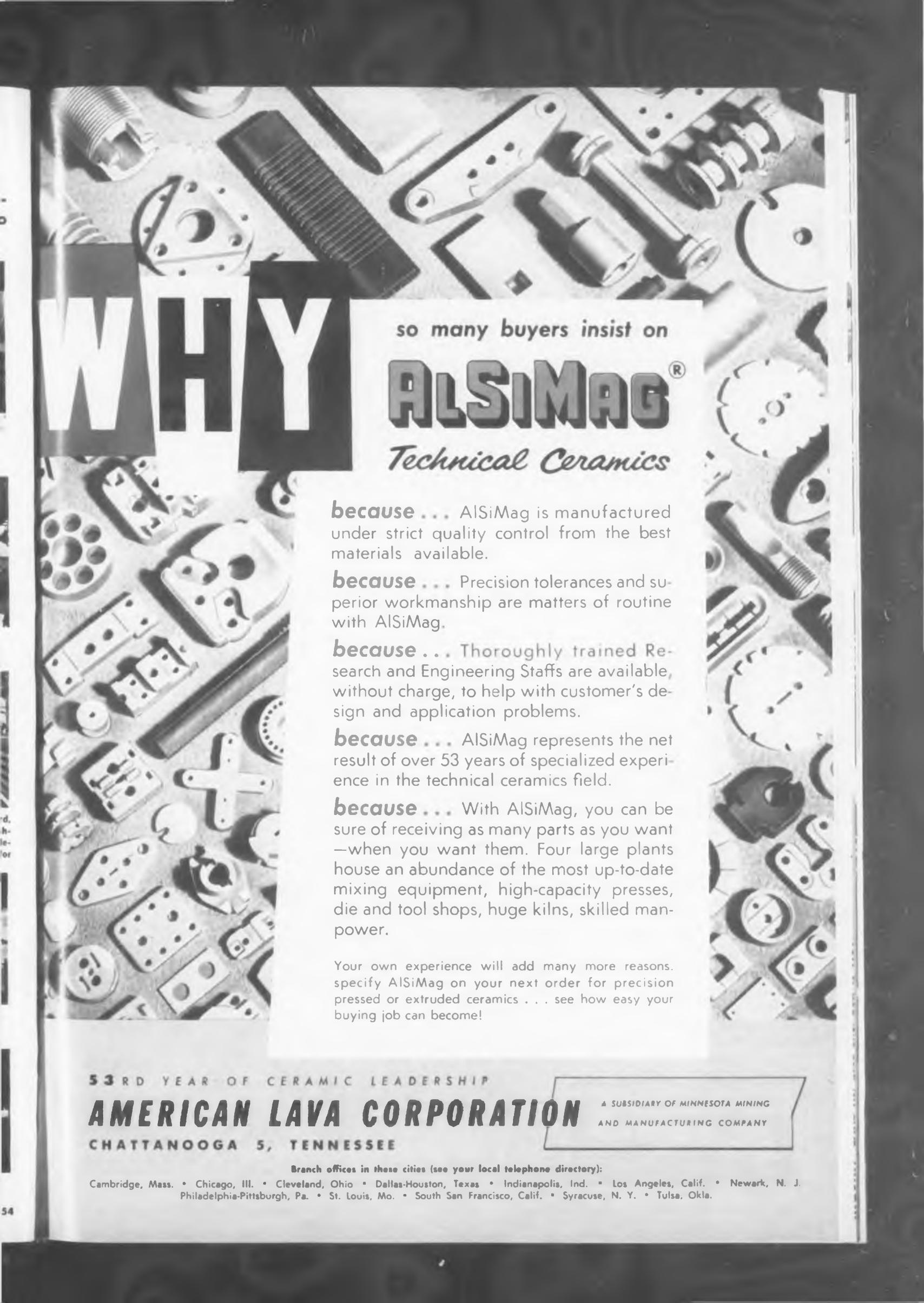
Operator at Izenour or light control board. Lighting cues are preset at rehearsal. Pushing console button during show gives desired groupings and intensities called for



Audience view of Studio 72. The working stage area is more than 5000 square feet



View of control room from theatre



WHY

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because . . . ALSiMag is manufactured under strict quality control from the best materials available.

because . . . Precision tolerances and superior workmanship are matters of routine with ALSiMag.

because . . . Thoroughly trained Research and Engineering Staffs are available, without charge, to help with customer's design and application problems.

because . . . ALSiMag represents the net result of over 53 years of specialized experience in the technical ceramics field.

because . . . With ALSiMag, you can be sure of receiving as many parts as you want —when you want them. Four large plants house an abundance of the most up-to-date mixing equipment, high-capacity presses, die and tool shops, huge kilns, skilled manpower.

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STAND-BY TV TRANSMITTING ANTENNAS

for channels 7-13

No Diplexer Needed



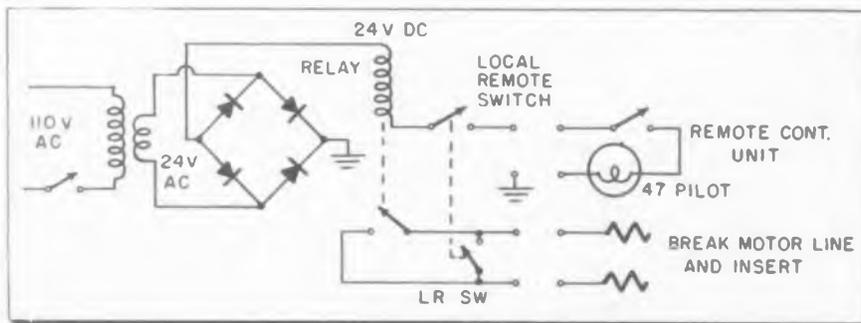
A simple, versatile and economical system consisting of two separate bays of type 1020 slotted-ring antenna can be used with a 50 kw transmitter. No diplexer of any kind is needed. The aural and visual transmission lines need not be of equal lengths. Write for Bulletin T-854.

ANTENNA SYSTEMS—COMPONENTS
AIR NAVIGATION AIDS—INSTRUMENTS



CUES for BROADCASTERS

(Continued from page 89)



Remote start device for tape recorder uses selenium bridge to keep ac off line

circuit power supply of 24 volts DC was built and mounted with the start relay on a standard length rack aluminum strip three inches wide.

A dpdt switch is used as a "remote-local" switch, in the "local" position one half is used to open the remote while the other half is used to short the terminals that are inserted in the magnecorder motor line. This makes it unnecessary to turn on the low voltage supply when the recorder is in the "local" position. The remote unit need consist only of a switch, but we included a 47 pilot lamp, to show the announcer where the tape machine was in "remote."

"Cues File"

HENRY C. LOVELL, Chief
Engineer, WHIR, Danville, Ky.

UPON receipt of each issue of Tele-Tech, we make a file card listing "Cues for Broadcasters" information. At top left is listed the month and year of the issue. This is followed by the page number. Next is listed the title of each topic. If a topic discusses some particular model or brand of equipment, this is usually listed in parentheses.

When a problem arises, these cards are handy to thumb through for ideas, and save the tedious task of going through a stack of magazines.

CBS EXECs INSPECT COLOR TV THEATRE



J. L. Van Volkenburg, President, CBS Television (standing second from left) and other CBS Television executives, watching rehearsal of "Toast of the Town" on monitors in the new CBS Television Color Theatre, which went into operation August 22nd.

Colored audiotape

now available
at no extra cost!



ONLY AUDIOTAPE offers you the time-saving, effort saving advantages of color cueing and color coding — in a magnetic recording tape known the world over for outstanding quality and uniformity

WITH Audiotape, color adds a new dimension in sound recording. Now available on distinctive green and blue plastic base, in addition to the clear plastic (showing the natural brown color of the coating), Audiotape permits instant visual identification of recorded selections — on the same or different reels.

Sections of various colored Audiotape, when spliced into a single reel as shown in the photo above, stand out sharply one from the other, without the need for any identifying leaders between them. Selections can be cued in this manner with great ease and precision. Also, complete reels, recorded on blue, green and brown tape, are easily identified as to content, tape speed, single or dual track or any other desired classification.

Through increased demand and increased production, it has been possible to reduce the cost of the blue and green plastic-base tapes, and they are now available at *no increase in price.*

Colored Audiotape Reels

Audiotape plastic reels, in the popular 7-inch and 5-inch sizes, are also available in a choice of attractive, jewel-tone colors — red, yellow, green or blue, as well as clear plastic. Here, too, coding and filing by reel colors offer a host of opportunities for faster

and easier identification of your tape recordings. And, like colored-base Audiotape, the colored reels, too, are available at *no extra cost.*

But whatever the color of tape or reel — with Audiotape, you can be sure of the finest, full-range performance obtainable with any tape recorder. For Audiotape's magnetic properties are carefully balanced to assure the most uniform response throughout the entire audible frequency range — plus maximum uniformity of output within the reel or from reel to reel.

Ask your dealer for an assortment of colored Audiotape. It will speak for itself — in performance and in cost.

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Purchasing and production people prefer *Electra* because of fast, dependable delivery—production schedules are met on time!

Electra Deposited Carbon Resistors are available in 8 sizes— $\frac{1}{8}$ watt to 2 watts, and in two types—coated as well as hermetically sealed. They are manufactured to specification MIL-R-10509 A.

Make your "First Choice" Electra Deposited Carbon Resistors!



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Electra Manufacturing Co.

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A one piece, molded, portable, controlled-atmosphere dry box can be hermetically sealed in 30 seconds. A relative humidity electronic circuit controls RH to a constant 1%. Made of



heat, chemical resistant, transparent plastic. Has no sharp corners. Mass produced with standard air-lock, filter system to control dust to 1 micron—glove assembly, etc., can be thrown away after radioactive contamination because of low cost and fast delivery. Weighs 15 lbs. P. M. Lennard Co., Inc., 671 Bergen St., Brooklyn 38, N. Y.—TELE-TECH & ELECTRONIC INDUSTRIES.

TEST CHAMBER

A test chamber, 3 x 3 x 7 $\frac{1}{2}$ ft. in size, especially designed for testing equipment of unusual shape, combines a temperature range of -100° F to $+200^{\circ}$ F., humidity from 20% to 95%, and altitude simulation from atmospheric



pressure to 80,000 ft. Used to test electronic instruments and communications equipment for commercial and military applications, the chamber is provided with an evaporative condenser to save water. It is capable of dissipating 300 w at -100° F. at sea level. Has a full opening door, non-corrosive inner liner, and is equipped with terminal pads for checking equipment performance. Bowser Technical Refrigeration, Terryville, Conn.—TELE-TECH & ELECTRONIC INDUSTRIES.

You've Been Waiting for this!

NEW HIGH-FREQUENCY DETECTOR

for Use from 25 to 5,000 Mc

This new, accurate and easily portable G-R Detector is specifically designed for general-purpose laboratory, production and field measuring applications.

Its high degree of sensitivity, linearity, selectivity, broad bandwidth and excellent shielding ideally adapt it for work at the Very-High and Ultra-High Frequencies.

This detector is not limited to a narrow frequency range. With the appropriate local oscillator, signals from 25 to 5,000 Mc are accurately detected. Operation is flexible, and bandwidth is broad eliminating serious detuning due to slight changes in frequency. A detector of this type is indispensable for Impedance, VSWR, Voltage, Current, and Power measurements in vhf and uhf bands.

This instrument is also a fine general-purpose tuned voltmeter. A well-shielded, 4-stage amplifier provides

high gain. With the precision built-in attenuator and linear panel meter, accurate measurements of relative r-f voltage levels are easily made — levels as low as $10\mu\text{V}$ to 5,000 Mc may be detected. Absolute measurements are made by calibrating the Mixer Rectifier at one voltage level.

The precision attenuator permits insertion-loss and attenuation measurements of filters, attenuators, and coaxial cables. Careful shielding permits direct measurements to 80 db, to over 100 db by using additional pads.

In these and other measurements, the Detector's superior characteristics contribute greatly to the convenience and reliability of the work at hand. The small physical size and compactness of the several units make this equipment easily transportable.



The Type DNT Detector Assembly consists of a Type 874-MR Mixer Rectifier, a Type 1216-A Unit I-F Amplifier, the appropriate Unit Oscillator and the necessary coaxial lines for interconnecting these units; a Low-Pass Filter, 10-db Pad, and 90° Ell are provided as auxiliary aids in measurements.

In operation, the signal to be detected and the local oscillator signal are mixed in the Mixer Rectifier to produce a 30-Mc difference frequency which is detected by the 30-Mc I-F Amplifier. With this apparatus, any frequency from 25 to 5,000 Mc can be reliably and conveniently detected.

Wide Frequency Range: Complete detector assemblies are available for operation from 25 to 950 Mc on fundamental frequencies. Higher frequency operation is obtainable by using oscillator harmonics.

Detector	Fundamental Range	Price
Type DNT-1	35 to 530 Mc	\$628.00
Type DNT-2	220 to 950 Mc	\$628.00
Type DNT-3	25 to 280 Mc (up to 5,000 Mc using harmonics)	\$667.00

Anyone of these Assemblies may be converted into either of the other two by merely adding an appropriate local oscillator for that range. Additional local oscillators, from \$195 to \$220.

High Sensitivity: 4-stage amplifier provides 100-db gain — less than $5\mu\text{V}$ from 50 Ω source at frequencies between 50 and 950 Mc gives 1% meter deflection over residual noise; sensitivity is slightly lower on harmonic operation at higher frequencies — less than $80\mu\text{V}$ produces full scale deflection.

Broad Bandwidth with good Selectivity: Bandwidth between half-power points (3-db down) is 0.7 Mc — 2 Mc either side of center frequency; response is down more than 20 db — 60-db down 3 Mc from center frequency.

Built-in Precision Attenuator: Mixer is accurately linear over more than 80-db range, permitting extremely reliable and rapid voltage-level measurements with precision attenuator — attenuator has 0, 3, 10, 20, 30, 40, 50, 60, and 70-db steps — accuracy is $\pm(0.3\text{ db} + 1\%$ of indicated attenuation).

Output Meter: Indicates relative r-f signal level — linear relative voltage scale as well as db scale permits convenient interpolation between steps.

Excellent Shielding: High-frequency signal is confined to well-shielded mixer unit — internal amplifier parts are individually shielded and thoroughly isolated from each other by numerous filters to obtain negligible leakage and regeneration.

Modulation Envelope brought out to binding posts: Cathode follower amplifies demodulated signal — bandwidth of output circuits is 0.4 Mc — 600 ohms output impedance — 2 volts, maximum open-circuit output.

Automatic Volume Control: Separate diode supplies a-v-c voltage to second amplifier stage for use in null detection.

Two Separate Internal Power Supplies: One for operating the I-F Amplifier — another for driving the local oscillator minimizing number of units necessary — regulation provided for all screen voltages.

Compact and Light-weight: Overall Detector weight including all interconnecting cables and accessories, as pictured above, is less than 17 lbs. — the largest unit, the Type 1216-A Unit I-F Amplifier is $5\frac{1}{4} \times 10 \times 6\frac{3}{4}$ inches. Weight $8\frac{1}{4}$ pounds.



GENERAL RADIO Company 775 Massachusetts Avenue, Cambridge 19, Mass.

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WASHINGTON

News Letter

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

NETWORK TV PROBE—Formal hearings on network television regulation, which was instituted in a resolution of Committee Chairman Bricker, Ohio Republican, by the Senate Interstate and Foreign Commerce Committee, are not slated to start until the next session of Congress in January. The investigation will not only be directed toward the need for intensified FCC regulation of the networks in this field of broadcasting, but will go into VHF and UHF television allocations, and probably into the manufacturing affiliations of the networks. Fact-finding investigations by the Committee staff were conducted during last month in the network headquarters in New York and the FCC in Washington.

MIDDLE-ROAD APPROACH—While there has naturally been a considerable amount of advance consternation in the industry over the investigation, there is, in the opinion of many impartial observers, foundation for the belief that the inquiry will be conducted on the basis of a middle-road approach which could well result in long-range benefits to the networks and television. The chief counsel of the Senate probe is former FCC Commissioner Robert F. Jones, who served on the Commission for five years and previously had been an Ohio Republican Congressman for nearly nine years, where he had gained the admiration and respect of Senate and House leaders of both parties. Mr. Jones has taken a leave of absence from his law firm in Washington to serve on the Senate Committee.

FCC VACANCY—Because his physicians advise him that he should relinquish the rigors of his duties at the FCC, Commissioner George E. Sterling, who has had a distinguished career in government service in the field of radio for more than 30 years, will be leaving government service effective September 30. It is known that Commissioner Sterling, one of the two "engineer" members of the FCC, has been offered several positions in the radio industry and a consultant engineer practice. After Commissioner Sterling does retire from the FCC, his successor is likely to be former Ohio State Commission chairman George C. McConnaughey who is now serving by appointment of President Eisenhower as Chairman of the federal Renegotiation Board. Mr. McConnaughey, if named to the FCC, is considered to be the next FCC Chairman.

POLICE RADIO—The original mobile radio service, police radio, has blueprinted a number of proposals to the FCC to improve and expand its operations and services. These were formulated at the annual meeting of

Associated Police Communications Officers in Pittsburgh recently. Most important to the radio engineering field was the proposal that the FCC should reassign part of the 88-108 megacycle FM broadcasting band for point-to-point police radio use. Another recommendation to the Commission was that police should receive space for point-to-point communication to replace the present assignments in the 72-76 megacycle band which have been rendered virtually useless in certain regions of the country through the protection of television channels. In another policy pronouncement the police radio organization has asked the radio equipment manufacturers for their views on the standardization of such equipment as cases, tables, mountings, control heads and other parts of mobile installations.

GOVERNMENT SURVEY—What appears to be the most important high level federal government agency ever to be established to formulate broad policies in the field of telecommunications and radio is the new commission established by President Eisenhower. Headed by Defense Mobilization Director Arthur Flemming and with the Secretaries of State and Defense as members, the new commission represents the most significant recognition of telecommunications by the government in history. One of the commission's most important survey assignments is in a sphere that has been sought editorially by TELE-TECH—that government agencies be required to present justifications for requests for frequency space as well as radio and telecommunications industries.

RADIATION REGULATION—After more than five years of study and revisions since the FCC's first notice of proposed rule-making on restricted radiation devices, including carrier current communications systems and certain land mobile radio receivers, the Commission's latest version of its proposal, issued last April, has proved totally unacceptable to the communications industry and major radio manufacturers, as shown by their recent comments to the Commission. Joined in a general view that the proposed rules are premature because of a lack of technical data on radiation, were the American Telephone & Telegraph Co., RCA, General Electric, Motorola, Radio-Electronics-Television Manufacturers Association and all the organizations of the principal mobile radio services.

*National Press Building
Washington, D. C.*

*ROLAND C. DAVIES
Washington Editor*



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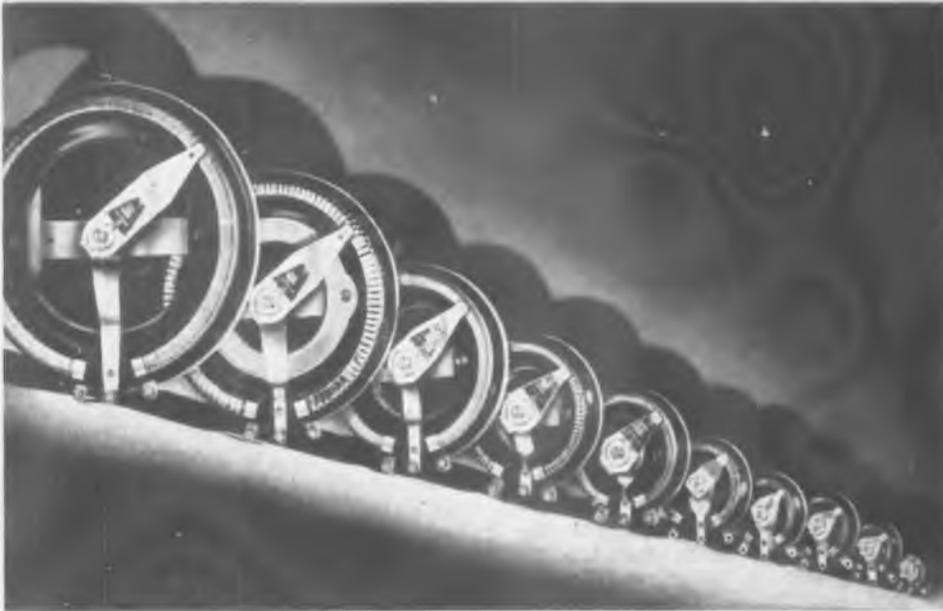
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	RP113	YES	YES	
J	RP151	50	NO	NO
	RP152		NO	YES
	RP153		NO	YES
	RP161	YES	NO	
	RP162	YES	YES	
	RP163	YES	YES	
G	RP201	75	NO	NO
	RP202		NO	YES
	RP203		NO	YES
K	RP251	100	NO	NO
	RP252		NO	YES
	RP253		NO	YES
L	RP301	150	NO	NO
	RP302		NO	YES
	RP303		NO	YES
P	RP351	225	NO	NO
N	RP401	300	NO	NO
R	RP451	500	NO	NO
T	RP501	750	NO	NO
U	RP551	1000	NO	NO

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MERCURY RELAY

The EM-1, single pole, plunger, mercury relay provides control as close as 0.01 C. in industrial laboratory baths, ovens, etc. Specifications, 35 amps at 115 v ac, and 25 amps at 230 v ac, and



2 HP at 115 and 230 v ac. Contacts normally open. Coils are obtainable in a variety of control voltages. Other units are available in one, two, and three pole models for loads up to 60 amps. UL approved operation is completely enclosed. Contactors are entirely unaffected by dirt, dust, heat, moisture, corrosive and explosive atmospheres. **Ebert Electronics Corp., 212-26 Jamaica Ave., Queens Village 28, N. Y.—TELE-TECH & ELECTRONIC INDUSTRIES.**

"SPEED NUTS"

Tandem-Type "Speed Nuts" are produced in coil or strip form with a partial shear between each nut for fast, simple detachment. These "fasteners with a handle" are said to eliminate slowdowns due to misplaced parts. In-



terchangeable for number 6-8-10 and 14Z screws. The fasteners are in coils or strips of any desired length and designed for making power-driven attachments with type A or B (Z) sheet metal screws. Provide double-locking, vibration-free attachments. The operator merely positions the nut end and power-drives a screw. A slight hand pressure snaps the nut from the strip. **Tinnerman Products, Inc., P. O. Box 6688, Cleveland, O.—TELE-TECH & ELECTRONIC INDUSTRIES.**



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WHATEVER THE DESIGN REQUIREMENT
for vacuum fixed or variable capacitors, JENNINGS can meet the need with a large selection of capacities, sizes, and voltage ratings.

High capacity units up to 5000 mmfd at 10 kv and 1000 mmfd at 45 kv are now being made in both variable and fixed types.

Small vacuum capacitors such as the one shown above are currently being used in VHF and UHF applications. The ECS, for example, has capacity ranges of either 2 to 8 mmfd or 3 to 30 mmfd and a voltage rating up to 15 kv.

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New Products

AUTO-TRANSFORMER

Model PA-3 variable transformer is adapted to work bench applications and other uses such as line voltage controls for power supplies and instruments, heat controls, motor speeds, light in-



tensity, etc. Particularly suited to the requirements of laboratories, service men, and model shops. Features a toroidally-wound variable transformer with "Lo Res" commutator surface and a new brush assembly that maintains almost constant pressure from full brush to no-brush. Size, $6\frac{1}{2} \times 6\frac{1}{8} \times 6\frac{1}{2}$ in. Input 115 v, 50-60 cps. Output, 0-135 v. Standard Electrical Products Co., 2240 E. Third St., Dayton, O.—TELE-TECH & ELECTRONIC INDUSTRIES.

CABLE INSPECTOR

The "inspector" is an automatic electrical wiring inspection system based on a continuous scanning circuitry developed for the chemical processing industry. A feature is automatic megging. Conductors are scanned at 1/sec.



Standard model is capable of checking insulation resistances to 110 megohms at 350 v dc. Higher resistance limits and test voltages are available. Extreme sensitivity is attained by an electronic leakage detector. The 10,000 tests required for insulation resistance check of a 100 conductor cable are performed in 200 seconds. Panascan Div. Panellit, Inc., Skokie, Ill.—TELE-TECH & ELECTRONIC INDUSTRIES.

More New Products Appear
on pages 92-96, 102, 107

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City _____

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Type _____ Size _____
Watt _____ Volts _____
No. terminals _____ C. S. July 1946 Approx. weight _____
Weight _____

REQUIREMENT	1	2	3	4
Voltage				
Watt. Requirements				
Terminal				
Lead PP				
Regulation				
Watt. Requirements				

Mounting preferred _____
Lead wire attaching terminals for _____
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Please include schematic diagram and physical drawing on separate sheet.

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tional fitting increases consumer acceptance and sales... proving over the years that confidence placed in KEYSTONE is well placed. For free information about how the KEYSTONE transformer reply sheet can help you, write box ... P-8 ... today!

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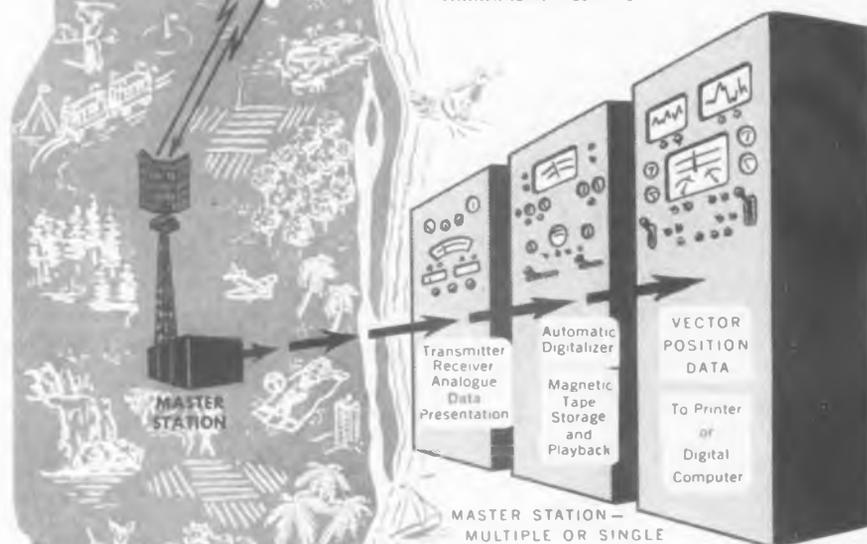


CUBIC RESEARCH AIDS IN AIR WEAPONS DEVELOPMENT

- Provides accurate test data
- Accelerates Weapon Evaluation



CUBIC RESEARCH IN ELECTRONIC PROBLEMS—IN FREQUENCIES FROM D.C. TO MICROWAVE—AIDS GOVERNMENT AIRCRAFT AND AIR ARMAMENT TESTING

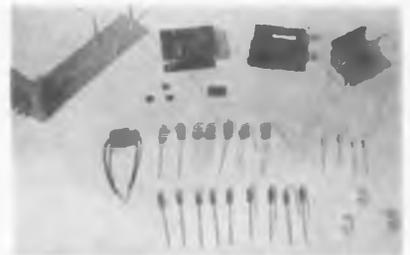


Latest CUBIC designs provide vector position coordinate data in non-ambiguous digital form. Simplified portions of the system permit recording of slant range or miss distance on a special phase meter. Multiple station arrangement with a standard telemetering transmitter, or a single station with a miniature transponder enable automatic storage of position data suited for digital computer use. New engineering features in the system correct automatically for variable phase errors that have plagued this type of equipment for the past decade. The simplified analogue-to-digital converter permits a low inertia system with a degree of accuracy and reliability heretofore unobtainable.

CUBIC is proud of its contributions to the armed forces which provide them with a factual basis for armament selection, and to the national air armament industry in support of their growth, and will continue to devote itself to the advancement of new techniques and their application for increasing support of the National Defense Effort.

Robot Guards Naval Engines

A new robot temperature-monitoring system harnesses midget-sized transistors to protect the operating life of naval engines. The transistorized system, designed by the Minneapolis-Honeywell Regulator Company here in cooperation with the Navy's Bureau of Ships, is a compact, miniaturized self-contained unit that watches over critical bearing temperatures. It is capable of steadily monitoring these temperatures in some 40 locations, usually in the turbine areas. Conventional systems now in use scan these points intermittently introducing the possibility of "hot" bearings



Monitor amplifier unit components

occurring between temperature checks. To accomplish this round-the-clock check with conventional vacuum tube units would require a system three times the size of the transistorized system.

Operating 24 hours a day the new electronic system continuously monitors all the critical points. When a bearing gets "hot" an alarm sounds and a signal light glows to identify the troubled area. By flipping a switch, a miniaturized electronic indicator then gives the attending seaman a precise temperature reading, enabling him to take corrective steps. The sensing elements used in the new system are thermistors. Three transistors in each of 40 amplifiers are utilized. The complete transistorized system is designed to draw less than 30 watts as contrasted to the 200 to 300 watt consumption of a comparable vacuum tube unit. Another time-saving design feature, according to E. Victor Larson, project engineer for Honeywell, is the use of printed circuits to replace complicated wiring arrangements for the system. He estimates that on a production line basis the printed circuit use will reduce wiring time for each amplifier from the 2 to 3 hours it would normally take to something under 10 minutes. It will also increase efficiency at least 50 per cent since the possibility of human error is literally eliminated.



CUBIC
CORPORATION

ELECTRONIC EQUIPMENT
RESEARCH...DEVELOPMENT
2481 CANON STREET,
SAN DIEGO, CALIFORNIA

HEAR THE DIFFERENCE !

Based on the famous University model WLC Theater System used so successfully and extensively in deluxe stadium and outdoor theater installations . . . auditoriums, expositions, concert malls and other important applications where only the highest quality equipment is acceptable—University engineers now bring you a smaller, compact version—the BLC—for general application in public address work. The BLC is the New standard for both voice and music, indoors and outdoors. The BLC is now yours, at the low low price of

ONLY
\$75
LIST



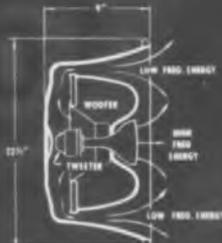
MAKE *Every* P.A.
A HI-FI INSTALLATION
WITH THE *New* MODEL
BLC

FULL RANGE
WEATHERPROOF
COAXIAL
SPEAKER



SPECIFICATIONS

Response 70-15,000 cps
Power
Capacity 25 watts
Impedance 8 ohms
Dispersion 120 degrees
Mounting
180° adjustable "U" bkt.
Dimensions
2 1/2" diameter, 9" depth



Ask your distributor for a convincing demonstration, and HEAR THE DIFFERENCE !

Better Lows: BALANCED "COMPRESSION" TYPE FOLDED HORN, starting with eight inch throat and energized by top quality low frequency "woofer" driver provides more lows than other bulky designs.

Better Highs: DRIVER UNIT TWEETER with exclusive patented "reciprocating flares" wide angle horn transmits more highs with greater uniformity . . . high frequency response that you can hear!

More Efficient: DUAL RANGE THEATER TYPE SYSTEM permits uncompromising design of the "woofer" and "tweeter" sections for greatest efficiency. Hear it penetrate noise with remarkable fidelity and intelligibility.

Less Distortion: SEPARATE LOW AND HIGH FREQUENCY DRIVER SYSTEMS with electrical crossover reduces intermodulation and acoustic phase distortions common to other systems which attempt to use two different horns on a single diaphragm.

More Compact: EXCLUSIVE WEATHERPROOF DUAL RANGE COAXIAL DESIGN eliminates wasted space. Depth of BLC is only 9"; can be mounted anywhere, even flush with wall or ceiling.

More Dependable: EXPERIENCED MECHANICAL ENGINEERING AND CAREFUL ELECTRICAL DESIGN meet the challenge of diversified application and environmental hazards. Rugged, and conservatively rated—you can rely on the BLC.

Write Desk No. 19 for full descriptive literature.

University

LOUDSPEAKERS INC.

80 SOUTH KENSICO AVENUE

WHITE PLAINS, N. Y.

NEW, SHOCK-PROOF 1 MC CRYSTAL UNIT PERFECTED

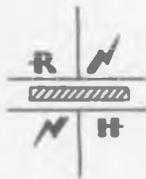
Reeves-Hoffman has perfected a 1 mc Crystal Unit, shock-mounted in an HC-6 holder, and built to meet all requirements for MIL types: CR-18, 19, 27, 28, 35, 36 and 48/ μ . The secret of the crystal's exceptional stability lies in the revolutionary, new nylon nest which firmly secures the AT cut crystal from shock, permitting Reeves to go down to 500 kc in an HC-6 holder while keeping frequency deviation at a minimum.

This radically different nylon mount proves once again Reeves-Hoffman offers superior quality in all types of crystal units... especially in the low frequency range.



Write today for further information and prices.

REEVES-
HOFFMAN
CORPORATION



A subsidiary of Claude Neon, Inc.

CHERRY AND NORTH STREETS
CARLISLE 2, PENNSYLVANIA

LICENSED UNDER PATENTS OF THE BELL SYSTEM

Huge NBC Color TV Center Ready

Reported to be the world's largest TV studio, freshly equipped for color broadcasting, a new facility has been opened by the National Broadcasting Co. The giant studio, located in Brooklyn, N. Y. (1268 E. 14th St.) and formerly a Warner Brothers soundstage, has been streamlined and equipped at a cost of \$3,500,000 to handle the network's "Spectaculars"—90-minute special color programs. There will be 33 of these super-productions, each carrying the budget of a major Broadway musical.

The studio is 178 ft. long and 88 ft. wide. Its height accommodated a 38-foot rampart, with a television camera atop, in a recent production of "Richard II." The longest single cyclorama in TV—464 ft.—will run along the walls. The lighting consists of 900 circuits with a capacity of 960,000 watts, sufficient to light a community of 3,000 homes.

The studio is unique in several respects:

1. It is claimed to be the only studio in the world with a lighting grid, the components of which can be raised or lowered by electric hoists remotely-controlled from the lighting bridge. There are 126 such hoists, with a capacity of 75,000 pounds of lighting equipment. This push-button hoist system, permitting individual height adjustment of 63 groups of lights, was developed by NBC engineers, and permits pre-setting of heights for 10 scenes.

2. It is reportedly the only studio in the world with the newly-perfected Lumi-Tron lighting board, a complex arrangement of some 2,000 controls, which permits the pre-setting of lighting for 10 scenes, double the maximum of any board used elsewhere in the industry. Further, it permits 10 changes of lighting within any one scene.

3. It is the only studio in the world with a large-screen color projector, newly developed by RCA, which permits studio audiences to watch the performance on a movie-size, 15-by-20-foot screen.

The color TV equipment permits the handling of 10 video sources including four studio cameras, and the achievement of such elaborate effects as triple dissolves.

By year's end, a large color studio, constructed and equipped at a cost of \$3,600,000, will be ready in Burbank, Calif., permitting NBC to tap the vast reservoir of Hollywood talent for "spectaculars" and other color programs.

NOW! the new

*Eliminates extra
manpower
requirements*

*Gray
Telop III*

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 . . . interior view of automatic slide holder which accommodates 4" x 5" opaque slides . . . One lens . . . no registration problem . . . no keystoning.

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 3 1/4" 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.

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.

TV Around The World

TRIAD
Octal
plug-in
TERMINALS



These new plug-in hermetic seals mate with a standard octal socket. They have the desirable feature of all Triad terminals: heavy moulded construction of mineral-filled MIL-P-14 approved phenolic, high dielectric strength, high conductivity gold alloy plated pins, hot-tinned solder rings, and resistance to "tracking" and fungus growth. They meet MIL-T-27 requirements.

These terminals may be had with either rolled or flat flanges. Rolled flanges are available to fit either a 1" or 1 1/8" O.D. can. Cans in either CRS or nickel alloys are available on special order.

For specifications and prices on these plug-in terminals and for a wide range of other single and multiple hermetic seals write for

Bulletin TH-54J



TRIAD
TRANSFORMER CORP
4055 Redwood Ave., Venice, Calif.



THE TV medium has continued to grow slowly but surely throughout the world during the past year. (See "World-wide Roundup of TV Statistics, TELE-TECH & ELECTRONIC INDUSTRIES, June 1953, page 146.) The survey of recent developments presented here includes a considerable amount of information received Aug. 1954 from the Voice of America, which is inaugurating an increasing number of TV activities under the directorship of J. R. Poppele.

SOUTH AMERICA

ARGENTINA: One government owned and operated station. All material subject to censorship. Importation of films severely restricted. About 25,000 receivers.

BRAZIL: Four transmitters in two service areas. Severe restrictions on set and equipment imports. Power line voltage and frequency fluctuation. Set costs very high. About 110,000 receivers.

CHILE: No stations on air. Considerable interest and preparations to go ahead as soon as government releases dollars. Opposing groups want investment return in one year vs. long term return.

COLOMBIA: One government owned and operated station. Good signal transmitted five hours per day. 400 government-paid receivers in selected homes and stores. Station to start commercial operation soon. Expansion expected.

PERU: No stations on air. Government to decide in few months whether it will permit commercial operation, which would result in four stations, as opposed to one for government operation.

VENEZUELA: Three stations in Caracas, one government owned. Private stations transmit six hours per day, government two hours. Country is wealthy. Film imports limited. About 30,000 receivers.

EUROPE

BELGIUM: Two transmitters serve French and Flemish districts. Both 819 and 625 standards used. About 7000 receivers.

DENMARK: One station on air two nights per week. About 1500 receivers.

FRANCE: Five stations on air. Labor union operational difficulties. About 110,000 receivers.

GERMANY (WESTERN): Thirteen stations reported on air. Conflict between Federal Government and Independent State Radio networks for control of TV. About 60,000 receivers reported by VOA, although some estimates are as high as 200,000.

GREAT BRITAIN: Five stations on air, using single channel, covering 80% of population. One or two channels to be added with start of commercial TV, probably late in 1955. About 3,500,000 receivers.

ITALY: Five transmitters reported on air. About 50,000 receivers.

NETHERLANDS: Single network on air two nights per week, time divided between political groups. About 12,000 receivers.

SOVIET UNION: Five stations reported on air. About 200,000 receivers.

SPAIN: One station on air. About 600 receivers.

SWITZERLAND: One station reported on air. Terrain and language problems.

FAR EAST & PACIFIC

AUSTRALIA: No stations reported on air. Plan approved for dual control government and commercial stations. No major equipment import restrictions expected.

HAWAII: Three stations on air.

JAPAN: Two stations reported on air. Public enthusiastic. About 50,000 receivers.

PHILIPPINES: One station on air.

THAILAND: One station on air about one hour per week. Only about 50 receivers.

NORTH AMERICA

CANADA: Sixteen stations reported on air, including six CBC. About 800,000 receivers. Rapid growth of set sales and network facilities.

CUBA: Four stations on air. Excellent facilities. About 225,000 receivers.

MEXICO: Six stations on air. About 100,000 receivers.

PUERTO RICO: Two stations on air. Some coverage of other islands.

UNITED STATES: 395 stations on air, including some 50 equipped for color. About 31,500,000 receivers. Over 300 stations are network connected in almost 200 cities.

NOW

KTR-100A

Color TV microwave relay

ONE BASIC SYSTEM FOR ALL BANDS

BROADCAST

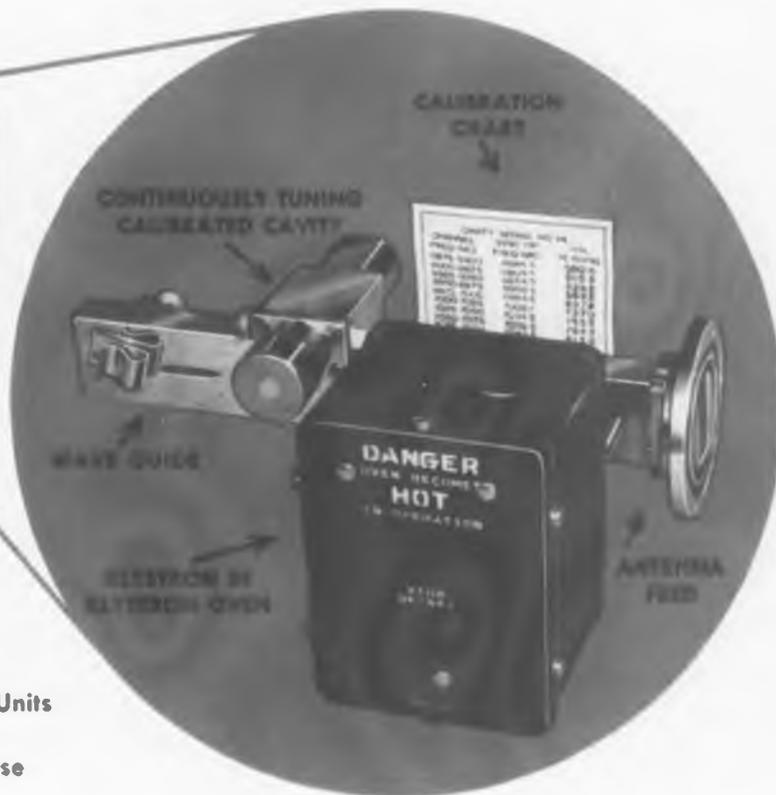
6875-7050
12800-13200

COMMON CARRIER

5925-6425
7050-7125
12800-13200

GOVERNMENT

7125-7200



ONE BASIC SYSTEM with all these extra features AT NO EXTRA COST!

- Complete Multiband Frequency Coverage
- Easily Interchangeable RF Plumbing Units
- Tunable Calibrated Reference Cavity
- Differential Gain and Differential Phase Controls
- Built-in Multiplexed Audio

The new KTR-100A microwave relay meets or exceeds all FCC and RETMA color specifications for multiplexed video and audio signals with a differential phase of less than $\pm 2^\circ$ and a differential gain of less than 1 db maximum.

It provides in a single, basic system complete equipment to cover all broadcast and common carrier bands and the adjoining government band . . . combines multiplexed video and audio . . . and is designed for the widest possible flexibility in application.

Not only are these features available *at no extra cost* but the new KTR-100A still remains *the lowest cost microwave in the industry.*

Write for complete information. Address Dept. 6130 TL

The advanced design of the new KTR-100A offers simplicity and accessibility with proven reliability . . . providing greater flexibility with maximum tube efficiency, power and long life. Easily interchangeable RF units (as shown above) provide for band changes and a referenced calibrated cavity makes possible frequency changes in the field within allocated bands. One basic system for color and monochrome and for all present and future frequencies protects your equipment investment.



Specialists in Microwave for Television

RAYTHEON MANUFACTURING COMPANY

Equipment Sales Division

WALTHAM 24, MASSACHUSETTS

ENGINEERS AND PHYSICISTS

for RESEARCH, DEVELOPMENT
AND PRODUCTION OF
SEMICONDUCTOR DEVICES

PACIFIC SEMICONDUCTORS, INC., is a new company organized around a central group of scientists, engineers, and administrators who have unusual records of recent accomplishment in the semiconductor field. Backed by several millions of dollars of corporate financing, rapid progress is anticipated in the development, manufacture and sale of semiconductor devices of advanced design, including diodes and transistors.

Positions are now available for qualified physicists and engineers in the following fields:

SEMICONDUCTOR PHYSICISTS

DUTIES To conduct the necessary experimental work for the improvement of semiconductor devices, including diodes and transistors, and to participate in the development of new products.

REQUIREMENTS A physics graduate with courses applicable to semiconductor solid-state work and at least one year experience or electronics preferably with semiconductor devices.

ELECTRICAL ENGINEERS

DUTIES To design electronic test equipment and instrumentation including supervision of construction, calibration and maintenance of such equipment.

REQUIREMENTS A degree in electrical engineering with experience in electronic circuit design and construction.

ELECTRICAL ENGINEERS

DUTIES To design circuits employing semiconductor devices and to determine the potentialities of new devices and associated circuits. To solve customer problems involved in the use of semiconductor devices.

REQUIREMENTS An Electrical Engineering graduate with emphasis upon electronics or communications. Experience in developmental circuitry including design and experimental work with audio frequency, radio-frequency (through UHF), and pulse equipment.

Mr. Joseph C. Ross, Jr., Personnel Manager will interview qualified applicants at the Sherman Hotel in Chicago on October 4th, 5th, and 6th.

PACIFIC SEMICONDUCTORS, INC.

10451 W. Jefferson Blvd.,

Culver City, California

Cuvette Densitometer

The cuvette densitometer is used in medical practice and research to make a continuous record of the rate of dye dilution in the heart chambers by observing the blood flow from a peripheral artery. From this record, calculations can be made to determine the amount of blood pumped by the heart during each stroke. An improved densitometer developed by S. R. Gilford of the National Bureau of Standards possesses several advantages over previous instruments of this type. Among these are greater stability and sensitivity, smaller size and greater convenience of application.

One of the serious defects in previous instruments for measuring blood capacity has been instability in the electronic circuitry. During the approximately 30 seconds required to record the dye-dilution curve, it is essential that zero and



Improved cuvette densitometer developed at NBS. Chassis No. 1, the electronic unit, contains: A, pilot light; B, power switch; C, indicating galvanometer; D, zero suppression control; E, scale-factor switch. Chassis No. 2, the optical system, contains: F, lamp housing; G, light-tight sliding tube; H, cuvette housing; I, cuvette; J, photo-cell housing; K, neutral-density filter selector.

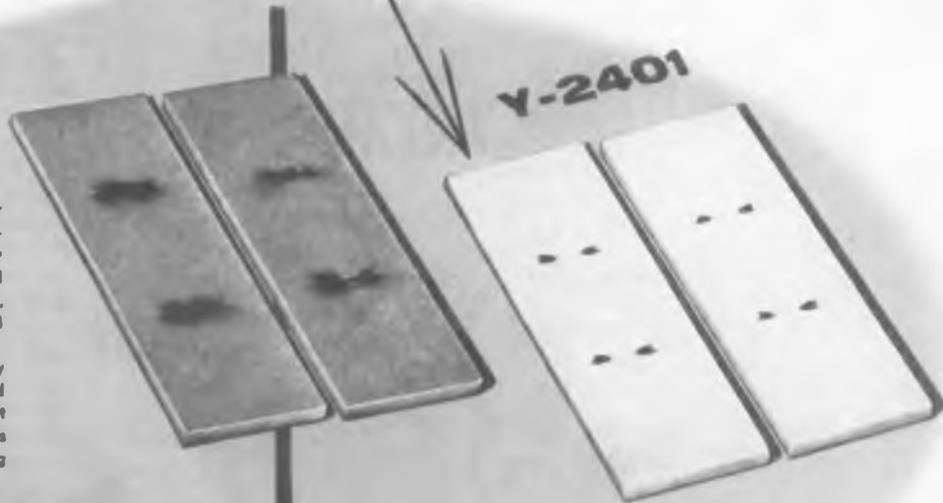
gain be stable. Also, since it is necessary to calibrate the instrument—a procedure which may be delayed by several hours in some instances—it is essential that the sensitivity remain constant for considerable periods of time. In the design of the NBS cuvette densitometer, therefore, very careful consideration was given to obtaining high stability of sensitivity.

The optical system of the instrument includes a source of monochromatic light for illumination of the cuvette, and a photocell to intercept the transmitted light. A stable light source is obtained by using an incandescent lamp powered by a constant-voltage transformer. A condensing lens collimates the beam of light. The filters which provide the monochromatic light give maximum response to Evan's Blue.

The NBS densitometer uses a phototube of the multiplier type to
(Continued on page 118)

this **new** and significantly superior Phenolite Laminated Plastic

Here's a test showing the superior arc resistance of this new melamine-polyester material—Y-2401 by name. All samples were subjected to 5 arcs of 15 KV, 30 millamps, through a $\frac{3}{8}$ " gap at a rate of 113 arcs per minute. Note how Y-2401 (two samples at right) showed only minor burns whereas Standard Grade XX phenolic material (at left) was deeply carbonized across the arc, resulting in conducting paths.



**EXCELS IN ARC RESISTANCE
... IN MACHINABILITY
... IN ELECTRICAL PROPERTIES**



With an ordinary band saw, operator saws out a Y-2401 part to be used in an oil circuit recloser.



In sections up to $\frac{3}{8}$ ", Y-2401 can be shaped by shaving dies as illustrated upper left.

(Center) Y-2401 drills cleanly, without chipping or cracking. Drill tools last longer without resharpening.

Here's the circuit breaker assembly with the Y-2401 parts in place. (Note how this assembly is composed almost entirely of various grades of versatile Phenolite.)



Also manufacturers of Vulcanized Fibre, Peerless Insulation, Vul-Cot Waste Baskets, Materials Handling Equipment, and Textile Bobbins

In test after test, this new high pressure laminate actually *created* new standards of performance. The illustration above shows how this new paper base-melamine Phenolite goes beyond current grades in arc resistance.

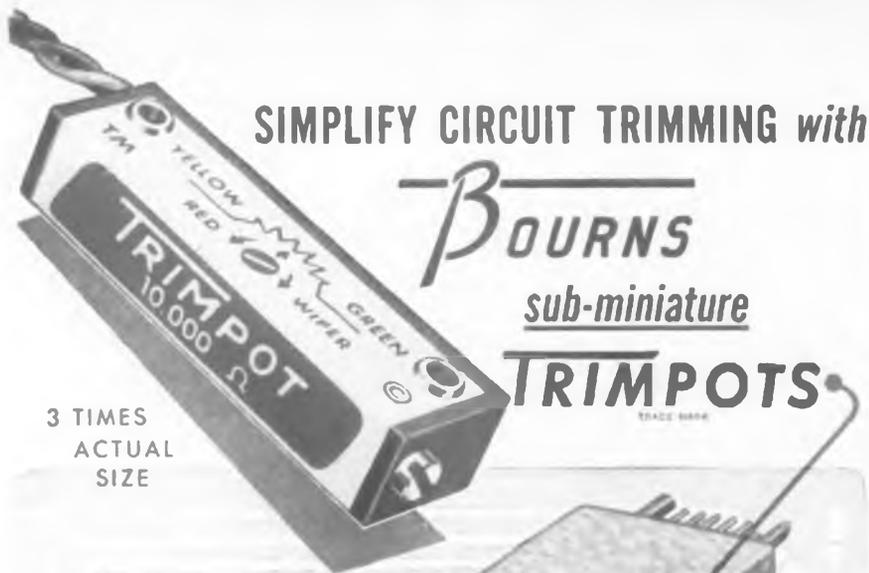
But that's only a start! Y-2401 does away with the difficult-to-machine aspects formerly encountered with melamine laminates. It can easily be punched, sawed, drilled, turned and milled to close tolerances. And being non-brittle, it can be rough-blanked much closer to final dimensions, thus reducing waste of stock and effecting lower machining costs.

Y-2401 has excellent dielectric strength, good moisture resistance and low dissipation factor. Combine all its good points, and you have the "just-right" insulation material for use in transformers, circuit breakers, switch bases, supports for sliding contacts; in radar, television and radio; in many other critical electrical applications. Available in 39" x 47" sheets, of thicknesses ranging from $\frac{1}{32}$ " to 1".

DETAILED DATA YOURS FOR THE ASKING—Write for Technical Data Sheet on Phenolite Grade Y-2401. Contains complete listing of its properties and possibilities. Gives all other information for thorough evaluation. Address Dept. K-10.

**NATIONAL
VULCANIZED FIBRE CO.**

WILMINGTON 99, DELAWARE



SIMPLIFY CIRCUIT TRIMMING *with*

BOURNS

sub-miniature

TRIMPOTS

3 TIMES
ACTUAL
SIZE

One of many applications
when space is at a premium

Actual size
only $\frac{1}{4} \times \frac{3}{16}$ "

RESOLUTION: AS LOW AS 0.25%

- POWER RATING: 0.25 WATT AT 100° F.
- WEIGHT: ONLY 0.1 OZ.

BOURNS **TRIMPOT** is a 25 turn, fully adjustable wire-wound potentiometer, designed and manufactured exclusively by BOURNS LABORATORIES. This rugged, precision instrument, developed expressly for trimming or balancing electrical circuits in miniaturized equipment, is accepted as a standard component by aircraft and missile manufacturers and major industrial organizations.

Accurate electrical adjustments are easily made by turning the exposed slotted shaft with a screw driver. Self-locking feature of the shaft eliminates awkward lock-nuts. Electrical settings are securely maintained during vibration of 20 G's up to 2,000 cps or sustained acceleration of 100 G's. BOURNS **TRIMPOTS** may be mounted individually or in stacked assemblies with two standard screws through the body eyelets. Immediate delivery is available in standard resistance values from 10 ohms to 20,000 ohms. BOURNS **TRIMPOTS** can also be furnished with various modifications including dual outputs, special resistances and extended shafts.

BOURNS also manufactures precision potentiometers
to measure Linear Motion; Gage, Absolute, and
Differential Pressure and Acceleration



BOURNS LABORATORIES

6135 MAGNOLIA AVENUE, RIVERSIDE, CALIFORNIA

Technical Bulletin On Request, Dept. 172

© B. L. PATENTS PENDING

Cuvette Densitometer

(Continued from page 116)

provide the required sensitivity. However, when a photo-multiplier tube is used with conventional circuits, cell fatigue may cause variations in sensitivity and baseline stability. This effect is noticeable even when the output current is very low. In the NBS instrument, the effect of cell fatigue is overcome by using a circuit described by Sweet—a feedback system in which the dynode potentials of the phototube are automatically decreased as the light level is increased. The result is that the circuit tends to maintain a constant output current regardless of the light flux impinging on the photo-cathode. Thus, the total current drawn from the anode never exceeds one microampere; at this level fatigue is negligible.

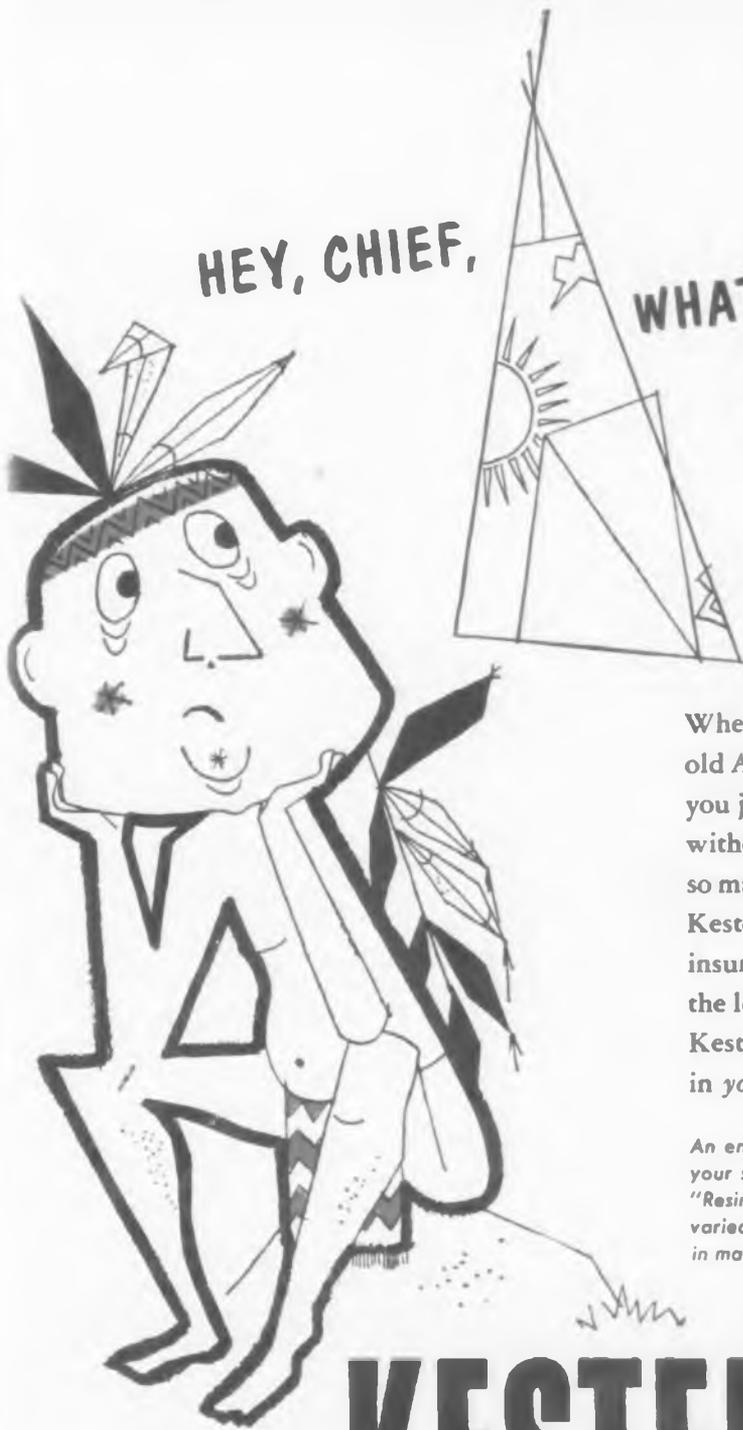
In this circuit, the anode current, normally the output, is kept constant and the dynode divider potential, which is a function of the incident flux, is used as the output. However, the output is not a linear function of the incident flux, but rather the logarithm of this quantity. Since the concentration of the dye is directly proportional to the optical density, and since the logarithmic characteristic of the instrument gives the optical density function, the output of the instrument is directly proportional to the dye concentration.

As the optical density function is a directly additive quantity, the relationship between the output and the concentration remains constant. Thus, a given change in concentration of the dye in the blood produces the same change in output regardless of the background optical density. This is not true for a system with linear response, which gives a progressively decreasing output for equal concentration changes as the background density increases.

CONVERSION CHASSIS



Close-up shows new Sarkes Tarzian selenium rectifier conversion chassis now available. When incorporated into existing equipment these units simplify future replacements by eliminating chassis removal and need for soldering



HEY, CHIEF,

WHAT'S A WIGWAM

WITHOUT WAMPUM?

Whether it's shells or beads — or good old American dollars, for that matter — you just can't operate successfully without showing a profit. That's why so many progressive companies depend on Kester quality and performance to insure maximum results in production at the lowest possible cost. And we'll bet Kester Solder can mean more "wampum" in *your* "wigwam," too!

An engineered adaptation can be made to your specific requirements with Kester "44" Resin, "Resin-Five" or Plastic Rosin-Core Solder . . . varied core sizes or flux-contents are available in many different diameters.

KESTER

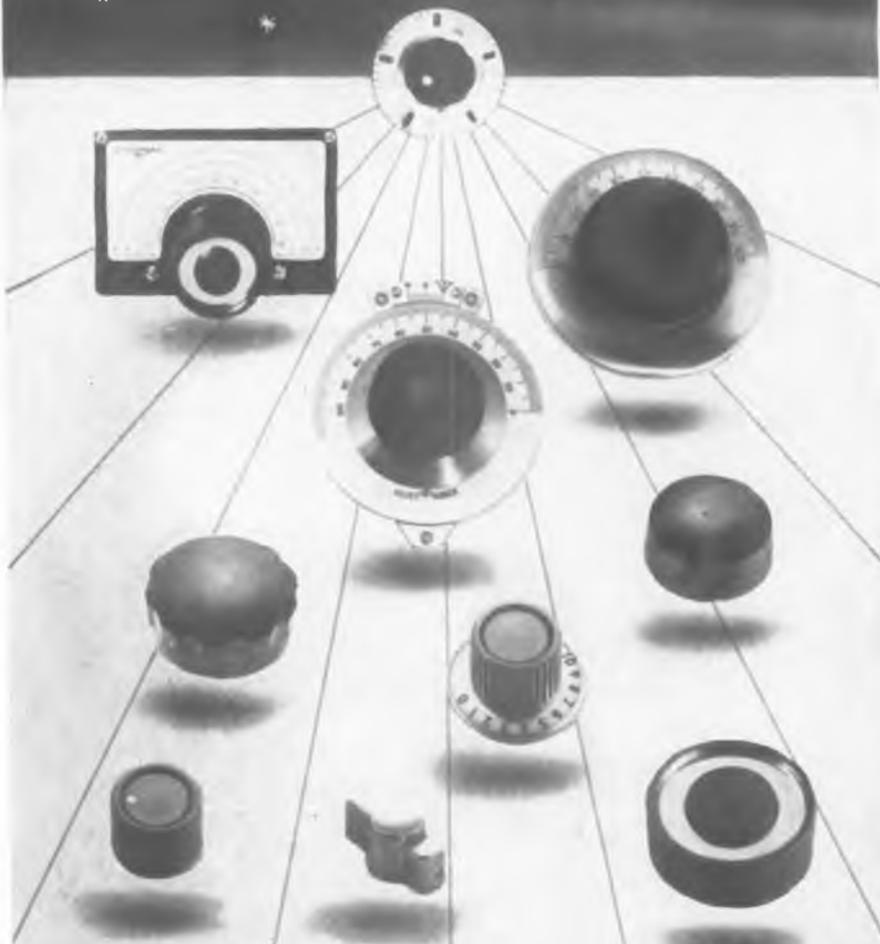
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WRITE TODAY for Kester's **NEW** 78-Page
Informative Textbook,
"SOLDER . . . its fundamentals and usage"



PRECISION components *tuned to tomorrow*



POPULAR DIALS AND KNOBS

For years, NATIONAL dials and knobs have been the popular choice of amateurs, experimenters, and commercial users.

NATIONAL dials feature smooth, velvety action, easily-read scales and quality construction. Many dials, like the N and ACN dials shown, can be specially calibrated or supplied with blank scales for commercial applications.

NATIONAL knobs — distinguished by their clean, functional, chrome and plastic styling and sturdy construction — are the most popular of their type ever produced. All fit $\frac{1}{4}$ " shafts. For commercial applications, they can be supplied in special colors and with special calibrations.

Write for new NATIONAL catalog of dials and knobs to Dept. T-1054

National

NATIONAL COMPANY, INC., 6 SHERMAN ST., MALDEN 48, MASS.

Economics of Electronic Firms

IRE President William Hewlett reports that a recent study by the Harvard Business School, indicated a 2% ratio of Research and Development expenditures to sales for the national average of all types of industry, compared with 5.4% for the electronic industry. For the West Coast, this figure is approximately 6%.

In a recent survey of 14 electronic manufacturers, another important fact was discovered. Where the national average ratio of cost of production equipment to yearly sales is approximately 70%, in the electronics industry this figure is about 9%. Further, while the national average of working capital per employee is around \$4,000, in the West Coast electronic industry, the figure is about \$2,500.

MRIA Appoints

Joseph F. Hards, President of the Magnetic Recording Industry Association, has announced the appointment of Robert Leon of Brush Development as Chairman of the Standards and Engineering Committee. Mr. Hards stated that the members of MRIA are anxious to establish standards for the magnetic recording industry.

Raytheon Moves

Raytheon Manufacturing Co. has announced that its New York office has completed its move from downtown Manhattan to 589 Fifth Ave.

"IMPACTOMETER"



The Bigelow-Sanford Carpet Co. recently displayed its "impactometer," a device to measure sounds in the home. The hammer dropping on sample floor material inserted at left creates sound waves which are picked up by microphone. These sound amplitudes are then visible in CRO at right.

Specify

NEW G-E LONG-LIFE RECTIFIER TUBES*!

- * 5AU4
- * 5U4-GA
- * 5Y3-GT

Sturdy, resist shocks, dissipate heat efficiently...yet prices are unchanged!

THE improvements you can SEE in the new 5U4-GA apply to all three new G-E rectifier tubes for television. G-E Design Service brings you, at no price increase, two rectifier tubes that are completely re-engineered, plus one brand-new type, the 5AU4. All are much more dependable than present types, so help reduce your TV production-line rejects. The new tubes are longer-lived—they cut down on service call-backs, increasing the reputation of your sets.

Recent introduction of new 6BQ6-GA and 25BQ6-GA sweep tubes, and this announcement of new G-E rectifier types, are only the first steps in an extensive General Electric program to design and build greatly improved receiving tubes for TV. Manufacturers of sets are asking for better tubes . . . G.E. is devoting every resource to the task of supplying them!

Keep in touch with G.E. for new-design tubes that will mean *new* high quality, *new* value, *new* reliable performance in the receivers you design and manufacture! Address
Tube Department, General Electric Company,
Schenectady 5, New York.



The 5U4-G prototype, though it did a good electrical job, was subject to damage from shocks and vibration. G.E.'s new 5U4-GA withstands hard usage, gives long service. Arrows (above, right) point to reasons why:

1.

Substantial mica supports brace the tube structure at both top and bottom, instead of at the top only.

2.

Glass bulb now is straight-side, compact, and strong. Diameter is 30% less than 5U4-G.

3.

New double-fin plate construction improves heat dissipation.

4.

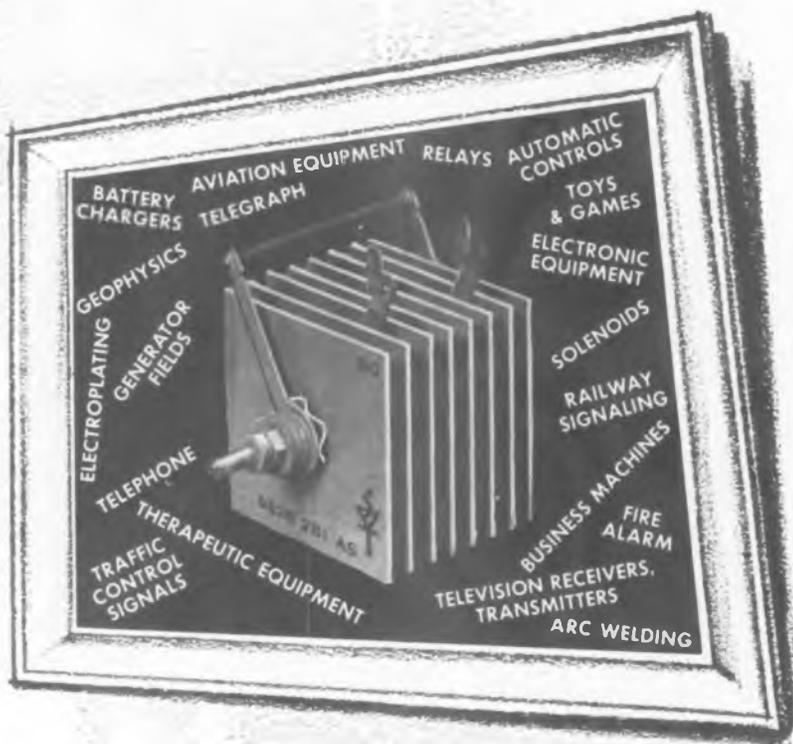
Base construction now is button-stem, with the leads passing through widely spaced individual seals at bottom of glass envelope. Adds strength, gives shorter leads and greater lead separation, and brings about better heat conduction . . . which in turn reduces electrolysis and air-leakage.

New G-E 5U4-GA has same base diameter and layout as prototype 5U4-G—is fully interchangeable.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

Whatever Your Application...



- • • Sarskes Tarzian Centre-Kooled Selenium Rectifiers give years of trouble-free, maintenance-free service. Write for complete information.

Sarskes Tarzian, Inc., RECTIFIER DIVISION

DEPT. T-5, 415 N. COLLEGE AVE., BLOOMINGTON, IND.
In Canada: 700 Weston Rd., Toronto 9, Tel. Murray 7535
Export—Ad. Auriema, Inc., N.Y.C.



"Centre-Kooled"
SELENIUM RECTIFIERS

Petition for Pay-As-You-See TV

Matthew Fox, President of Skiatron TV, Inc., has petitioned the FCC to provide TV with a "subscriber" source of revenue to broaden its economic base and its services to the public. Skiatron TV is the holder of franchise to operate a system of coding and decoding TV programs, known as "Subscriber-Vision."

Citing the rapidly disintegrating financial situation of the nation's UHF stations, now causing deep concern both in Congress and the Federal Communications Commission, Mr. Fox asked that Skiatron TV be granted permission to start pay-as-you-see broadcasting to America's homes as an immediate method of solving the UHF problem.

The petition asked that the F.C.C.:

1. Modify its regulations to permit broadcasting of home pay-as-you-see TV for a maximum of 35 hours per week;

2. Limit such permission to UHF stations only for the next three years to help overcome their present economic plight caused by inability to acquire top talent and programs.

Tallest Tower

World's tallest video tower is near completion at Oklahoma City's Station KWTW. Coupled with a power increase to 316,000 watts, the tower will give KWTW the broadest coverage pattern in the Southwest.



The 1572 foot tower, a triangular guyed structure, measures 12 feet in width across each of its three faces. It is supported by a total of 24 guy cables spanning out to anchors almost a fifth of a mile from the base. Total weight of the massive structure will be over 1,300,000 pounds.

For the big difference
in size
and weight
 use
Astron Metalite®
Hy-Met*.....



ONLY 1/77 the size and weight of equally rated, high capacitance, low voltage, paper and foil capacitors. Astron Metalite Hy-Met utilizes lacquer coated dielectric tissue on which an aluminum film approximately 50 millimicrons thick has been deposited . . . to eliminate the bulky windings necessary in larger conventional paper and foil capacitors. The all important space and weight saved enables Astron to build a dependable high temperature Metalite Hy-Met (operation up to 125° C) smaller and lighter . . . so small and light that every miniaturizing requirement, no matter how exacting, can easily and efficiently be met.

Modern electronic designs require tiny but tough capacitors able to withstand severe environmental and electrical conditions. This is where ultra-small Metalite Hy-Met "fits in!" Astron uses an extremely pure thermosetting impregnant in Metalite Hy-Met insuring high capacitance stability over the entire operating temperature range -55° C to +125° C . . . units have low R.F. impedance due to small size and short circuit path . . . hermetically sealed . . . positive glass to metal seals . . . a wide variety of case styles and mounting brackets . . . self-healing properties to add extra protection against overvoltages or momentary surges . . . higher insula-

tion resistance . . . metal cased Metalite Hy-Met meets all MIL humidity, thermocycle immersion and vibration requirements. Designing miniaturized electronic equipment, noise suppression circuits, or other devices where space and weight are vital such as airborne units? Then you should have all the details about Astron Metalite Hy-Met . . . for complete design characteristics and physical information write to Astron for your free copy of Bulletin AB-19A TODAY!

ASTRON
 CORPORATION



225 GRANT AVENUE, E. NEWARK, N. J.

Export Division: Rocke International Corp. 13 E. 40 St., N. Y., N. Y.
 In Canada: Charles W. Pointon 8 Alcina Ave., Toronto 10, Ontario

(Cont)

*Trademark

dependable operation up to 125° C



POLARIZED SENSITIVE RELAYS

We have been making polarized relays for a number of years and at the present time find, to our own surprise, that we have seven basic types in production, ready for production or in the prototype stage. We have analyzed their relative usefulness for our own information. The condensed result may be of interest.

First, as to polarized relays in general, a word or two. All of them respond according to polarity of a direct current applied to their coils, or "follow" (if they can) an alternating current. All of them can be wound with two separate coils, responding to the magnitude and polarity of the difference between the two (opposed) coil currents.

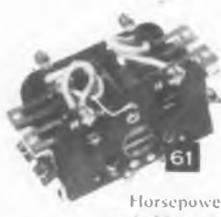
Depending on arrangements, some "latch" or "remember", occupying either of two switch positions indefinitely until a new pulse of opposite polarity is received in the windings (our "Form Z"). If to this type, spring bias is added so it will remain in only one of the two positions unless current of proper polarity is applied to oppose the spring, it is called "biased polar" (our "Form Y"). Finally, if some rather involved centering mechanisms are added, it will stay in neither position without coil signal but occupies one midway between. Of course, a simple stiff spring would do this but in an undesirable way. (Treatise available.) The result is a "3-position" or "null-seeking" relay (our "Form X").



Power switching on inputs from 8 to 450 milliwatts.



Circuit switching on inputs of 1 to 15 milliwatts. Pulse repeating. Light duty telegraphy.



Horsepower switching on inputs of 200 to 450 milliwatts. Exceptional latching contactor.

SWITCH RATING*	2 TO 5 AMP.	.06 AMP. (2.0 AMP.)	20 AMP.
MAX. SWITCH COMB.	4P2T	SPDT	2P2T
FORMS AVAILABLE (SEE TEXT)	X, Y, Z	X, Y, Z	Z, LATCHING
RATED LIFE, NO. OF OPERATIONS*	100,000	100,000,000 (100,000)	100,000
VIBRATION IMMUNITY	10 G TO 55 CPS	10 G TO 55 CPS	30 G TO 55 CPS



12 milliwatts, 2 pole, 3-position, plug-in with improved thermal stability.



Highly developed pulse repeater for telegraphy and data handling up to 400 bauds sec.



Small and military: 6 to 90 milliwatts.



Cheap, commercial and rugged.

SWITCH RATING*	2 AMP.	.06 AMP. (0.5 AMP.)	1.5 AMP.	1 AMP.
MAX. SWITCH POLES	2P2T	SPDT	SPDT	2P2T
FORMS AVAILABLE (SEE TEXT)	X (Z)	Z, Y	X, Y, Z	Y, Z
RATED LIFE, NO. OF OPERATIONS*	100,000	500,000,000 (100,000)	100,000	100,000
VIBRATION IMMUNITY	10 G TO 55 CPS	15 G TO 500 CPS AT HIGHEST SENSITIVITY.	30 G TO 500 CPS	NOT YET RATED.

* Switch rating and life rating are both conservative and arbitrary; rated current at 110 V AC (resistive load) can be switched for rated number of operations without failure, however.

SIGMA

SIGMA INSTRUMENTS, INC.
86 PEARL STREET, SO. BRAintree, BOSTON 85, MASS.

Military Contract Awards

Electronic products, dollar value, and names of manufacturing contractors receiving awards as reported by U.S. Dept. of Commerce.

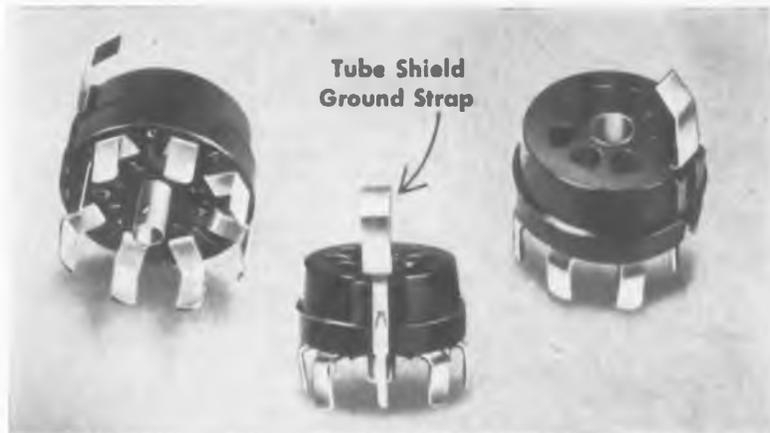
Batteries, dry cell-44,261—Burgess Battery Co., Foot of Exchange St., Freeport, Ill.
Resistors-47,567—Daystrom Instrument, Resistor Div., Daystrom, Inc., Archbald, Pa.
Cable, telephone-44,019—General Cable Corp., 25 Beale St., San Francisco 5, Calif.
Radiac Meter-29,245—El-Tronics, Inc., Fifth & Noble St., Philadelphia 23, Pa.
Radio Receiving Set-2,656,424—Motorola, Inc., 4545 Augusta Blvd., Chicago 61, Ill.
Antenna Groups-221,709—Bendix Aviation Corp., Eclipse Pioneer Div., Teterboro, N.J.
Quartz Crystals-50,096—Midland Mfg. Co., Inc., 3155 Fiberglass Rd., Kansas City, Kan.
Anodized-Gel Battery-192,375—The Magnavox Co., Fort Wayne 4, Ind.
Power Resistors-112,498—International Resistance Co., 401 North Broad St., Philadelphia 8, Pa.
Mercury Type Batteries-132,035—P. R. Mallory & Co., Inc., 60 Elm St., North Tarrytown, N.Y.
Radio Compass-29,656—Edgar L. Scillitoe, Inc., 617 Brooklyn Ave., Brooklyn 3, N.Y.
Voltage Regulators-53,006—Westinghouse Electric Corp., 32 North Main St., Dayton 2, Ohio.
Control Panel-79,057—Munston Mfg. & Service, Inc., Beech St., Islip, N.Y.
Simulator-2,102,556—Link Aviation, Inc., Binghamton, N.Y.
Speed Indicator-53,695—Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.
Speed Indicator-54,074—Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N.Y.
Transmitters-148,767—Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.
K-37 Camera-82,760—X-Ray Department, General Electric Co., 4855 Electric Ave., Milwaukee, Wis.
Electric Analog Computer-83,195—Goodyear Aircraft Corp., 1220 Massillon Road, Akron, O.
Tape, magnetic-95,247—Reeves Soundcraft Corp., 10 East 52nd St., New York 22, N.Y.
Generators, signal-86,603—Munston Mfg. and Service Inc., Beech St., Islip, Long Island, N.Y.
Reperforators, teletypewriter-31,949—Teletype Corp., 1400 Wrightwood Ave., Chicago 14, Ill.
Rectifiers, metallic-30,114—Winder Aircraft Corp., P.O. Box 268, Winder, Ga.
Switchboards-177,951—Automatic Elec. Sales Corp., 1033 West Van Buren St., Chicago, Ill.
Recorders-90,889—Bendix Aviation Corp., Freeport Instrument Div., 1400 Taylor Ave., at Lock Roven Blvd., Baltimore 4, Md.
Multiplexers-123,831—Western Union Telegraph Co., 60 Hudson St., New York 13, N.Y.
Radio Sets-1,165,213—A.R.F. Products Inc., 7627 Lake St., River Forest, Ill.
Teletypewriter Sets-3,244,855—Kleinschmid Labs., Inc., County Lane Rd., Deerfield, Ill.
Control Panels-471,024—Radiomarine Corp. of America, 75 Varrick St., New York 13, N.Y.
Teletypewriter Sets-2,152,578—Kleinschmid Labs., Inc., County Lane Rd., Deerfield, Ill.
Radio Receivers-160,214—Collins Radio Co., 855 35th St. N.E., Cedar Rapids, Ia.
Teletypewriter Sets-2,259,884—Kleinschmid Labs., Inc., County Lane Rd., Deerfield, Ill.
Switches, engaging-28,860—Lear Inc., 110 Ionia Ave. N.W., Grand Rapids, Mich.
Receivers, radio-100,514—Wells-Gardner Co., 2701 N. Kildare Ave., Chicago 39, Ill.
Transmitters, flow rate-115,215—Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.
Transmitters, true airspeed-241,211—Kollsman

(Continued on page 126)

Big Savings Ahead



**2 New SYLVANIA SOCKETS save
Assembly Time... Cut Costs
... Improve Performance!**



1 New Sylvania 7-pin Miniature Printed-circuit Sockets. Contacts and center shield are shaped so that sockets can be stacked one upon another for automatic feeding and assembly. Small slots are used on the circuit board to receive the contacts, resulting in stronger chassis construction. Only one socket assembly need be stocked since terminals can be interconnected by printing the circuit on the chassis board rather than using a metallic connector on the socket itself.

Insulator is molded of general-purpose or low-loss phenolic. Contacts are brass or phosphor bronze, plated to suit your specification. Supplied with or without center shield. Now available in 7-pin construction with 9-pin miniature and other types to follow. Tube Shield Ground Strap can also be furnished.

2 New Sylvania Solderless-type Sockets for wire-wrapped connections are now being made in all 7 and 9-pin miniature sizes. Contacts are shaped to provide reliable connections with the use of present wire-wrapping tools.

For full information concerning these or other Sylvania parts, or special quality components engineered to your own specifications, write to Dept. 4A-4410, Sylvania today.



See the full story of Sylvania's Fabricating Services in Sweet's Catalog—Product Design File. Look for $\frac{1b}{Sy}$

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Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

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LIGHTING • RADIO • ELECTRONICS • TELEVISION

The New SHURE "TWIN-LEVER"

CERAMIC PICKUP CARTRIDGE

for High Fidelity systems



PC Series for 33 $\frac{1}{3}$, 45, 78 r.p.m.

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

A new frontier for the Ceramic principle has been crossed by the development of this cartridge. Designers of high fidelity phonograph systems 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", high fidelity ceramic cartridge represents the ultimate in commercial high fidelity reproduction—without compensating preamplifiers! Smooth, wide range response from 50 to 12,000 c.p.s., plus or minus 3 db. 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 playing 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!

TECHNICAL DATA for MODELS PC4 and PC5

Output Level at 1,000 c.p.s.	.40 volts (33 $\frac{1}{3}$, 45 rpm)
Output Level at 1,000 c.p.s.	.65 volts (78 rpm)
Frequency Response	50-12,000 c.p.s.
Compliance	1.30 x 10 ⁻⁶ cm/dyne
Tracking Force	5 to 8 grams
Net Weight	7.3 grams
Dimensions	1 $\frac{1}{4}$ " overall length; $\frac{3}{8}$ " wide $\frac{1}{8}$ " 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.

Military Contract Awards

(Continued from page 124)

- Instrument Corp., Standard Coil Corp., 80-08 45th Ave., Elmhurst, N.Y.
- Trainers, radar-714,818—Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, Calif.
- Actuators-65,189—Lear Inc., Ionia Ave., N.W., Grand Rapids 2, Mich.
- Recorders, sound-69,420—Westrex Corp., 11th Ave., New York 11, N.Y.
- Amplifiers, 12-channel carrier-34,325—William Miller Instruments, Inc., 325 N. Halstead Ave., Pasadena 8, Calif.
- Oscillographs, multichannel-39,650—CEC Instruments Inc., 711 14th St., N.W., Washington 5, D.C.
- Antennas-38,722—American Phenolic Corp., 1830 South 5th Ave., Chicago 50, Ill.
- Radar, ground-2,334,979—Bendix Radio Div., Bendix Aviation Corp., Baltimore 4, Md.
- Elements, telephone transmitter-30,430—Stromberg-Carlson Co., 100 Carlson Rd., Rochester 3, N.Y.
- Transmitters, radio-260,232—Aircraft Radio Corp., Boonton, N.J.
- Terminals, telephone-202,349—Western Elec. Co., Inc., 195 Broadway, N.Y.
- Receivers, radio-424,345—Collins Radio Co., 855-35th St., N.E., Cedar Rapids, Ia.
- Terminal Sets, radio-495,865—American Machine & Foundry Co., 1085 Commonwealth Ave., Boston 15, Mass.
- Radio Sets-210,810—A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.
- Radar-75,500—Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, Calif.
- Radio Compasses-3,945,899—The Magnavox Co., Fort Wayne, Ind.
- Components, computer set-6,782,524—Ford Instrument Co., Div., Sperry Corp., 31-10 Thomson Ave., Long Island City, N.Y.
- Radar Trainers-1,089,148—Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, Calif.
- Trainer, bombing navigation-111,948—Boeing Airplane Co., Seattle 14, Wash.
- Oscilloscopes-91,354—Industrial Television Inc., 369 Lexington Ave., Clifton, N.J.
- Wire-30,207—Boston Insulated Wire and Cable Co., Boston, Mass.
- Harness Assys-31,781—Marcon Mfg., Co., 141 River Rd., Nutley 10, N.J.
- Generators, signal-228,509—Cosmos Industries, Inc., 31-28 Queens Blvd., Long Island City, N.Y.
- Test Sets, radio-74,485—Taffet Radio and Television Co., 2530 Belmont Ave., Bronx 58, N.Y.
- Reader Systems, zero-64,105—Sperry Gyroscope Co., Div., Sperry Corp., Great Neck, N.Y.
- Connector Plugs-45,409—Cannon Electric Co., 3209 Humboldt St., Los Angeles 31, Calif.
- Capacitors-29,666—Bendix Aviation Corp., E. Joppa Rd., Towson 4, Md.
- Tubes, electron-33,750—Bomac Labs., Inc., Salem Rd., Beverly, Mass.
- Tubes, electron-72,900—General Electric Co., Syracuse, N.Y.
- Tachometers, oscilloscope-497,702—General Motors Corp., AC Spark Plug Div., Flint, Mich.
- Coil Winders-44,303—Coil Winders, Inc., New York Ave., Westbury, L.I., N.Y.
- Test Sets, servo-96,904—Telectro Industries Corp., 35-16 37th St., Long Island City 1, N.Y.
- Oscillographs, recording-26,430—GEC Instruments, Inc., Subsid. Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.
- Actuators, motor assy-28,588—Wm. R. Whitaker Co., Ltd., 915 N. Citrus Ave., Los Angeles 38, Calif.
- Oscilloscopes-26,218—Tektronix Inc., P.O. Box 831, Portland 7, Ore.

TV set costs go down—quality stays high with Tung-Sol "series string" TV tubes

2AF4

(Prototype—6AF4)
Heater Current 0.6 A
Heater Volts 2.35

3AL5

(Prototype—6AL5)
Heater Current 0.6 A
Heater Volts 3.15

3AU6

(Prototype—6AU6)
Heater Current 0.6 A
Heater Volts 3.15

3AV6

(Prototype—6AV6)
Heater Current 0.6 A
Heater Volts 3.15

3BC5

(Prototype—6BC5)
Heater Current 0.6 A
Heater Volts 3.15

3BE6

(Prototype—6BE6)
Heater Current 0.6 A
Heater Volts 3.15

3CB6

(Prototype—6CB6)
Heater Current 0.6 A
Heater Volts 3.15

4BQ7A

(Prototype—6BQ7A)
Heater Current 0.6 A
Heater Volts 4.2

4BZ7

(Prototype—6BZ7)
Heater Current 0.6 A
Heater Volts 4.2

5AN8

(Prototype—6AN8)
Heater Current 0.6 A
Heater Volts 4.7

5AQ5

(Prototype—6AQ5)
Heater Current 0.6 A
Heater Volts 4.7

5BK7A

(Prototype—6BK7A)
Heater Current 0.6 A
Heater Volts 4.7

5T8

(Prototype—6T8)
Heater Current 0.6 A
Heater Volts 4.7

5U8

(Prototype—6U8)
Heater Current 0.6 A
Heater Volts 4.7

5V6GT

(Prototype—6V6GT)
Heater Current 0.6 A
Heater Volts 4.7

6AU7

(Prototype—12AU7)
Heater Current 0.6 A
Heater Volts 3.15*

6AX7

(Prototype—12AX7)
Heater Current 0.6 A
Heater Volts 3.15*

6S4A

(Prototype—6S4)
Heater Current 0.6 A
Heater Volts 6.3

6SN7GTB

(Prototype—6SN7GTA)
Heater Current 0.6 A
Heater Volts 6.3

12AX4GTA

(Prototype—12AX4GT)
Heater Current 0.6 A
Heater Volts 12.6

12B4A

(Prototype—12B4)
Heater Current 0.6 A
Heater Volts 6.3*

12BH7

(Prototype—12BH7)
Heater Current 0.6 A
Heater Volts 6.3*

12BQ6GA

(Prototype—6BQ6GA)
Heater Current 0.6 A
Heater Volts 12.6

12BQ6GT

(Prototype—6BQ6GT)
Heater Current 0.6 A
Heater Volts 12.6

12BY7A

(Prototype—12BY7)
Heater Current 0.6 A
Heater Volts 6.3*

12L6GT

(Prototype—25L6GT)
Heater Current 0.6 A
Heater Volts 12.6

12W6GT

(Prototype—6W6GT)
Heater Current 0.6 A
Heater Volts 12.6

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

Thermal characteristics of all the heaters are controlled so that heater voltage surges during the warm-up cycle are minimized, provided that these tubes are used with other types similarly controlled.

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

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

(Other types are in development)

All the economies of series string design, with no sacrifice in reception quality, are available to TV set manufacturers who engineer their sets around this new line of Tung-Sol Receiving Tubes.

The competitive position you achieve through savings in transformer and circuitry costs will be strengthened by the long life and high performance of these Tung-Sol Tubes.

The statistical quality control methods by which Tung-Sol maintains



outstanding uniformity in tube production, make these new types your best assurance of utmost economy in series string TV set manufacture. For more information, 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

NEW STANDARD OF PROFESSIONAL TAPE RECORDING



Now
for the
first time

... a professional tape recorder that offers both
MAXIMUM OPERATING CONVENIENCE
plus **UNMATCHED DEPENDABILITY**

Dynacord is engineered to exceed the rigid requirements of broadcast stations, sound studios, industry and government. Its wide dynamic range and many convenient operating features amaze engineers and audiophiles alike. Compare it in every way with any other professional tape recorder and see why Dynacord sets the new standard of professional recording.

Model DTM Tape Transport Mechanism, \$350 net.
Model DP-100 Broadcast Amplifier, \$150 net.
Model DS-10 Audiophile Amplifier, \$75 net.

Write for
details and
bulletin

Exclusive 2-speed, inside-out Hysteresis synchronous motor. Direct capstan drive.

Exclusive dynamic braking, fast, positive, fool-proof.
Frequency Response: 50-15,000 CPS at 15 in./sec. \pm 2DB
Signal to Noise Ratio: better than 55 DB

THE PENTRON CORPORATION
777 South Tripp Avenue, Chicago 24, Illinois, Dept. TT10
Canada: Atlas Radio Corp., Ltd., Toronto

Largest exclusive makers of tape recorders and accessories

Hear the "ALL ELECTRONIC ORCHESTRA"—CHICAGO HI-FI SHOW
Sept. 30—Oct. 2 • NEW YORK AUDIORAMA Oct. 14-17



Toroidal Inductors

(Continued from page 69)

mechanical means. The case is of brass and hermetic sealing is accomplished by the use of a special shaft bushing manufactured by the Automatic and Precision Manufacturing Company of Yonkers, New York. As previously mentioned, the terminals are mounted on the side of the case and the inductor, as normally furnished, is adaptable to either chassis or panel mounting.

A typical curve showing percentage variation in inductance as a function of shaft rotation is given in Fig. 4. The mean inductance value is specified as the nominal value of a "Rotoroid" and the range of values is from 50% to 150% of the nominal. It will be noted that the mean inductance value is obtained at the midpoint of the rotation and that the variation in inductance is substantially linear over a range of 40 or 45% above and below the mean value.

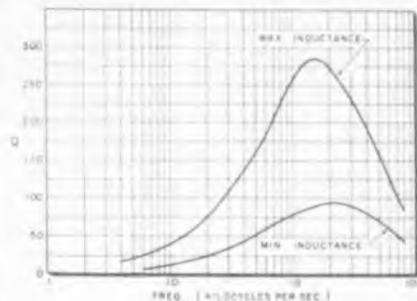


Fig. 6: Q as a function of frequency for VTI-B-.006. The mean inductance is 0.006 henrys

Fig. 5 shows the variation of Q as a function of frequency at maximum and at minimum inductance, for a "Rotoroid" Type VTI-A whose nominal (mean) inductance is 0.30 henrys. Fig. 6 shows corresponding curves for a Type VTI-B which has a nominal inductance of 0.006 henrys.

Magnet Stability

It is believed that "Rotoroids" offer a combination of features not previously available in inductors for audio frequencies: They allow continuous and stepless adjustment of inductance with 180° shaft rotation, absolutely free of electrical noise, and requiring no dc saturating current. They have high Q and produce very little stray coupling of signals to or from other parts of a circuit in which they are used. The choice of nominal inductance values is extremely wide and the inductors are applicable to frequencies over the

entire audio range, particularly above approximately 300 cps. They are hermetically sealed and designed to withstand the shock and vibration of normal use.

Degree of Stability

One factor still under investigation is the degree of stability of the permanent magnets. The magnets used are Alnico V, supplied pre-charged by The Indiana Steel Products Company of Valparaiso, Indiana, and they are believed to be as stable as any available . . . stable enough to make the "Rotoroid" resettable with sufficient accuracy for most uses.

"Rotoroid" Types VTI-A and VTI-B use toroidal coils similar to Burnell Standard Toroid Types TC-16 and TC-3, respectively. Inductance ranges (nominal or mean values) are from 1 mhys. to 32 hys. for the VTI-A, and from 1 mhy. to 500 mhys. for the VTI-B. Two miniature types, VTI-C and VTI-D, equivalent to Burnell Toroids TCO and TC-6, are available.

"Rotoroid" Applications

"Rotoroids" as new components have numerous applications. Designers of low-frequency circuits are handicapped by the lack of large variable capacitors to provide means of varying tuning, impedance, or phase. Usually the same result can be obtained by using variable inductors (possibly with circuit modifications). "Rotoroids" appear to have substantial advantages over other available types of variable inductors in such applications. Some specific devices for "Rotoroid" application are: tunable audio oscillators (such as in tone channel generators for carrier multiplex systems), adjustable selective networks, variable filters and equalizers, variable impedance devices, variable phase shift networks, telemetering devices, electro-mechanical control devices, and servo systems.

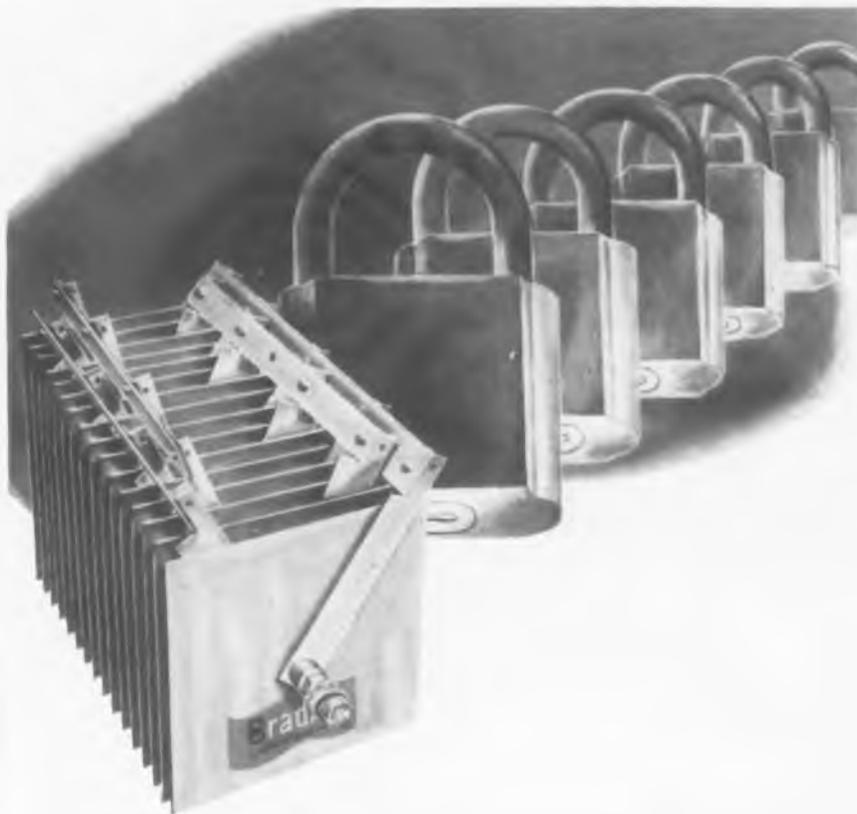
Other Features

Several other available features make "Rotoroids" extremely versatile and adaptable: Any reasonable number of taps or additional windings can be supplied. Capacitors or other components can sometimes be incorporated in the same case. The shaft can be coupled to a servomotor. (The standard shaft is $\frac{1}{4}$ inch in diameter by $\frac{1}{2}$ inch long; longer shafts can be supplied.) Two or more "Rotoroids" can be ganged.

Application has been filed for a patent covering several new developments, including those described herein.

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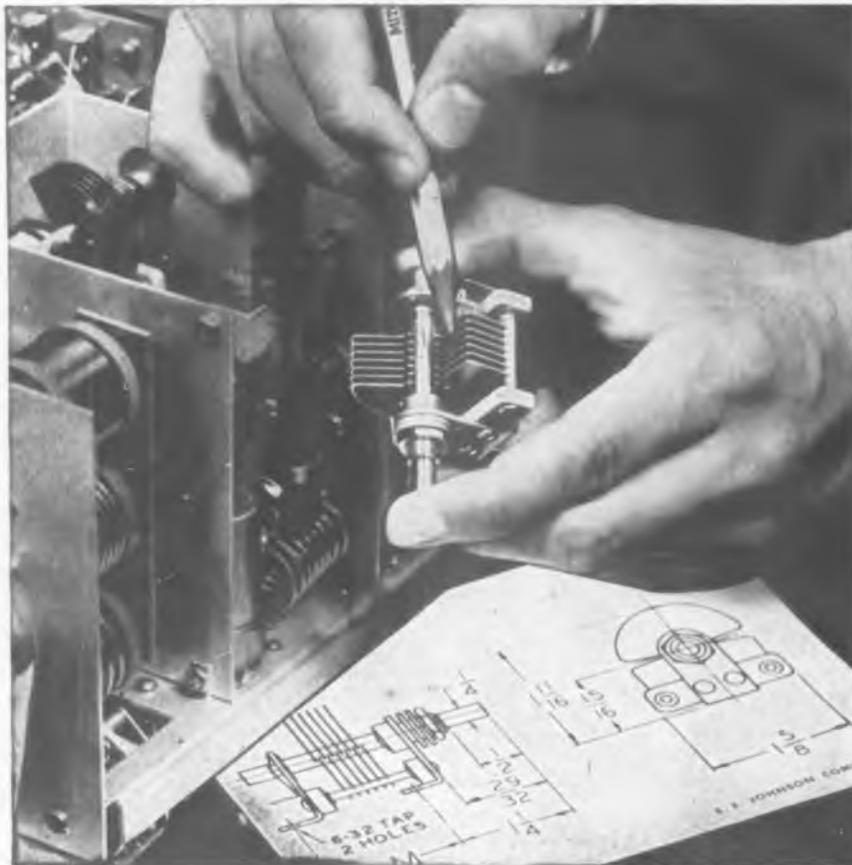
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Accurately aligned, soldered brass plates .023" thick • All metal parts heavily nickel plated • Double-bearing construction with $\frac{1}{8}$ " shafts extended at rear for ganging two or more units • Plate spacing .024" - 1200 volts peak rating • Rotor contacts silver plated beryllium copper for smooth high frequency operation.

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Cat. No.	Type No.	Cap. per Sec.		"M" Dimension	Net Price
		Max.	Min.		
149-1	20R12	20	5	1 7/32"	\$2.05
149-2	35R12	35	6	1 7/32"	2.10
149-3	50R12	50	6.5	1 7/32"	2.15
149-4	75R12	80	8	1 7/32"	2.30
149-5	100R12	102	8.5	1 13/32"	2.45
149-6	140R12	140	9.5	1 19/32"	2.65

Johnson Type "R" capacitors are available in maximum capacities to 320 mmfd. with .036", .050", .071", or .095" plate spacings as well as special platings and shaft lengths in production quantities. Also available without mounting feet for panel mounting applications.



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Transistor Reliability

(Continued from page 79)

is a problem that is being investigated intensively. One might say that this could have been the result of ambient humidity, but in contradiction to this life tests conducted under "dry" conditions predict this possibility. The effect seems to be due primarily to temperature because it is observed to be appreciably worse in a relatively short time at 65°C again under dry conditions.

It is of interest that opens are so small in number that they are included in this summary only to emphasize the fact. Short circuits can be similarly categorized. Both of these items have always been a major item in tube failures. As a matter of fact, although it is not immediately obvious from Table III, only transistors with opens or broken leads are totally inoperative in the sense that tubes become totally inoperative. In other words, totally inoperative transistors account for only 6.7% of the total defective. In the case of tubes in the military service, the number is approximately 30%.

It should be emphasized that the order of test in Table III is important. That is, the cutoff current rejects if carried as far as the noise test would, in the majority be rejected for noise as well. Another fact of interest is that 64% of the defective units occurred in the first stage, 30% in the second, and 6% in the third. Therefore, although the overall reliability figure was 2% per year for the three stages combined, it was 3.84% for the first stage where noise requirements are tight, 1.8% for the second stage, and .36% for the third.

Other Environments

From this present experience and other life tests we can make some predictions for applications outside the environmental bounds of the hearing aid for PNP diffused junction germanium transistors where 2% reliability figures are looked for. We should emphasize that these statements refer to the present stage of the art and do not include potential possibilities.

Moisture resistance is in some respects more of a test problem than a real one. Test conditions can be devised which will cause transistors to fail in a short time, but the fact still remains that there is still little evidence that in our climatic environment moisture is a problem, particularly at low voltages. Perhaps we

can orient ourselves practically on this by considering that untreated crystal microphones have always been a problem in hearing aids because of moisture effects. Transistors have not.

Operating temperature is all important and applies to transistors of germanium whether hermetically sealed, evacuated, or sealed in an inert gas. Also, it does not matter as a first order effect whether the temperature is ambient or created by dissipation. There is little doubt that in applications critical to noise or cutoff current reliability begins to fall off at 50°C and is serious at 65°C. However, if a circuit is well stabilized for the effect of cutoff current, is well degenerated or non-critical for gain and can tolerate noise factors of 25 db, then reliable operation of the 1% order can be achieved at 65°C. As far as we know, low temperatures do not effect the reliability of junctions encapsulated in plastic.

There is no difficulty with reliability up to, perhaps, -12 volts collector voltage. One could question the reliability at -22.5 volts if the circuit is critical to cutoff current. There does not seem to be any damaging effects due to high currents, even up to many times present "ratings," but data is still being accumulated.

In conclusion, we feel that our experience demonstrates conclusively that plastic encapsulated transistors within the electrical bounds of the hearing aid and under climatic conditions that man may be expected to endure are capable of giving reliability figures that are completely comparable to some of the most reliable tubes.

References:

1. "Transistor Reliability Studies," R. M. Ryler & W. R. Sittner, IRE Proceedings, Feb. 1954.
2. Aeronautical Radio Incorporated, General Report #1 "Investigation of Electron Tube Reliability in Military Applications," Jan. 4, 1954.

New Remler Division

R. C. Gray, president of Remler Co., San Francisco, has announced the creation of a new research division of the company, the Gray Scientific Div., under the direction of Dr. Winfield W. Salisbury.

Bozak Moves to Norwalk

The R. T. Bozak Co. now located in Stamford, Conn. has leased a new building on the Post Road, South Norwalk just east of Burndy Engineering Co. This is the third move to larger quarters for this company since it was established in 1949.



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accuracy to $\pm 0.01\%$

- accurate control of frequency
- accurate control of voltage
- good wave shape
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SPECIFICATIONS

Model	FCD250	FCD1000	FC1000
Input voltage	95-130VAC, 1 ϕ , 50-60~	208 or 230VAC, 1 ϕ , 50-60~	208 or 230VAC, 1 ϕ , 50-60~
Output voltage	115VAC, 1 ϕ , adjustable between 110-120 volts		
Output frequency	400~, adjustable $\pm 10\%$	400~, adjustable $\pm 10\%$	60~, adjustable between 45 and 65
Output voltage regulation	$\pm 1.0\%$	$\pm 1.0\%$	$\pm 1.0\%$
Output frequency regulation	$\pm 1.0\%$ in standard models; $\pm 0.01\%$ with auxiliary frequency standard (output frequency is fixed when using frequency standard)		
Capacity	250VA	1000VA	1000VA
Load range	0.1 to full load		
Distortion	5% maximum		
P. F. range	Down to 0.7 F		
Time constant	0.25 seconds		
Envelope modulation	2% maximum		

These industrial and laboratory frequency changers resulted from contracts for precision inverters. They should prove useful for testing components or complete instruments that must operate over variable frequency conditions. They can also be used as sources for precision 60~ or 400~ for timing applications, or used with servo and/or gyro motors in design work.

Sorensen electronic frequency changers are also being used with field equipment such as geophysical vans, where motor generator set frequency control is often inadequate. Another use will be for checking equipment designed for 50~ (foreign) usage; conversely, the same instrument can be used to convert 50~ line to 60~ source.

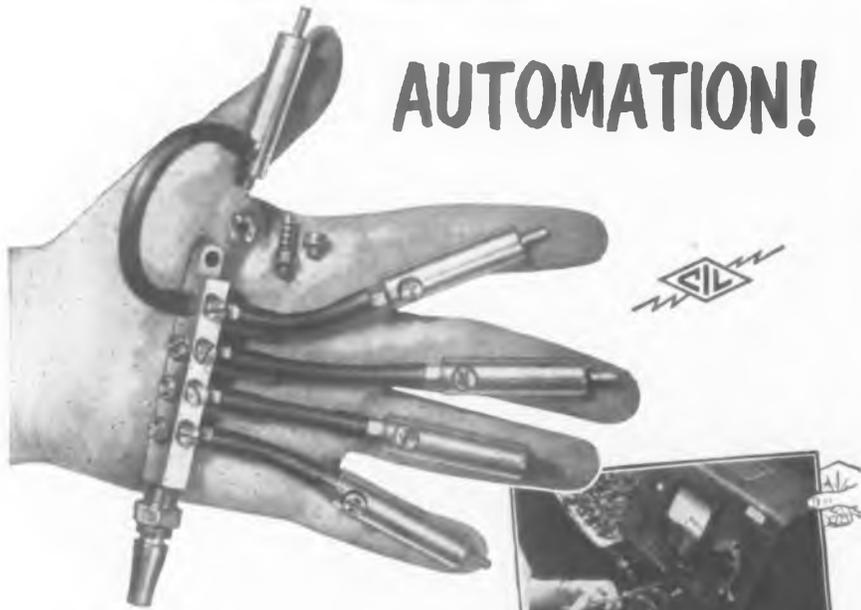
Electronic frequency changers of other ratings are now in design. We shall be happy to send further information, or to correspond with you concerning your individual requirements. Address Sorensen & Co., Inc., 375 Fairfield Avenue, Stamford, Conn. In Europe, write directly to Sorensen A.G., Gartenstrasse 26, Zurich 2, Switzerland.

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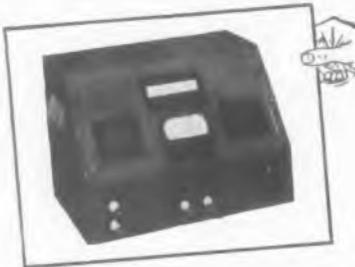
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Clippard **MINIATURE PNEUMATIC CYLINDERS** (No. MAC 38), are shown above in a typical test jig set-up activating electrical contacts. Size of cylinders overall is $2\frac{3}{16}$ " x $\frac{7}{16}$ " dia., stroke $\frac{3}{16}$ " maximum, spring return piston. Operates on as little as 12 pounds air pressure.



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P. C. 4 AUTOMATIC CAPACITANCE COMPARATOR grades, sorts, checks or matches all types of condensers (10 mmfd to 1000 mfd) at production speeds with laboratory accuracy. Requires no accessories other than the standard capacitor against which unknowns are to be compared.

Tube Selection

(Continued from page 71)

off tube in the first i-f and a sharp one in the second). Tubes of various cut-off values (measured under conditions of Fig. 1) were then put in the second i-f and the overload point (20% sync stretch) noted.

By using a tube with a cut-off of 5.2V (1% point) the overload point was only 2000 μ v. If the sharpest one-third of the tubes for the controlled stages were rejected, the lowest cut-off tube possible will be at 6.4V. The minimum overload signal for the receiver will now be 60,000 μ v. The minimum signal handling capacity of the receiver increases thirty times by tube selection.

Four-Stage Results

Fig. 4 shows the result on a four-stage i-f receiver. This receiver had three gain-controlled i-f stages. The third i-f stage, however, was operated with a very remote screen, so that the second i-f tended to overload the first. Wide cut-off tubes were then put in the first and third i-f stages, and a variety of tubes in the critical second i-f stage. The cut-off voltage of these vs. their overload point is plotted in Fig. 4. The results are similar to the three-stage i-f receiver. Since three out of four stages are controlled in this i-f, only the narrowest 25% in cut-off can be rejected for this set. This point is at a bias of 6.25V. From Fig. 4, this gives a minimum overload signal of approximately 250,000 μ v.

Testing Tubes

Fig. 5 shows how tubes would be tested for production. This illustration shows a 2 x 2 test board holding 4 tubes, but an actual production test board should be at least 10 x 10, holding 100 tubes. Assume tubes for a three-stage i-f were to be selected. First, all 100 tubes are inserted in their sockets. The regulated negative bias supply is set to 6.4V (33% point in distribution curve). A 0-500 microammeter could be used to measure plate current. A red line is drawn at the 100 microampere reading. The operator now switches rapidly through the 100 tubes. All tubes reading on or below the red line get coded with the color A. They are in the sharpest 33%. After the operator switches through the 100 tubes, she codes all uncoded tubes with color B. These tubes are suitable for use in the controlled i-f stages. Open filament tubes, and tubes not meet-

ing manufacturers' cut-off specifications can be thrown out at this point. An average operator should be able to go through a minimum of 300 tubes per hour. This is about 2100 tubes per day and would accommodate a production rate of almost 700 sets. Skill on the part of the operator is incidental, and very little training for the individual would be required. When tubes are selected for a four-stage i-f where three stages are gain controlled, the 25% point on the distribution curve or approximately 6.25V should be used. Of course, if only two stages of a four-stage i-f are gain controlled, the 50% point could be the point of acceptability. For a four-stage i-f, one operator selecting tubes can supply a production rate of slightly over 500 sets a day.

New GE Microwave Lab.

GE will establish a new electron tube development laboratory in an ultra-modern structure to be built immediately on Stanford University land. Announcement of the new laboratory was made in a joint statement by Dr. W. R. G. Baker, GE vice-president and general manager of the company's Electronics Div. at Syracuse, N. Y., and Dr. Wallace Sterling, president of Stanford. Dr. Baker explained that work at the laboratory will be concentrated on developing and exploring the application of microwave electron tubes which he said "promise to revolutionize the broadcast, communications and radar industries over the next ten years."

H. R. Oldfield, Jr. has been appointed manager of the new laboratory.

WALSCO VERTICAL CHASSIS



Walter L. Schott and Fred Miller (left) check printed circuit strip from new TV chassis PC-9. Design employs 25 tubes. Use of printed circuits reduces solder connections from 2900 to 56



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HF NM-20B, 150kc to 25mc
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High Speed Relay

(Continued from page 86)

was about to bounce. Second the armature was so constructed that friction losses and air loading were high.

The shape and duration of the driving impulse greatly affects contact bounce. As the driving voltage is decreased a point will be reached at which the armature will exhibit bounce. This is due to the fact that the transient flux is just sufficient to accomplish the armature transfer and there is no surplus of force to hold the armature in position. High peak currents of short duration cause the armature to be accelerated to high speed but fail to supply force during the period when the probability of bounce is the greatest.

In order to keep the average coil energy to a minimum, the relay was designed to operate on a current impulse. If this impulse is obtained by discharging a capacitor through the relay coils the series network of R.

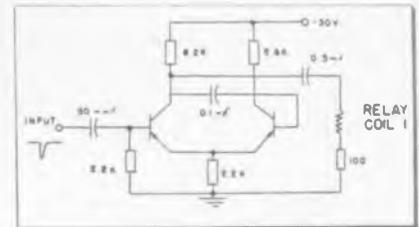


Fig. 10: Polarized relay transistor circuit

L, and C must be at least critically damped or the negative overshoot will cause the armature to be thrown back to its original position. For a coil inductance of 30 mh., a capacitor of 1 ufd in series with a resistor of 100 ohms is ideal for operation on 24 vdc. This provides a driving impulse of approximately 1 usec. duration and of sufficient peak value to affect transfer in a short period of time.

An improvement over the single layer leaf armature was obtained by folding the armature in the shape of a V. Filling the void in the V with a fluid or viscous material completely eliminated bounce but this was considered not too desirable, if not impractical in the case of a fluid, gave excellent results.

Activating Circuits

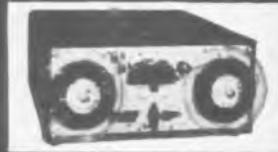
The following circuits are representative of the types of circuits Continued experimental work with the V armature led to the development of a laminated armature which

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DEPARTMENT TT-10

High Speed Relay

(Continued from page 135)

nishes a few milliamperes of holding current. A second and identical circuit is required to energize the other relay coil. This circuit will operate on negative input pulses of 3-5 v and as narrow as 0.5 μ sec. The transistors are operated well within their rating up to switching rates of several hundred operations per second.

This paper was presented at the 1953 National Electronics Conference held in Chicago.

RTCA Assembly To Review Status of Common System

A symposium on the subject "Where Are We and Where Are We Going with the Common System?" will be a major feature of the Fall meeting of the Assembly of the Radio Technical Commission for Aeronautics on October 1 at the Willard Hotel in Washington. Officials of government and industry will comprise the panel of the symposium.

RTCA received the Collier Trophy six years ago for "the greatest achievement in American aviation"—the Common System. It is generally recognized that the implementation of the Common System has not proceeded exactly as planned. However, the need for, and importance of, a Common System continue to be recognized. The objective of the symposium is to explore such questions as: where do civil aviation and the military services stand today concerning the Common System?—how close are we to achieving it, or how far away?—which are the organizations responsible for it and what are they doing about it?

Blonder-Tongue Expands

Blonder-Tongue Labs, Inc., of Westfield, N. J., has expanded its production capacity with the opening of a second plant in Westfield providing over 50,000 square feet of space.

TV FOR COLOMBIA



New telecruiser being loaded for HJRN-TV, (Radio Difusora Nacional de Colombia), in Bogota, Colombia. Telecruiser is built to DuMont specifications by the Flexible Corp. of Loudonville, Ohio.

NEC Preview

(Continued from page 73)

Technic, Inc., Providence, R. I.	7
Technology Instrument Corp., Acton, Mass.	50
Tektronix, Inc., Portland, Ore.	101-102
Teletronics Laboratory, Inc., Westbury, L. I., N. Y.	119
Tel-Instrument Co., Inc., Carlstadt, N. J.	39-40
Tensolite Insulated Wire Co., Inc., Tarrytown, N. Y.	9K
Transistor Products, Inc., Boston, Mass.	49
Waveline, Inc., Caldwell, N. J.	104
Weckesser Co., Chicago, Ill.	5

Audio Engineers Sixth Annual Meeting

Sessions on microphones, tape machines and tape recording, records and record manufacturing, pickups and loudspeakers will comprise the program for the Sixth Annual Meeting of the Audio Engineering Society, to be held October 14-16, in the Hotel New Yorker, New York. The three-day gathering will be preceded by a banquet in the same hotel.

The technical papers program for the convention is as follows:

- "Cathode Follower Circuits Applied to a Microphone." John K. Hilliard and James J. Noble, Altec Lansing Corp., Beverly Hills, Calif.
- "Microphones for Informal Use." L. M. Wigginton and R. M. Carrell, RCA Electronic Products Div., Radio Corp. of America.
- "Uniaxial Microphones." Dr. H. F. Olson, John Preston and J. C. Bleazey, RCA Labs, Div., Princeton, N. J.
- "Quantitative Measurement of Wind Noise Sensitivity in Microphones." R. M. Carrell, RCA Electronic Products Div., Radio Corp. of America.
- "A Moving Coil Feedback Disc Recorder." C. C. Davis, Westrex Corp., Hollywood, Cal.
- "An Experimental Study of Distortion." C. J. LeBel, Audio Instrument Co., New York.
- "An External Automatic Sweep Generator for Use with Cathode Ray Oscilloscopes." Alan Bloch, Audio Instrument Co., New York.
- "Transistorized Magnetic Tape Recorder." A. I. Aronson, RCA Engineering Products Div., Radio Corp. of America, Camden, N. J.
- "A New Miniaturized Tape Recorder." A. C. Travis, Jr., Broadcast Equipment Specialties Corp., Richmond Hill, L. I.
- "Definite Stereophonic Sound." Col. R. H. Ranger, Rangertone, Inc., Newark, N. J.
- "Frequency Modulation Noise in Magnetic Tape." Robert A. von Behren and Robert J. Youngquist, Minnesota Mining & Mfg. Co., St. Paul, Minn.
- "Magnetic Recording Measurements." Walter H. Erikson, RCA Electronic Products Div., Radio Corp. of America, Camden.
- "Defects in Magnetic Recording Tapes, their Causes and Cures." Frank Radocy, Audio Devices, Inc., New York.
- "Locating Defects in Magnetic Recording Tape." Andreas Kramer, Audio Devices, N. Y.
- "New Use and New Magnetic Products in Tape, Film and Instrumentation Applications During the Past Two Years." E. W. Franck and E. Schmidt, Reeves Soundcraft Corp., Springdale, Conn.
- "Quality Control in Record Manufacturing." E. H. Uecke, Capitol Records, Hollywood.
- "An Evaluation of Record Stylus Pressure Considerations." and "Recording Quality and its Relation to Manufacturing." Dr. A. Max, RCA Victor Div., Radio Corp. of America, Indianapolis, Ind.
- "The Advantages and Problems of Full Frequency Phonograph Records." Paul Weathers, Weathers Industries, Inc., Barrington, N. J.
- "Geometrical Considerations of the Record Groove and Reproducing Stylus." William S. Bachman, Columbia Records, Inc., New York.
- "Speculations on the Cause and Prevention of Needle Wear and Noise in the Phonograph Playback Process." Dr. Frederick V. Hunt, Rumford Prof. of Physics and

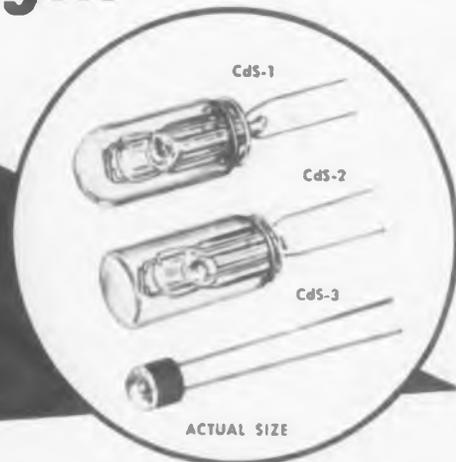
(Continued on page 138)

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From counters, headlamp dimmers, burglar alarms, process control and inspection devices to sensitive photoelectric measuring devices, these new Standard Piezo CdS Crystal Photocells pave the way to drastic cost and size reductions—even to the point of making photoelectric automation feasible for many home and industrial uses where equipment costs have been prohibitive in the past.

Using a special cadmium sulfide sensitive element, these tiny photocells deliver from 1 to 2 milliamperes when illuminated with 50 to 100 foot-candles and with a bias of approximately 100 volts. Inexpensive sensitive relays and the smallest batteries or power supplies can readily be used.

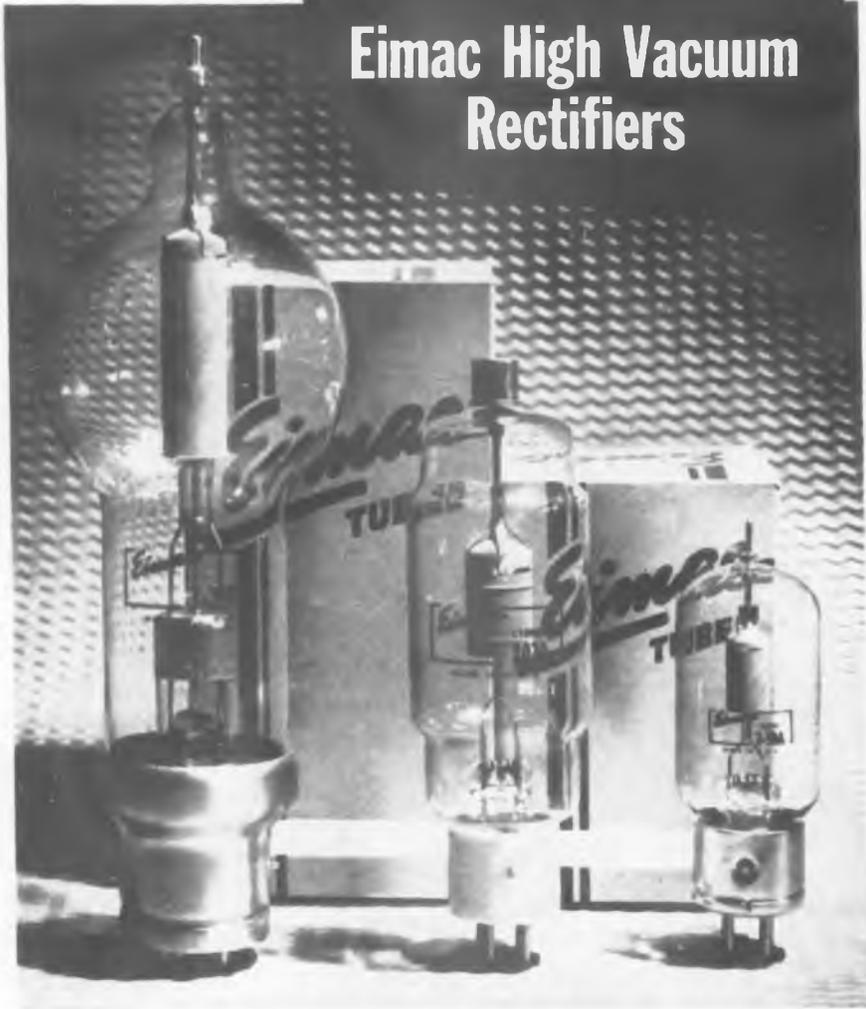
Standard Piezo CdS Crystal Photocells are supplied in two hermetically-sealed glass types and one subminiature type measuring only 1/4" in diameter by 1/4" long including built-in lens. Still smaller styles with identical characteristics can be made to order.

STANDARD PIEZO

Leaders in modern crystal development

. . . for over 25 years.

Eimac High Vacuum Rectifiers



LOW CURRENT, HIGH INVERSE VOLTAGE OPERATION

Eimac's complete line of eight high vacuum rectifiers cover a wide range of average current, 15ma to 750ma and peak inverse voltages from 25,000v to 75,000v. In power supply units, voltage multipliers, pulse service or special applications at high frequencies, extreme ambient temperatures and high inverse voltages, Eimac high vacuum rectifiers are ideal. They give reliable performance at high frequencies and high volt-

ages without generating radio frequency transients and have no lower limit to ambient operating temperature. Ruggedly constructed, Eimac high vacuum rectifiers contain many of the famous Eimac transmitting tube features such as an instant heating thoriated tungsten filament, that allows application of filament, plate voltages simultaneously; an exclusive radiation cooled pyrovac* plate; and elimination of internal insulators.

• For additional information about Eimac high quality, high vacuum rectifiers, contact our Technical Services department.

* An Eimac trade name.

TYPE	EIMAC HIGH VACUUM RECTIFIERS			FILAMENT	
	Average Current MA	PLATE Dissipation Watts	Peak Inverse Voltage	Volts	Amps
2-25A	50	15	25,000	6.3	3.0
2-50A	75	30	30,000	5.0	4.0
8020	100	60	40,000	5.0	6.5
2-150D	250	90	30,000	5.0	13.0
250R	250	150	60,000	5.0	10.5
253	350	100	15,000	5.0	10.0
2-240A	500	150	40,000	7.5	12.0
2-2000A	750	1200	75,000	10.0	25.0



EITEL-McCULLOUGH, INC. SAN BRUNO CALIFORNIA

The World's largest manufacturer of transmitting tubes.

AES Meeting

(Continued from page 137)

- Gordon McKay, Prof. of Applied Physics, Harvard University.
- "Present-Day Developments in Magnetic Phonograph Pickups" Walter O. Stanton and Theodore Lindenberg, Pickering Co., Inc., Oceanside, L. I.
- "A Twin Lever Ceramic Cartridge," H. E. Bauer, L. Gunter, Jr., and C. E. Seeler, Shure Bros., Inc., Chicago
- "Amplifiers for Music Reproduction," Hermon H. Scott and Herbert P. Kent, Hermon Hosmer Scott, Inc., Cambridge, Mass.
- "Loudspeaker Quality Control and the Consumer," Edward V. Reiss, University Loudspeakers, Inc., White Plains, N. Y.
- "Correlation of Transient Measurements of Loudspeakers and Listening Tests," Murlan S. Corrington, RCA Victor TV Div., Radio Corp. of America, Camden.
- "Recent Developments in High Fidelity Loudspeakers," Dr. Harry F. Olson, John Preston and Everett G. May, RCA Lab. Div., Princeton.
- "Acoustical Calibration of Loudspeakers at the Higher Frequencies," John K. Hilliard, Altec Lansing Corp., Beverly Hills, Cal.
- "An Electrostatic Loudspeaker Development," Arthur A. Janszen, Engrg. Consultant, Cambridge, Mass.
- "A 20-inch Corner Horn of Unusual Development," Paul W. Klipsch, Klipsch & Associates, Hope, Ark.
- "Multi-Crossover, Multi-Impedance Networks for Compatible Multi-Speaker Systems," Abraham B. Cohen, University Loudspeakers, Inc., White Plains, N. Y.
- "High Efficiency Three-Way Speaker Systems," Saul J. White, University Loudspeakers, Inc., White Plains, N. Y.

IRE-AIEE Symposium On Automation

The Philadelphia Sections of the Institute of Radio Engineers and the American Institute of Electrical Engineers have arranged a six evening program (starting 7:30 p.m.) with nine lectures on automation covering automatic production in electronic, metalworking and process industries. Meetings will be held at the Phila. Electric Auditorium, Edison Building, 9th and Sanson Streets. Registration for complete series is \$3.00 for Professional Society Members, \$4.00 for non-members. Single lectures are \$1.00 each. Dates and papers to be presented are as follows:

Oct 14 Automation in the Automotive Industry, J. E. Cunningham, Wilson Automation Co., Detroit.

Oct 21 Electronic Auto-Assembly I, Automatic Fabrication in the Electronics Industry, Cleo Brunetti, Dir. of Research, Meel Div., General Mills, Minneapolis.

Oct 28 Electronic Auto-Assembly II, Automatic Wiring, Semi J. Begun, V.P. & Dir. Adv. Div., Cleveite-Brush Development Co., Cleveland.

Etched Circuits, Donald Mackey, Electronic Components Dept., Tube Div., R.C.A., Camden, N. J.

Nov 4 Electronic Auto-Assembly II, Flexible Control of the Electronic Assembly Automation, Geo. W. Gamble, Supvr. Ind. Sys. Unit, G. E. Adv. Elect. Center, Ithaca.

Modular Approach to Mechanized Assembly, Robt. F. Henry, Electronics Div., A.C.F. Corp., Alexandria, Va.

Nov 11 Process Control, Instrumentation and the Analogue Computer, in Process Control, Donald P. Eckman, Prof., Case Institute of Technology, Cleveland.

Important Developments affecting Automation in Chemical Plants, Victor F. Hanson, Asst. Dir. Eng'g. Res. Lab., E. I. DuPont de Nemours & Co., Wilmington.

Nov 18 Management Aspects of Automation, W. W. Beardsly, Manager, Manufacturing Engineering Services, Dept. 7, General Electric Co., Schenectady, N. Y.

PERSONAL

Roderick A. Brew has been appointed chief engineer of Richard D. Brew Co., Concord, N.H.

Dr. Leslie G. Peck has joined Arthur D. Little, Inc., Cambridge, Mass., where he will direct the Computing Lab.

Walter H. McDonald has succeeded **Bruce Quisenberry** as chief of the Signal Corps Office of Technical Liaison. Mr. Quisenberry has become associated with Automatic Electric Co., Chicago, Ill.

Dr. Paul Oncley has been named audio development engineer at Kay Electric Co., Pine Brook, N.J. During World War II Dr. Oncley was affiliated with the Div. of Physical War Research at Duke Univ.



P. Oncley



R. A. Humphrey

Richard A. Humphrey has been appointed chief of Research and Development of the Clifton, N.J. plant of Mycalex Corp. of America.

Harold H. Newby, chief engineer for KAKE Radio in Wichita, Kans., has assumed the position of chief engineer for KAKE-TV. **Martin Umansky** has become general manager of the station.

Dr. Ernst H. Krause has resigned the post of assoc. director of research at the Naval Research Lab. to become Director of Research Labs. at the Missile Systems Div. of Lockheed Aircraft Corp. Assisting Dr. Krause are **Dr. Montgomery H. Johnson**, associate director, **Dr. Eric Durand**, **Edward J. Zadina** and **Henry R. Senf**.

Jerome Corwin has joined the engineering staff of the Special Products Div. of I-T-E Circuit Breaker Co. and will head up the Design and Development Section on electro-mechanical devices, servo mechanisms and computers. Mr. Corwin was formerly chief of the Mechanical Engineering Section of the U.S. Army Signal Corps Labs.

Harold H. Adler has been appointed chief engineer in charge of color TV development program at Lion Mfg. Corp., Chicago, Ill.

(Continued on page 163)



ELECTRICAL ENGINEERING OR PHYSICS GRADUATES

*Here is an ideal way
for the engineer or
physicist with some
aptitude for writing to
enter the field of advanced
electronics. In this
relatively new and
expanding area you can
make immediate and
effective use of your
academic training while
acquiring additional
experience.*

Hughes Research and Development Laboratories are engaged in a continuing program for design and manufacture of integrated radar and fire control systems in military all-weather interceptor aircraft. Engineers who produce the maintenance and operational handbooks for this equipment work directly with engineers and scientists engaged in development of radar fire control systems, electronic computers, and other advanced electronic systems and devices.

Your effort in the field of engineering writing through these publications transmits information to other engineers and technical personnel on operation, maintenance and modification of Hughes equipment in the field.

You will receive additional training in the Laboratories at full pay to become familiar with Hughes equipment. Seminars are conducted by publications specialists to orient new writers. After-hours graduate courses under Company sponsorship are available at nearby universities.

HUGHES Culver City, Los Angeles County, California

RESEARCH AND DEVELOPMENT LABORATORIES

SCIENTIFIC AND ENGINEERING STAFF

Photograph above: Engineer-writer John Burnett (left) works with engineers John H. Haughawout (right) and Donald King to compile handbook information.

Relocation of applicant must not disrupt an urgent military project.

Simul-Scopic*

Signals

TAKE THE GUESSWORK OUT OF SCOPES

It's all done by combining any number of electron guns up to ten in a single cathode ray tube. Then, when you have to measure simultaneous phenomena, you've actually got a number of oscilloscopes in one—all operating continuously without the disadvantages of electronic-switching or an optical system. And only ETC multi-channel scopes and multi-gun tubes make Simul-Scopic signals available to meet such a wide variety of individual needs.



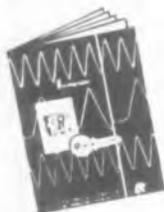
MULTI-CHANNEL SCOPES

... with the combination you need of band width, gain, sensitivity, frequency response, with or without film strip recording. Separate intensity, focus, and axes controls for each channel.



MULTI-GUN TUBES

... with 2 to 10 guns ... round or square face ... 3 to 12 inches. Special purpose tubes made to specification, including every type capable of commercial manufacture.



THIS FREE CATALOG

... entitled "Oscillography—Key To The Unknown", shows why there is no other equipment so easy to use, so comprehensive in its presentation, and so economically practical for simultaneous oscillography. Write for your copy.

* *Simul-Scopic* — Two or more simultaneous events which can be observed on a cathode ray tube (Reg. Applied for)



electronic tube corporation

1200 E. MERMAID LANE, PHILADELPHIA 10, PA.



G. S. Marshall, with offices at 40 S. Los Robles, Pasadena 1, Calif., has been appointed sales rep for the Calif., Ariz. N.M. area by Waveline Inc., Caldwell, N.J., microwave instrument and accessories manufacturer. Similar appointments went to J. R. Dannemiller Assoc. 1791 Oakmont St., Cleveland 21, Ohio for Ohio, Mich., western Penn., and W. Va.; Murphy & Cota, 1409 Peachtree St., N.E., Atlanta, Ga., for southeastern U.S. and Ed. A. Ossmann and Assoc. 65 Webster St., Saratoga Springs, N.Y. for the Schenectady, N.Y. area.

Equipment Sales Corp., Kingsport, Tenn. has been named sales rep for the eastern Tennessee area by the Fielder Instrument Div., Robertshaw-Fulton Controls Co.

John P. Dearie has joined the Industrial Div. of Art Cerf & Co., Newark, N.J. Mr. Dearie was formerly with Western Electric Co. and Daystrum Instrument Co.

Roscoe Kent of St. Petersburg, Fla. has been named representative for Bliley Electric Co., Erie, Pa. to cover the company line of quartz crystals, solid ultrasonic delay lines, crystal ovens, and frequency standards in Florida.

Detroit Tap & Tool Co., Baseline, Mich., has been appointed exclusive distributor for Automatic Methods Inc., Elizabeth, N.J., to handle sales and service of "Auto-Tap" lead screw tapping tools in Ohio, Indiana, Michigan, northern Illinois, Wisconsin, eastern Iowa, and California. The B. C. MacDonald Co., with offices in St. Louis, Wichita, and Kansas City will cover Missouri, southern Illinois, Kansas, Nebraska, and western Iowa.

Byron McDonald Co., Los Angeles has been appointed southern California radio-TV sales rep for Krylon Spray Coatings and Krylon Dulling Spray. Two midwest appointments were also announced by the company: for the state of Michigan, the Wayne Beitel Co., Birmingham and for Ohio and Louisville, Ky., the John O. Olsen Co. Cleveland.

K. C. Burcaw & Co., of 22128 Grand River Ave., Detroit, has been announced as reps for the state of Michigan by Dale Products, Inc., Columbus, Neb. resistor manufacturer.

Arnold P. Clough, 10 Winslow Rd. Sharon, Mass. has been named to represent Fairchild Recording Equip. Co. in all the New England states, except Connecticut. Leonard Zlowe, 108 W. 14th St., N.Y.C. represents Fairchild in Connecticut and metropolitan New York. On the West Coast, the company has named Irving R. Stern, 406 S. Spring St., Los Angeles 13, Calif. rep for southern California and Arizona, and the E. L. Berman Co., 758 Natoma St. San Francisco, Calif. to represent their line of hi-fi equipment in the northern California area.

News of
**MANUFACTURERS'
REPS**

T. R. Matthews, 160 Glen Ellyn Way, Rochester, N.Y. has been appointed rep for upper N.Y. state by Trav-Ler Radio Corp. Similar appointments went to: **Jack Geartner**, 823-86th St., Miami Beach, Fla. for the state of Florida and **Sidney S. Adler**, 3377 Krameria St., Denver, Col. for the states of Colorado and Wyoming.

Stanley A. Harris Co., 318 Harvard St., Boston, Mass., has been appointed representative for Allies' Products, Inc., Washington, D.C. in the Boston-New England area. **Paragon Sales Co.**, 111 S. 22nd St., Philadelphia, Pa. will cover the Philadelphia area.

James M. Scales recently announced the formation of the **James M. Scales Co.**, with offices in the Western Merchandise Mart, San Francisco, Calif. The company will specialize in representing manufacturers of electronic equipment and supplies.

Walter J. Brauer and Associates, 15631 Lakewood Heights Blvd., Cleveland 7, O., recently announced that **Thomas O. Miles**, former instructor in Naval radio, had become a member of the organization.

Announcement has been made of the formation of the **G. G. Leeds Co.**, sales engineers, in Great Neck, N.Y. The company presently represents Victoreen Instrument Co., Instrument Div., and Vacuum-Electronic Engineering Co.

Eltron Engineering Sales, 246 Walnut St., Newtonville, Mass. has been appointed exclusive New England representative for Helipot Corp., potentiometer mfr. of S. Pasadena, Calif.

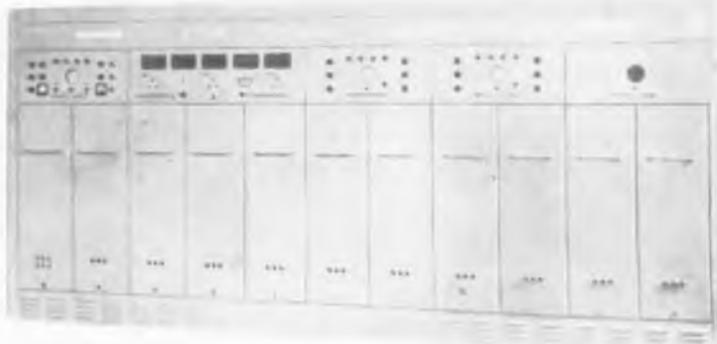
Sid Levin, 4217 Okalona Rd., Cleveland 21, Ohio, will represent Granco Products in Ohio excluding Trumbull, Mahoning, Columbiana and Jefferson Counties, and in Michigan. **Jack Geartner Co.**, with offices at 823 86th St., Miami Beach, Fla., will represent the line in Florida.

Tom Blackburne has been appointed engineering sales rep for the New England States by Transicoil Corp., mfr. of control system components and assemblies. Mr. Blackburne will be located at 119 Ann St., Hartford, Conn.

ROLLING REP



J. C. Van Groos Co., Sherman Oaks, Cal. manufacturers reps, are using this converted bus to bring their products to engineers in the Cal., Arizona, N.M. area. Equipment is set up in the bus, and powered from a 110 v. generator. Added features—indirect lighting, plush carpets.



This compact equipment is accessible, too, because of this



This Time Signal Generator was built for Air Force ballistics testing by Vitro Laboratories, a division of Vitro Corporation of America. It employs Grant Industrial Slides.

We asked Charles K. Raynsford, project group leader, why Grant Slides were used here. His answer:

"Primarily for the convenience of the service technician. Each of those eleven sections contains approximately 150 vacuum tubes. Even with the low tube failure rate of 2% per 1000 hours, fast serving for preventive maintenance becomes quite important!

"In addition, this compactness would have been impossible without the Slides. In a conventional arrangement, the unit would have been twice as large."

"May we quote you on that?" we asked.

"Well," he answered, "say 'appreciably larger'. That would have increased the wiring capacitance, which, in turn, would have required more power to get the same band width."

"All in all, we're proud of this design," he added.

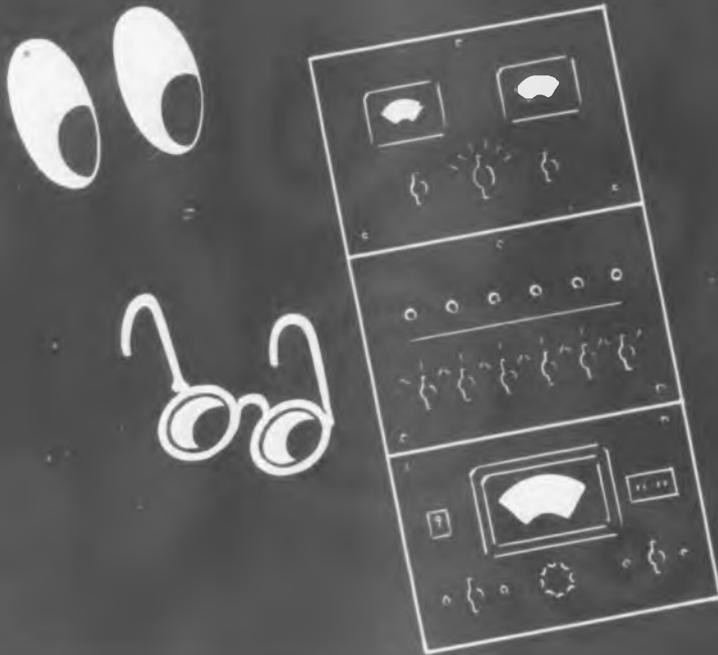
That makes it even. We're proud of our Slides.

Grant Industrial Slides

A product of Grant Pulley and Hardware Corporation
31-75 Whitestone Parkway, Flushing, New York



let's peek behind the panel



... and see why the Rust Remote Control System is your best buy

First . . . you'll find that no two Rust systems are exactly alike. They are not "packaged" units, but *engineered* systems, specifically designed to fit *your* transmitter.

Second . . . you'll see that the Rust system is *complete*—you have nothing else to buy "to fit *your* equipment". You even get interconnection diagrams, especially made for your transmitter and monitors.

Third . . . there are no tubes, so there are no tube failures. There are no adjustments, so there are no maladjustments. The Rust system functions as it should . . . with practically no maintenance.

If you are considering Remote Control, investigate before you buy. Take a peek behind the panel and you'll choose Rust.

FOR EXAMPLE — Rust Type RI-108-5 Tower Lighting Unit

Like other Rust accessory units, RI-108-5 Tower Lighting Unit is complete and self contained. It offers an extra feature in that it not only meters lighting current but it controls lights at the option of the operator. Its control feature can over-ride the time-clock or photocell for civil defense emergencies or other purposes. With Rust, there's "an extra with every accessory". Send for Brochure showing what you get when you buy the Rust System.



the rust industrial company, inc.



608 WILLOW STREET, MANCHESTER, N. H.

Scale Model

(Continued from page 91)

stability, particularly where thin walls are specified. Where wet weather is a factor, wood models can be moisture-proofed to a fair degree. However, other general types of model construction in which no wood is used are considered as almost completely weather proof. One such type has the additional and perhaps most outstanding advantage of extreme light weight

Plastics

Fiberglass reinforced resins—usually polyesters—are laid up in or on forms and backed by polystyrene foam, either in "sandwich" form or as simple backing. Techniques developed at C.E.A. allow models and sections of models (e.g.: tail groups, nose sections) with dimensions in the order of 12 to 18 ft. which weigh from less than 75 to 90-odd lbs. (See Fig. 8) The strength of a "skin" of fiberglass reinforced plastic only .005" thick is exceedingly great when properly bonded to structurally correct layers and bracing members of polystyrene foam. Complex surfaces, openings, attachment features, are possible to fabricate to very close scale fidelity tolerances. The application of the metal skin is not difficult, but it is interesting to note that certain metal surface treatments may actually weigh in themselves as much or more than the entire plastic model inside them!

Where the frequency band involved in the test project sets a minimum factor of scale reduction to the model size of, say 8, or 7, and the aircraft involved is a very large one, such extremely light-for-their-size models can be supplied for use on some of the taller antenna range towers. In such cases, weight being within the tower's load limits, "breeze loads" become a factor and often the plotting of the measurement patterns is restricted to calm conditions only.

Electrical Continuity

Other problems, important in antenna model design and fabrication, whatever their type of construction, are worthy of comment. One has to do with provisions for obtaining satisfactory electrical bonding between the mating surfaces where access-to-interior demountable sections or doors fit to the main portion of the model. (See the diagram of Fig. 9) Of course, these mating surfaces should fit accurately, but in critical

meas, a precaution is often taken which acts in somewhat the same way as a light trap around a camera cover. That is, a second surface of contact, generally at right angles to the primary surface, is carefully fitted, and the metal surfaces are smoothed for good continuous contact. Gaps in the contact between these mating surfaces can not only interrupt proper current distribution, but could, if in resonance dimensionally, radiate as antennas themselves.

Frequently, silver plated beryllium copper "finger stock" is used to assure that no such gaps will exist in the surface "envelope." (Fig. 9) It has been found helpful in this regard to design such demountable sections with as much of the separation plane lying in a "water plane" (horizontal plane parallel to the craft's longitudinal axis and perpendicular to its vertical axis) as possible, and at the same time, as small a cut as possible in a plane which cuts a major axis. Cuts paralleling a major axis generally lie parallel to current lines, thus causing minimum upset of the latter and occasional gaps, unless they are large compared to wavelength, rarely cause troublesome disturbances pattern-wise. However, separations in surfaces across a fuselage or body, or transversing a wing, can and do frequently show current interruption and inaccuracies in patterns. Finger stock, as mentioned above, can minimize this condition, as can the use of small to medium-size braided shielding, inside of which is pulled small live rubber tubing. This self-expanding tube of braiding will, when set into one of two mating surfaces, assure a virtually continuous contact in which electronic "gap-osis" will not be likely to exist.

PLOTTING BOARD



New automatic plotting board announced by Benson-Lehner Corp., 2340 Sawtelle Blvd., W. Los Angeles 64, Calif., is the Electroplotter Model G which accepts inputs from punched cards, punched tape and keyboard. This unit plots on a 30" x 30" surface with an accuracy of 1 part in 1500, or 0.02", whichever is greater.



Three NEW Fairchild Precision Potentiometers

TYPE 751 7/8"

TYPE 741 1 1/4"

TYPE 754 2"

LINEAR

Type 751, resistance range 400 to 20,000 ohms, linearity $\pm 0.5\%$ or better; Type 741, resistance range 500 to 25,000 ohms, linearity $\pm 0.5\%$ or better; Type 754, resistance range 800 to 100,000 ohms, linearity $\pm 0.15\%$ or better. All are extremely compact and are available with servo mounts. Internal clamp rings permit ganging without increasing overall diameter. All have gold-plated terminals for reduced contact resistance and easier soldering. Standard resistance values: Types 741 and 751—500, 1000, 5000, 10,000, 20,000 ohms; Type 754—1000, 5000, 10,000, 20,000, 50,000 ohms.

Three more reasons why Fairchild can supply ALL your precision potentiometer needs

Fairchild makes a complete line of precision potentiometers to fill all your needs—linear and nonlinear potentiometers, single or in ganged combinations . . . single-turn, helical and linear motion . . . with servo or threaded bushing mounts . . . and with resistance elements to meet your requirements.

Fairchild guarantees accuracy of $\pm 1\%$ in nonlinear types and $\pm 0.5\%$ in linear types. Highly accurate production methods and close mechanical tolerances, plus thorough type-testing and quality control, assure high resolution, long life, low torque and low electrical noise level in every Fairchild potentiometer. For more information, or for help in meeting your potentiometer problems, call on Fairchild Camera & Instrument Corp., Potentiometer Division, 225 Park Avenue, Hicksville, L. I., N. Y., Department 104-53E1.

FAIRCHILD

PRECISION POTENTIOMETERS

NEW DEVELOPMENTS AT BUREAU OF STANDARDS—V

I. Calibrating Vibration Pickups & Accelerometers

In recent years the widespread use of vibration pickups has introduced a serious calibration problem. There was need for rapid, reliable means of amplitude and acceleration calibration over wide frequency ranges. Several accurate calibration methods have recently been developed at the National Bureau of Standards. In one method, a "chatter" accelerometer determines very accurately the peak value of a sinusoidal acceleration, when this value is slightly

in excess of one *g*. The device is useful in setting the acceleration level of vibration generators which are used in the calibration of vibration pickups. In another method, a steel bar is mounted on a conventional vibration generator. A vibration pickup is attached to one end of the bar, and the system is driven at its resonant frequency. Use of the resonance effect achieves values of acceleration up to 1090 *g*—much higher than would be attainable if the pickup, with-



FULL 14" PICTURE

Price: \$399.00

Ideal for Broadcast and Industrial

Use

MONITOR

MODEL 600-A

FEATURES

- Rugged metal case
- More picture per square inch of panel
- High contrast, high light output
- All operating and positioning controls available from front. (driving, AFC, H width and linearity on rear panel)
- All standard—easily available tubes
- Available for rack mounting

SPECIFICATIONS

Bandwidth: 8 mc (More than 600 lines)
HIGH GAIN
 Input signal required—approximately .2 volt peak to peak.
 Inputs: Negative picture composite signal . . . or
 Negative picture with separate negative sync.

Bridging connection on sync.
 Input impedance: Hi-impedance (with bridging or termination jack)
 Input power: 117V—50 or 60 cycle—150 watts.
 Overall Dimensions: 16½" wide, 11½" high, 18¾" deep. Wt. 58 lb.



TELEVISION DIVISION

470 N. SECOND STREET • BEECH GROVE, INDIANA

OF THOMPSON PRODUCTS

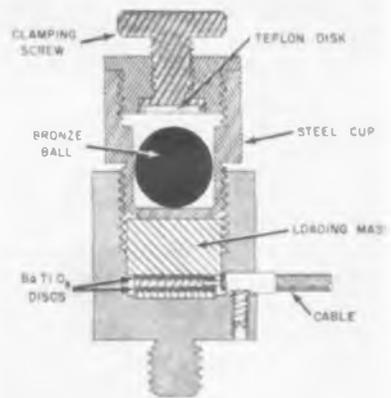


Diagram of chatter accelerometer

out the steel bar, were mounted directly on the same type of shaker.

Chatter Accelerometer

The "chatter" accelerometer is a device in which a loose mass on a vertically vibrating surface bounces or "chatters" when the peak acceleration of the sinusoidal motion exceeds $\pm 1 g$. Using an improved accelerometer developed by C. W. Kissinger of NBS, the acceleration of the shaker table to which the device is attached, as well as the chatter of the loose mass, are converted into an electrical signal which is displayed on the screen of an oscilloscope. The mathematical relationship was also derived between (1) the amount by which the peak value of the sinusoidal acceleration exceeds 1 *g* and (2) the point in the cycle at which the first bounce occurs. If this mathematical relationship is applied to the accelerometer output as observed on the oscilloscope screen, acceleration levels from about 1.01 *g* to 1.04 *g* may be set with an accuracy of approximately 0.2% at frequencies up to 60 cps, and with somewhat decreased accuracy up to about 150 cps. The accuracy of calibration was estimated by comparison with an optical calibration in which the peak-to-peak displacement of the chatter accelerometer was measured with a micrometer microscope. Stroboscopic illumination makes the accelerometer appear to be nearly motionless for ease of measuring displacement. In the Bureau's chatter accelerometer, the loose mass can be clamped by a screw and prevented from chattering. The accelerometer can then be used as a secondary standard for accelerations in excess of 1 *g* at frequencies up to 1200 cps.

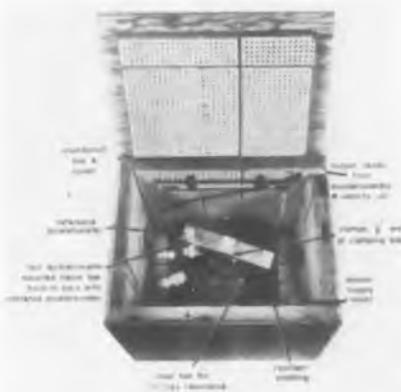
Steady-State Calibration

The method for steady-state calibration at high values of sinusoidal acceleration was developed by T. A. Perls

and C. W. Kissinger of the NBS staff. In this method, a steel bar is clamped to the head of an electrodynamic shaker at its center point, so that both ends of the bar are free. The accelerometer being tested is clamped back-to-back with an NBS-33-14 secondary-standard accelerometer at one end of the bar, and a balancing weight is fastened to the other end, if needed. The whole system is driven at its resonant frequency by a 70-watt amplifier. Steady-state accelerations have been measured with this system up to 1090 g, zero to peak, at 874 cps. When the resonant bar was additionally loaded with a 40-gram test accelerometer, accelerations up to 665 g were attained. In comparison, if the steel bar had not been used and the accelerometer had been mounted directly on the shaker head, the maximum attainable acceleration would have been only 50 g.

Vibrational Amplitude

A series of tests was conducted in



Internal view of steel bar with vibration pickup clamped at one end. Measures 1090g

which the steel bars used as part of the resonant system were first tested in the annealed state, and then heat-treated and again tested. Results indicate that the heat treatment increases the maximum steady-state acceleration twofold. In most cases the vibrational amplitude did not remain proportional to the shaker excitation current over the full available power range. Thus, the elastic properties of the bars used in the tests limit the maximum steady-state vibratory amplitudes attainable by this method.

Shaker Armature

In this method, the armature of the electrodynamic shaker is part of the resonating system, and its amplitude of motion at resonance is proportional to the amplitude at the ends of the bar. This mode of operation makes it possible to determine that the output of an NBS-33-14 accelerometer from 25 to 1090 g at 874 cps is proportional, within 2%, to the output of a velocity pickup built into the armature of the shaker.

2. Diode Amplifier

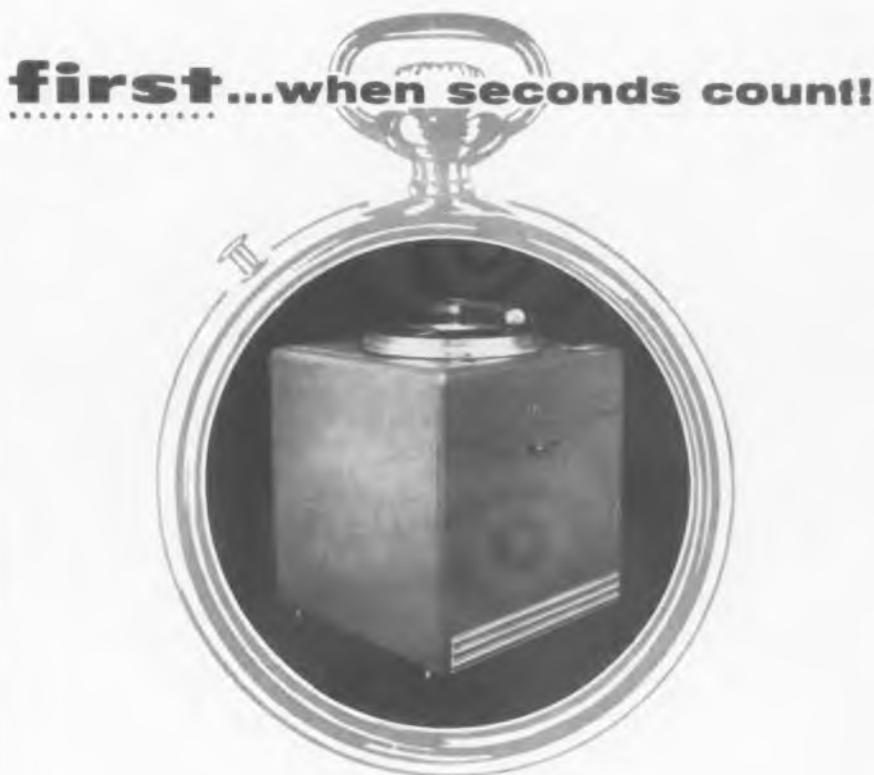
Research on application of semiconducting diodes has led to the development of a new class of amplifiers that utilizes the reverse transient phenomenon of these two-element rectifying devices. Devised by A. W. Holt, the diode amplifier—using no vacuum tubes and achieving power gains up to 10 per stage—promises important application in the future design of high-speed electronic digital computers. For example, it may be used as a pulse repeater stage, in varied types of flip-flop circuits, or as a wide-band, flat-response amplifier. Future improvement in the manufacture of diodes may make the

principle useful for amplification at even microwave frequencies.

The basic requirement of the diode amplifier is that it be supplied with power from an r-f source whose frequency is the same or higher than the modulating signal frequency. This requirement puts the circuit in the same category as magnetic and dielectric amplifiers.

A semiconductor diode of the germanium or silicon type has two static conditions: (1) a forward conducting state, characterized by high conductivity, and (2) a reverse conducting state, characterized by low conductivity. The forward state is achieved by applying a biasing voltage so that the anode

(Continued on page 153)



Commercials fall into place—accurately—with the Fairchild 530.

Exact timing of transcribed program material is assured with this superior transcription turntable.

Unsurpassed in broadcasting—telecasting applications—synchronous at all three speeds—it reaches stable speed in minimum time without overshoot. Noise and rumble are virtually non-existent.

In the entire field, no similar unit matches the performance of the Fairchild 530—*first . . . when seconds count!*

* Write for illustrated literature and prices

FAIRCHILD RECORDING EQUIPMENT

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52 West Houston Street
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THE WAVEGUIDE HOUSE SINCE 1943

Tri-axial Pulse Cables

(Continued from page 76)

over a frequency range from 10 kc to 10 mc due to the improved magnetic shielding.

Conventional shielding theory indicates that the energy leaking through the braid is in the form of a cylindrical transverse electric (TE) wave, which is reflected at any boundary at which it encounters large changes in intrinsic impedance of the media.

The intrinsic impedance η in rationalized mks units is defined as:

$$\eta = \frac{j\omega\mu}{g + j\omega\epsilon}$$

where: $\omega = 2\pi$ freq. — radians/sec.
 μ = permeability — hys/m.
 ϵ = permittivity — fds/m.
 g = conductivity — mho/m.

(For example, at 1 mc the intrinsic impedance of a good conductor like copper is 0.37 milliohms and that of a good dielectric like polyethylene is 250 ohms, resulting in a ratio of over 600,000.) This would indicate a large improvement could be obtained by the introduction of a dielectric interlayer between the braids used as the outer conductor and the outer braid used solely for shielding purposes. Full effect of this outer shielding braid can be obtained only by grounding it directly to the shields of the equipment and maintaining it electrically insulated from the common grounding bus used within the equipment.

Fig. 7 is the measured surface transfer impedance of the three developmental pulse cables which contain two copper braids, a 5 mil 50% overlap polyethylene tape separator, and a third copper braid. These curves do not fully illustrate the performance discussed above inasmuch as the cables were tested with all the braids connected to a common ground resulting in data similar to that indicated in Fig. 6.

Noise measurements were performed at medium power pulse conditions on several of these representative types of pulse cables in an attempt to correlate surface transfer impedance with noise in terms of $\mu\text{V}/\text{kc}$. Unfortunately, these measurements are too incomplete to be presented at this time; however, they do indicate the need for decreasing the capacitance coupling between the outer conductor and shield.

While the three polyethylene pulse cables discussed herein fall short of ultimate requirements of the highest power modulators, they appear

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to more than adequately fulfill the need for current applications in the medium power field. These cables exhibit lower attenuation and higher peak and average power handling capacity than the present standard rubber cables. They are capable of operation at peak voltages from 10 to 20 kv and at impedance levels of 50 to 25 ohms with maximum average powers of 15 to 24 kw with a 1 μ sec. pulse. The "triaxial" construction offers considerable reduction in noise radiation. The polyethylene dielectric provides less distortion of short pulses and incorporates a greater margin of safety between operating voltage and ultimate corona levels. Pending the development of suitable "triaxial" connectors, these cables may be used on an interim basis with conventional ceramic pulse connectors slightly modified to accommodate the small dimensional changes.

This paper was presented at the 1953 National Electronics Conference in Chicago.

New Headlight Dimmer

O. T. McIlvaine of Electron-Radar Products, 1041 N. Pulaski Rd., Chicago, Ill., has developed a new automobile headlight dimmer which eliminates the photo cell and the entire amplifier usually employed. Heart of the new unit is a miniature photo gas tube which delivers

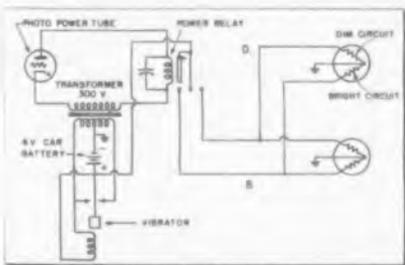


Photo and schematic of new headlight dimmer.

enough power to activate a relay directly (20 ma plate current).

In total darkness the new tube will stand an anode voltage of 800 v. without passing current. However if any light is on the tube it will fire at 250 v. This voltage spread can be regulated in tube design to get operation over a range of 125 to 1000 volts. A high vacuum type tube instead of the gas filled unit can also be employed in which case the grid element is made photosensitive.



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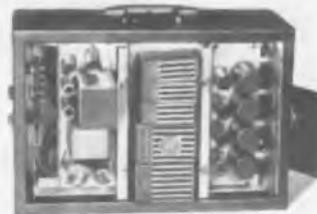
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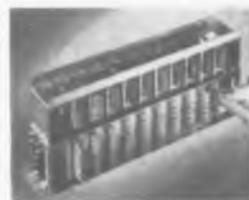


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C11	6.3	173	.36
C2	6.3	171	.44
C22	5.5	184	.44
C3	5.4	197	.64
C33	4.8	220	.64
C4	4.6	229	1.03
C44	4.1	252	1.03

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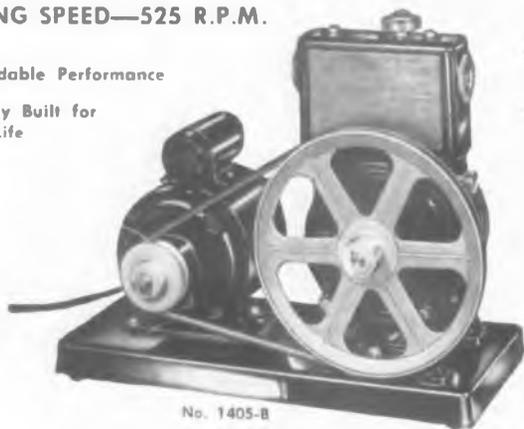
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NEW!

48-Page Booklet on Welch Duo-Seal Pumps has just been issued. A complete description, including performance curves of the Duo-Seal Pumps ranging from 21 liters per minute to 375 liters per minute, is given, as well as a greatly enlarged listing of Diffusion Pumps, Vacuum Gauges and accessories.

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BULLETINS

Magnetic Tape Recording

Bulletin No. D2-1, a 14-page, illustrated booklet prepared by Ampex Corp., 934 Charter St., Redwood City, Calif., explains a new technique for data recording, machine control and process regulation. Describes various recorders and accessories.

Metal Stampings

A new brochure prepared by American Name Plate & Mfg. Co., 4254 W. Arthington St., Chicago 24, Ill., illustrates the use of decorated metal stampings as functional components.

"Magnetostriction"

Bulletin A-169, released by International Nickel Co., Inc., 67 Wall St., New York 5, N.Y., consists of 28 pages, 11 graphs, and an extensive bibliography. Discusses ferromagnetic metals and alloys.

High Frequency Resistors

Catalog Data Bulletin F-1, prepared by International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa., presents comprehensive data on 43 different types of high frequency resistors—giving characteristics, construction, etc., with charts, graphs, and photos.

Machines

Pages 2246, 2253, 2253, 2310, 2375, and 2401, covering respectively, a glass machine, a glass lathe, a molded flare stem machine, an automatic flare machine, a pin pointing machine, and high-speed beading machine have been released for the catalog of Kahle Engineering Co., 1307 Seventh St., North Bergen, N.J.

Transformers

Bulletin WCF-201, released by Acme Electric, West Coast Engineering Labs, 1375 West Jefferson Blvd., Los Angeles, Calif., illustrates and discusses the important phases of transformer engineering production.

Cores

Technical information covering a new series of ferrite width and linearity cores for TV receivers and industrial cathode ray apparatus is available on letterhead request to Ferroxcube Corp. of America, 233 East Bridge St., Saugerties, N.Y.

Communication Equipment

A brochure prepared by Electrical Communications, 765 Clementina St., San Francisco 3, Calif., presents various types of communication and remote control equipment that the company designs and manufactures.

Waveguide Components

Catalog X-3, prepared by Transline Associates, Div., EDDCO, 57 State St., Newark, N.J., details the X-band components and test equipment made by the company. Literature available.

Network Filter

Bulletin 424 presents a block diagram and describes the VHF Ghost Eliminator Network Filter made by Prodelin Inc., 307 Bergen Ave., Kearny, N.J. Unit consists of two notch filters combined to block unwanted narrow bands of frequencies.

Test Instruments

A four-page, two-color brochure released by William Miller Instruments, Inc., 325 N. Halstead Ave., Pasadena 8, Calif., describes the company family of high-precision instruments used primarily for multi-channel static and dynamic test data recording.

BULLETINS

Power Plants

Bulletin LP354 by Katolight Corp., First Ave. at Chestnut, Mankato, Minn., describes ac and dc power plants in a range from 500 to 50,000 w. For emergency or continuous use.

Coils

J. W. Miller Co., 5917 South Main St., Los Angeles 3, Calif., have released Catalog No. 15 which lists the standard stock coils, filters, chokes, i-f transformers, i-f trimmers, r-f chokes, kits, etc., produced by the company.

Packaging

A four-page, two-color folder, "Engineered Packaging," prepared by the Webhart Corp., 33 West Union St., Pasadena 1, Calif., describes in words and pictures how the corporation conducts research, designs, and tests any type of product packaging through to final shipping.

Amplifiers

Electro-Voice Inc., Buchanan, Mich., have announced the availability of technical data describing their new 20 w and 30 w amplifiers employing a new "Circlotron" circuit that have no output transformers.

Super Mike Boom

Allen B. DuMont Laboratories, Inc., 1500 Main Ave., Clifton, N.J. have announced Bulletin TR-693 that describes the Type MB-96 super mike boom, a low cost unit that can be reset from 7 to 17 feet and adjusted from 6½ to 9½ feet in height.

"Capaswitch"

An advance information sheet released by Mullenbach Electrical Manufacturing Co., P.O. Box 15136, 2300 East 27th St., Los Angeles 58, Calif., illustrates and describes the "Capaswitch" that uses an electrorestrictive capacitive element to transfer the contacts.

Transformers

The Perkin Engineering Corp., 345 Kansas St., El Segundo, Calif., announced Bulletin No. T354 describing their line of transformers, filter chokes, and magnetic amplifiers. Shows photos and gives typical units and ratings.

Electronic Hardware

Chassi-Trak Corp., 6252 Iona Rd., Indianapolis 3, Ind., have released technical information that illustrates and describes "Chassis-Trak" installations in standard cabinets and racks.

Mechanical Differential

A data sheet released by Ford Instrument Co., Div. of Sperry Corp., 31-10 Thomson Ave., Long Island City, N.Y., illustrates and describes a 1½-in. addition to the company line of single spider gear differentials.

Potentiometers

A 12-page technical paper, No. 341, "Characteristics of Precision Servo Computer Potentiometers," by D. C. Duncan, discusses linearity and gives engineering data. Available on request at Helipot Corp., 916 Meridian Ave., S. Pasadena, Calif.

Frequency Control Units

Precision Crystal Laboratory, 2223 Warwick Ave., Santa Monica, Calif., presents technical information covering the frequency control units incorporated in the company line.

Crystal Unit

Bulletin 46-A, issued by Bliley Electric Co., Union Station Bldg., Erie, Pa., illustrates and presents the specifications of the Bantam BX Crystal Unit.

(Continued on page 150)

ANALOG-DIGITAL CONVERTER



NO AMBIGUITY FAST RESPONSE

A shaft position to digital conversion component for data handling systems and digital computers. Multi-brush pick-offs eliminate ambiguity. Adapted to be used in digital to analog conversion systems and closed loop systems. Standard unit handles 13 digits; 7, 17, and 19 digit models also available. Multi-channel converters designed to be time-shared with one scan network. Custom models may be ordered to your specifications.

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Length: 2-3/4 to 5", according to model
Torque: Under 0.2 oz. in.
Meets applicable military specifications

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BULLETINS

(Continued from page 149)

R.R. Microwave Equipment

"RCA Microwave Radio Relay for Dependable Railroad Communication," a 35-page color brochure presents a typical RCA railroad microwave system and tells what it can do for a typical railroad. Interested readers write to Radio Corp. of America, Engineering Prods. Div., Camden, N.J.

Telephone Receivers

Data sheet RR-1, released by Roanwell Corp., 662 Pacific St., Brooklyn, N.Y. describes Style No. 0017 telephone receivers, Models RA-1H and RA-1 which incorporate some of the most recent transducer developments.

Electronic Components

A catalog covering electron tubes, diodes, synchros, coaxial connectors and cable motors, pulse transformers, relays, and other equipment is available on request at Electronic Research Laboratories, Dept T 715 Arch St., Philadelphia, Pa.

Analogue Computers

Data sheet 301, illustrates and describes the Model 30 analogue computer of differential equations. Instrument made by Donner Scientific Co., 2429 7th St., Berkeley 10 Calif.

Resistors

Shallcross Manufacturing Co., Collingdale, Pa., have released engineering Bulletin L-33 describing "Borohm" resistors and giving their electrical performance data. Units have a consistent temperature coefficient of less than 0.001%/v.

Germanium Diodes

Bulletin GD-1A lists ratings and specifications and includes a replacement guide of International germanium diodes for replacing RETMA types. Also gives ratings and characteristics for "Red Dot" germanium diodes for 100° C applications. Available at International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

Indicating Instruments

A four-page, illustrated brochure with outline drawings, and electrical and mechanical specifications, announced by DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N.Y., covers a series of indicating instruments that conform to American Standards Assoc. and JAN-1-6 requirements.

Ceramic Capacitors

A data sheet prepared by Radio Materials Corp., 3325 N. California Ave., Chicago 18, Ill., gives the exact capacity drift in percentages for the various TC's between P-100 and N-2200.

Wave Analyzers

Bulletin 54-C gives complete engineering details and illustrates the automatic wave analyzer produced by The Davies Laboratories, 4705 Queensbury Rd., Riverdale, Md. Unit provides Fourier analysis of vibration and similar data.

Recording Tape

Bulletin No. 117 gives the physical characteristics and magnetic properties of Type EP "Audiotape" made by Audio Devices Inc., 444 Madison Ave., New York 22, N.Y. Also gives lengths, widths, and prices.

Iron Cores

Prices and detailed electrical and mechanical specifications covering the "EE" series "preferred" type powdered iron cores are available on letterhead request to Electronic Components Div., Stackpole Carbon Co., St Marys, Pa.

BULLETINS

Cycle Timers

Bulletin A.W.H. RC200 prepared by A. W. Laydon Co., 230 North Elm St., Waterbury, Conn., contains complete information on a new line of miniature, hermetically-sealed repeat cycle timers.

Capacitors

Catalog No. X-100, a 20-page booklet, illustrates and describes a complete line of miniature, hermetically-sealed high-temperature (-50° - 125° C) tubular paper capacitors. Available at Gudeman Co., 340 W. Huron St., Chicago 10, Ill.

"Phenolite"

A two-color, 12-page brochure prepared by National Vulcanized Fibre Co., Wilmington 99, Del., describes "Phenolite" manufacture, fabricating facilities, and numerous end uses for the material.

Power Supplies

Mag-Electric Products, Inc., 12822 Yukon Ave., Hawthorne, Calif., have released a data sheet that describes their line of magnetic amplifier controlled dc power supplies.

Components

A 12-page, illustrated product brochure released by Servo Mechanisms, Inc., El Segundo Div., 316 Washington St., El Segundo, Calif. informatively covers many of the latest developments of the company machine computers, master-air data computers, accelerometers, positioning mechanisms, etc.

Potentiometers

The first additions to the "TIC Potentiometer Handbook", issued by Technology Instrument Corp., 531 Main St., Acton, Mass., data sheets ST18 and ST18, feature potentiometers that have low-friction ball-bearings, compact size, standard AIA 1-3/8 in. servo mounting, high linearity and precision construction throughout.

Resistors

Catalog No. 537-AT gives full engineering specifications for the line of high-temperature carbon deposit resistors made by Allie's Products, Inc., 1028 Conn. Ave., N. W., Washington, D.C. Ambient temperatures: 70° C. - 250° C. Tolerances as close as 0.1%.

Tubes and Cavities

Availability of the following new technical literature was announced by the General Electric Tube Department, Schenectady 5, N.Y. ETR-886, lists recommended receiving and CRT types for AM, FM, and TV receivers. ETD-548C covers the history of the G-E "Five-Star" line. ETD-892 describes the new GL-6265 type, "Five-Star" version of the 6BH6, for critical applications in two-way communication systems. ETD-881 describes the new GL-2C39B metal-and-ceramic "lighthouse" tube.

Ceramics

Engineering specifications on the AISiMag line of ceramics are found on Chart No. 244, available from the American Lava Corp., 671 Broad St., Newark, N.J.

Radioactivity Instruments

Detectors, alarm systems and lab and classroom equipment for the measurement of radio-activity are described fully in an illustrated brochure released by the Nuclear Instrument and Chemical Corp., 223 W. Erie St., Chicago 10, Ill.

Vibration Analysis

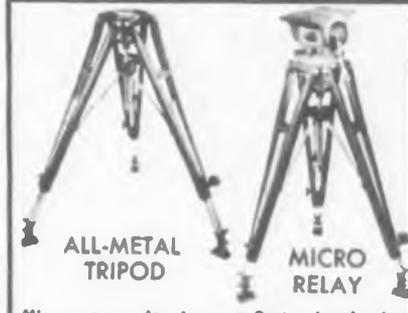
A 16-page informational brochure, "Balance—final dimension of precision," discusses the relationship between vibration phenomena and precision manufacturing. International Research and Development Corp., 168 East Hosack St., Columbus 7, Ohio.

NOW... A SUPER LINE OF ACCESSORIES THAT SURPASS ACCEPTED STANDARDS—for STUDIO, MOBILE and MICRO-RELAY EQUIPMENT

Famous BALANCED TV Head supporting a TV camera. Both are mounted on one of our all-metal tripods, which in turn is mounted on a Coco Spider Dolly. Here is a "team" outstanding for versatility and maneuverability in studio or on location.



New Model C BALANCED TV Head provides correct center of gravity in a FLASH—without groping. No matter what focal length lens is used on the turret, the camera may be balanced by the positioning handle without loosening the camera tie-down screw. Something every cameraman has always desired.



Micro wave relay beam reflector head, also metal tripod. Head is perfect for parabolas up to 6 ft. diameter, withstands torque spec's environmental treated. Tripod legs work in unison, one lock knob, spurs and rubber foot pads included.



Secures tripod of camera or beam reflector to car top. Made of bronze and brass, with ball-type, yoke-swivel construction. A lot depends on roof clamps—that's why these are made with EXTRA care.



Similar to BALANCED TV head but much lighter in weight (only 20 lbs.), this new Professional Junior Spring head is ideal for Vidicon cameras weighing up to 25 lbs. Spring head tilt assures camera will return to neutral position when lever is in unlocked position... a wonderful safety factor.



MINI-PRO
New lightweight all-metal MINI-PRO Tripod fulfills a tremendous need—especially for Vidicon cameras weighing up to 8 lbs. Low height measures 33" and maximum height 57". Reversible spur and rubber cushions. Maximum leg spread 35°.



NEW PORTABLE 3-WHEEL COLLAPSIBLE DOLLY
Dolly folds to fit into carrying case—18"x12"x36". Weighs only 60 lbs. Has wheel in rear for steering, which may be locked for straight dollying.

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Passive Network Type 303

- RESOLUTION TIME 5×10^{-11} SECOND OR LESS
- NO LIMIT ON REPETITION RATE
- NO TIME JITTER
- MATCH ANY IMPEDANCE AT INPUT & OUTPUT SPECIFICATIONS

INPUT IMPEDANCE: 1 megohm shunted with 12 uuf maximum. It may be converted into a lower value by connecting a resistor in shunt.

OUTPUT IMPEDANCE: 200 ohms nominal. May be converted into other values by connecting resistor in series or shunt.

TIME DELAY: Continuously variable from 0 to 0.25 us for Type 303a. Ten other models available with time delay continuously variable from 0 up to 0.8 us.

BAND WIDTH: Over 15 megacycles.

PHASE DETECTOR — 0.1° ACCURACY

100 KC to 15 MC—Type 205

ACCURACY: ± 0.1 degree (8 minutes) in phase reading, or $\pm 1\%$ of the time delay indicated on the dial of the continuously variable delay line.

TIME DELAY: Three continuously variable delay lines are supplied with the

SPECIFICATIONS:
mill. 0 to 0.45, 0 to 0.25, and 0 to 0.05 microsecond. Continuously variable delay lines with different time delay can be obtained on request.

INDICATOR SENSITIVITY: 0.01 Volt full scale

WRITE FOR DATA:

PRICE \$144.

PRICE \$445.

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"The Years Ahead"

(Continued from page 83)

trobot" for short—will be feasible provided its output is large, its product accuracy high, its operation speedy, and its efficiency acceptable. Its cost must be suitably related first to its cost of production, and second to the current cost per hour of the approximately "equivalent" mental or physical labor which it can perform. In short, the electrobot must be a competent and economic worker.

The physical appearance of an electrobot will vary widely, depending upon its function. It need not resemble men in appearance any more than helicopters resemble birds. Even now various electronic computers, control mechanisms, and guidance devices may be regarded as rudimentary electrobots. In years ahead, electrobots will reach a stage of complexity, functional capability, and general utility considerably surpassing anything we may now imagine.

ELECTROBOT CHARACTERISTICS

The existence of man himself proves that the electrobot is physically possible. However, the construction of an electrobot having the full capabilities of man may be wholly beyond the scope of man's creative ability and scientific knowledge. Nevertheless, as the decades and centuries pass, and as new "component parts" for such electrobots are developed, their scope will steadily expand.

It is debatable whether such electrobots can have all or even many of the attributes of man himself. There can of course be imagined self-repairing electrobots, electrobots which will produce duplicates of themselves or of other electrobots, and electrobots which can learn the "rules of the game" and thus, to some extent, adapt themselves to their environment, and indeed rather simulate some of the rudimentary behavior of humans.

Whether electrobots can have what we term temperament, inspiration, and intuition is less certain. It is sure that variations of performance or mutations of form can be built into the programming mechanism of an electrobot. The variations thus induced may be either planned, and along specific lines, or they may be wholly random, being deliberately introduced by a "noise factor." In these respective cases the performance of the robot might be termed either conventionally wise or artistic, or else erratic and "temperamental." It may also be possible to build into machines the capability of self-improvement. Roughly this would correspond to evolution in the animal world.

Electricity replaced much physical work and has made purely physical labor less important in our economy. Electronics has replaced much physical labor, some of it quite complicated, and is beginning to tackle both simple and complex mental tasks of routine nature.

Already man is being displaced in certain apparently personal activities. For example, one military specialist has stated that "strong arguments can be made on the basis of present knowledge that the man in the aircraft (at least in the fighter aircraft) is a liability and should be taken out of it as soon as possible." Airplane designers are beginning to regard man as a specialist robot—and not a particularly satisfactory one for their purposes.

In the years ahead electronic devices may perform a considerable portion of all routine physical and mental labor and even a number of non-routine tasks. Certainly this trend cannot continue indefinitely without provoking reaction from the physical and mental workers.

Clearly enough, means must be found for utilizing man's resulting leisure time beneficially. Production must be increased to avoid the evils predicted by Malthusian doctrines. Further the survival capabilities of a liberated and unthreatened humanity must be studied. Man exists today in a complex and resistant environment, subject to stresses which develop in him strength and mental and moral growth. With the large-scale removal of obstacles, will man evolve or will he vegetate? Indeed can a moral or intellectual substitute for struggle and effort be found?

1954 WESCON Breaks All Records



Interior view of exhibits at recent 1954 Western Electronic Show & Convention in Los Angeles. Registration totaled more than 23,000, exceeding last year's figure by almost 10,000. More than 2800 attended the technical

sessions held in the Ambassador Hotel and the Institute of Aeronautical Sciences Building where 115 papers were delivered. Next year's conclave will take place in San Francisco in the Civic Auditorium, August 24-25-26.

NBS Developments

(Continued from page 145)

is more positive than the cathode; the reverse state is achieved by applying voltage of opposite polarity. The forward voltage acts to create a steady supply of "carriers" of current within the semiconducting material, thus maintaining a condition of high conductivity. Carriers are not created during the reverse static state. If the voltage applied to the diode is switched quickly from forward to reverse voltage, a transient phenomenon occurs in which a large reverse current flows for an appreciable time after switching takes place, and decays until the static reverse state is reached. The transient current occurs because the carriers which were present due to the forward voltage remain available to be swept out by the application of the reverse voltage. The carriers do not remain indefinitely during a period of delay between cessation of forward voltage and application of reverse voltage; instead, their number decreases with time during this period.

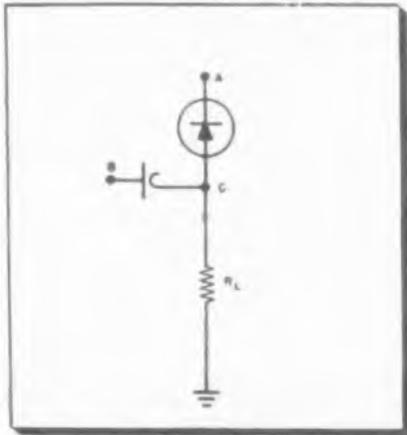


Fig. 1: NBS basic diode amplifier circuit

Although amplification in the diode is not a continuous phenomenon, the action may be likened to the way in which amplification is obtained in a transistor. In a transistor, the emitter can be regarded as a diode existing in the forward conducting state, and the collector as a diode in the reverse state. If any of the carriers created by the forward biased diode are transported to the vicinity of the reverse biased diode, a larger current than the static current will flow in the latter diode.

Voltage on the emitter of a transistor produces current which creates carriers. These carriers change the current in the collector, which in turn changes the voltage across the collector. In the case of a junction transistor used in the common base circuit, the collector current is almost equal to the emitter current, so that power gain is effectively determined by the ratio between the forward and the reverse resistance. Thus, power gain is obtained by a transfer of current from one circuit of low impedance to another circuit of high impedance.

(Continued on page 154)

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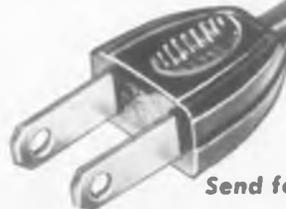
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NBS Developments

(Continued from page 153)

The diode amplifier obtains its power gain in a similar manner, except that one electrode serves as both emitter and collector, but at different times. During one-half of the cycle, the anode is more positive than the cathode, and the anode acts as the emitter of the junction transistor; during the other half-cycle, the anode acts like a collector. When it is an emitter, it injects carriers into the germanium with only a small applied forward voltage—i.e., at a low impedance level. When it is a collector, the anode withdraws these same carriers, but only by applying a

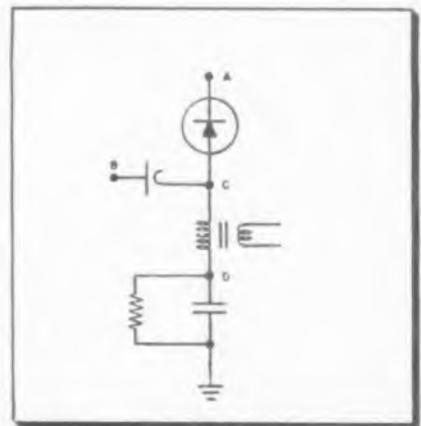


Fig. 2: Transformer-diode-coupled amplifier

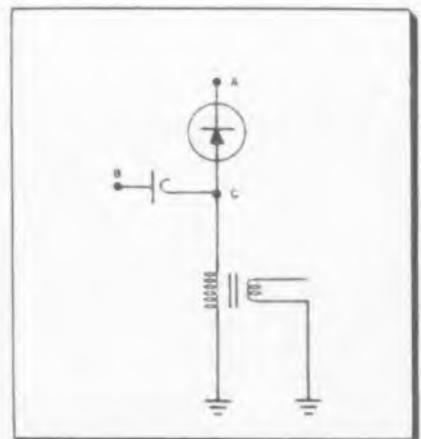


Fig. 3: R and C between transformer and ground aids transformer primary recovery

much higher voltage—at a higher impedance level.

Resistance-Diode-Amplifier

The simplest form of diode amplifier is the resistance-diode-coupled circuit (Fig. 1). The waveform applied to point A is from a one-megacycle power source. This frequency was chosen for experimental purposes because its one-microsecond period is approximately equal to the decay time of the carriers in the diodes which have been most ex-

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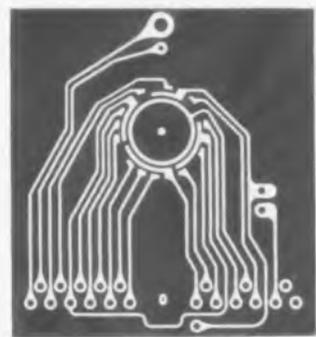
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NBS Developments

(Continued from page 154)

tensively used. The r-f supply, or "clock," not only acts as the power source but also as the switch which controls the two separate phases of the amplification cycle: the intake of signal power into the amplifier diode (injection of carriers) and the output of amplified power (decay of carriers). As an analogy, the operation of the diode amplifier may be likened to that of a gasoline engine, where fuel is injected

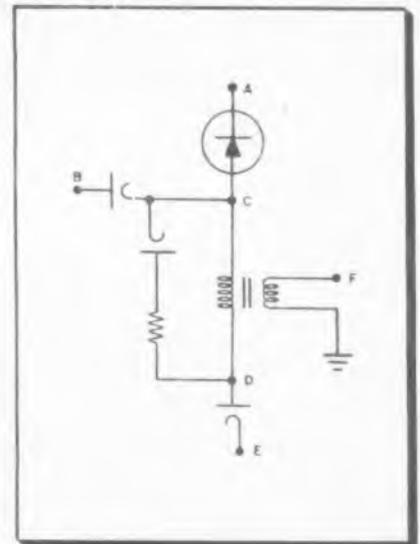


Fig. 4: Improvement on circuit of Fig. 3

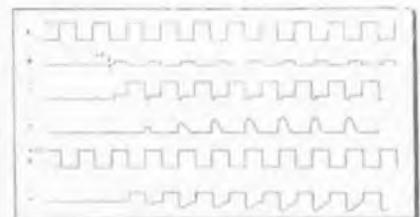


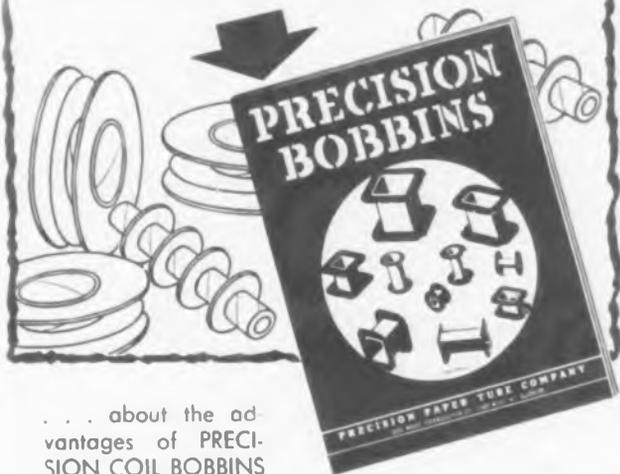
Fig. 5: Waveforms at various points (Fig. 4)

during the one part of the cycle and fired at a latter part of the cycle.

When there is no input at point B, there is no output because of the high impedance of the amplifier diode. A small voltage spike does appear in the output due to the small capacitance of the diode. This, however, can be decreased by paralleling the load resistor with a capacitor for capacitance division. When point B is raised to plus 2 volts while the clock is at zero volts, carriers are injected into the diode by current in the direction B-C-A. The diode then presents for a short time a very low impedance to the reverse voltage that the clock applies. Since this impedance is low compared to the load resistor, most of the clock voltage appears across the resistor.

Power gains of about 10 (average output power/average input power) have been measured using a 20-volt clock. The only limitation on the amplitude of

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NBS Developments

(Continued from page 156)

the clock voltage is that it not exceed the reverse breakdown voltage. The requirement on the clock supply is rather severe in that during the time that the clock is at zero volts, its impedance should be very low, so that as much as possible of the available input signal power will be across the diode and not divided between the diode and the clock source. In practical applications, the clock voltage may be distributed as a full sine wave and then half-wave rectified near the point of use.

Transformer-Diode-Amplifier

Some circuit element which transforms voltage gain to current gain is essential to most of the circuits using the diode amplifier, because there is no average current gain in the diodes that have been used so far in the experiments performed at the Bureau. The transformer - diode - coupled circuit shown in Fig. 2 achieves current gain through a step-down transformer. Its

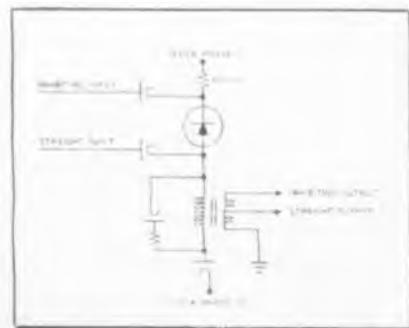


Fig. 6: Computer pulse repeater

operation is similar to the resistance-diode-coupled amplifier. The circuit in this form is suitable for the amplification of low-duty-cycle pulses but will not operate at high duty cycles because the stored energy in the magnetic circuit will not permit the transformer primary to "recover" or "fly back." A solution to this difficulty is obtained through the addition of a capacitor and resistor between the transformer primary and ground, as shown in Fig. 3. This circuit has the disadvantage that the flyback requirements of the inductance are satisfied only on a many-pulse basis and not on a pulse-to-pulse basis. The many-pulse average can also cause trouble in turning off the stage at the end of a train of pulses.

If the end of the transformer primary (point E, Fig. 4) were to be driven by a clock voltage 180° out of phase with the power supply clock, the flyback requirements would be satisfied on a pulse-to-pulse basis because the point D would be allowed to fly back or not as necessary. During the time the clock pulse is on and when point A is up, point E is at ground and conventional current flows through the path A-C-D-E. After



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power clock pulse, point E is given positive by the other clock phase, connecting the diode between D and E. At this same time, point B may be charging the diode amplifier for the next power clock pulse. The series diode and resistor between C and D provide critical damping of the flyback.

Pulse Repeater Stage

Further development of the diode-amplifier concept leads to the design of a complete "pulse repeater stage" for application in electronic digital computers. The circuit shown in Fig. 6 satisfies the essential requirements for a computer stage. It is a combination of the transformer-diode-coupled amplifier (Fig. 4) and an inhibiting gate. Extra logical "or" gates may be added as desired. Delay lines may be used but can be avoided in most cases, since the carriers in the amplifier diode store information. It may be necessary, however, to use some delay lines to time accurately the inhibiting pulses.

Flip-Flop Circuits

The diode amplifier can be used as the basis for a variety of "dynamic"

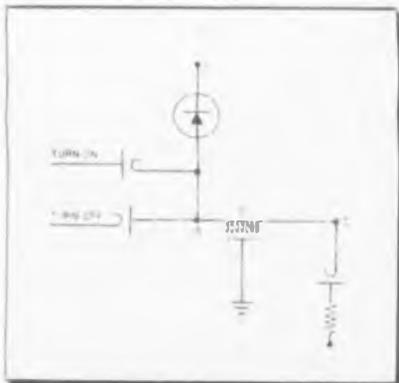


Fig. 7: Flip-flop circuit with diode amp.

flip-flop circuits—oscillators which can remain stable either in an oscillating or a non-oscillating state. The circuit shown in Fig. 7 stores energy between clock pulses in a delay line. The oscillating state is started by raising point B to plus 2 volts to inject carriers. On the clock pulse immediately following, point B is raised to plus 20 volts, and the pulse travels down the delay line. At point C it sees an open circuit and so is returned in the same polarity at the proper time to inject more carriers into the amplifier diode. The delay line serves as an impedance-matching device as well as a delay line, for it can provide the necessary current. In injecting carriers into the amplifier diode, however, the delay line sees a very low impedance, and so some energy is returned down the line for a third travel, negative this time. At point C, however, the negative pulse is matched and absorbed; if it were not absorbed, it would

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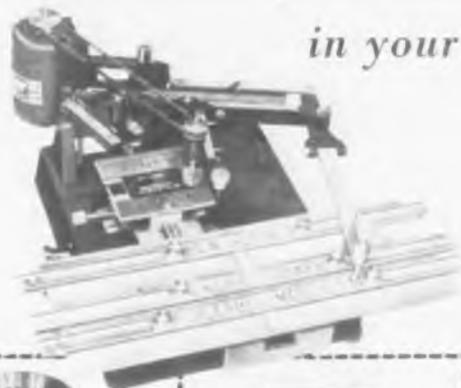
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NBS Developments

(Continued from page 159)

travel back down the line a fourth time and prevent the next carrier injection.

Another flip-flop circuit, shown in Fig. 8, is a current-doubler type. Essentially, it charges two capacitors in series and then discharges them in parallel. If point B is pulled positive, diodes No. 1 and No. 3 are cut off; and current flows through the path B-C-D-E, thus charging the two capacitors in parallel. When point B becomes negative, diode No. 2 is cut off, and current flows through the paths E-D-B and E-C-B, thus discharging the capacitors in parallel. When used with the germanium diode amplifier, this circuit makes a flip-flop whose applied frequency can be varied over a very wide range. Many other flip-flop circuits

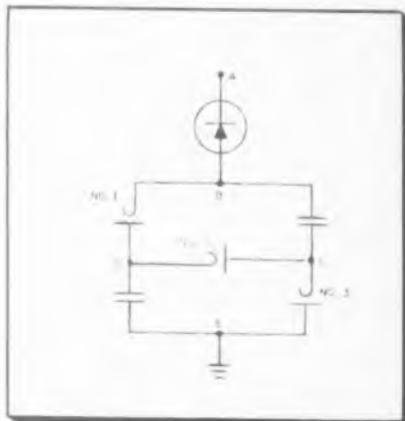


Fig. 8: Current-doubler flip-flop circuit

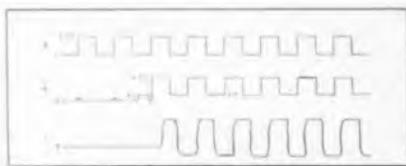


Fig. 9: Waveforms of circuit in Fig. 8

have been developed, some of which are even simpler and less expensive than these described here.

Higher-Speed Circuitry

Silicon junction diodes have a much faster transient recovery than germanium junction diodes, and therefore can be used in faster circuits. In experiments to study the usefulness of the silicon diode as a diode amplifier, a current-doubler type of flip-flop operated satisfactorily with a clock frequency of 25 mc; the circuit exhibited start-stop times of about 100 millimicroseconds. It should be possible to achieve much higher frequencies by using diodes with even shorter decay times. This promises to provide very fast, practical circuitry for future use in electronic computers and many other useful applications as well.

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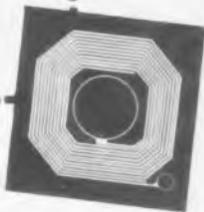
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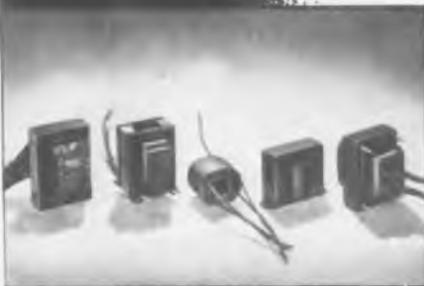
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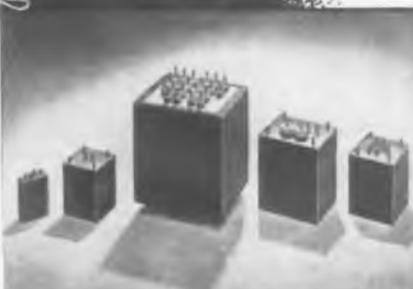
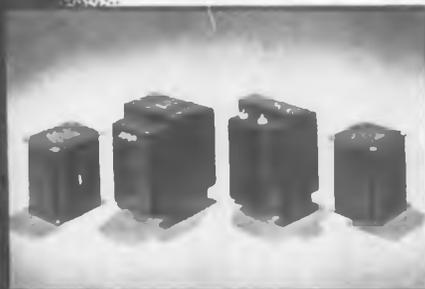


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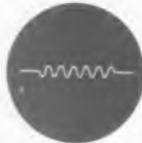
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PERSONAL

(Continued from page 139)

Douglas R. Corron, Paul N. Hanover, George J. Pack, B. L. Sander, Melvin R. Schroeder, Martin M. Scroggin Jr. and Herbert S. Simon have joined the technical staff of the Hughes Research and Development Labs, Culver City, Calif.

Kenneth Slawson has been promoted to vice-president of the Ford Instrument Div. of the Sperry Corp. He will continue to assist the president, R. F. Jahn, in the general management of the company.

Robert W. Kerr, formerly deputy group executive of American Machine & Foundry Co.'s General Products Group, has been named a divisional vice-president, and group executive of AMF's General Products Group.

Leroy J. Packer will direct and supervise the new Computer Division of Polarad Electronics Corp., Bklyn, N.Y. Mr. Packer was previously group leader of the Digital Techniques Group at the Columbia University Electronics Research Lab.



I. J. Packer



F. O. Stratton

Frazier O. Stratton has been promoted to chief engineer of Sterling Engineering Co., subsidiary of A.M.&F. in Laconia, N.H.

Dr. Louis G. Dunn has resigned as Director of Jet Propulsion Lab. at Calif. Inst. of Technology to become associate director of the new Guided Missile Research Div. of Ramo-Wooldrige Corp., of Los Angeles, Calif.

Emil A. Sellars has been appointed chief engineer at WBTW, Florence, N.C. Sellars was formerly chief engineer at WGVL in Greenville, N.C.

Richard E. Mathes is the new director of engineering at Raymond Rosen Engineering Prods., Inc., Philadelphia, Pa. Mr. Mathes was associated with RCA for 18 years as a research and development engineer.

Arthur E. Dunn has been appointed sales engineer for Air Associates, Inc., Electronic Equipment Div., Teterboro, N.J.

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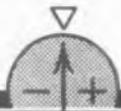


Speed-Chassis

The Speed-Chassis is a flexible breadboard assembly with interchangeable socket arrangements which can be mounted on a relay rack. A shield can and panel are available to make successful breadboard assemblies both permanent and neat.

Two insulated tie-point strips and one grounded tie-point strip are provided, each 14" long. Individual plates are available, with holes already punched, to fit most all needs. In addition, three sizes of blank plates are cataloged.

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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.

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puts two instruments
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Now users of the light, compact A R C Type 15D navigational receiving equipment can employ a single panel instrument that performs the work of two units previously used. The cross-pointer meter and the course selector have been combined into one part that fits a standard 3 1/8" instrument hole. This saving in instrument panel space is important, particularly now that dual VOR installations are so popular. In addition to the space saving, installation costs are cut. Ask your dealer to specify the new #16706 Course Indicator as part of your 15D Installation—whether single or dual. The indicator may be purchased separately for use with older Type C and D equipment. Write for complete data.

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 - Simultaneous Voice



R-13B Receiver with D-10A Dynamotor
B-13 Converter, E-14 Rack and M-10 Mounting



C-22A
Control Unit,
M-18 Mounting



A-13B Antenna

New GE Division

Formation of the Chemical and Metallurgical Div. within the General Electric Co. has been announced by Robert Paxton, executive vice president. The new division includes the former Chemical Div. and the Carboly Dept. Concurrently, Mr. Paxton announced the appointment of Robert L. Gibson as general manager of the Chemical and Metallurgical Div. Mr. Gibson will make his headquarters in Pittsfield, Mass. The Chemical and Metallurgical Div. will be made up of 5 operating departments: Carboly, Plastics, Silicon Prods., Chemical Materials, and Laminated and Insulating Prods.

**Electronic Tube Corp.
Bought by K. C. Meinken**

Kenneth C. Meinken, former president of National Union Corp., has purchased the Electronic Tube Corporation of Philadelphia and has been elected by the board of directors to the presidency of the corporation.

**Ward Establishes
Antenna Research Lab.**

Ward Products Corp. of Cleveland, Ohio, announces the establishment of a new antenna research laboratory in Ashtabula, Ohio, for the design and testing of all types of television and automotive antennas. Laboratory testing facilities include the latest type of equipment for the measurement of impedance, V.S.W.R. and gain characteristics of antennas, in accordance with the standards set up by the antenna industry. A pattern range has also been constructed in the laboratory. The new laboratory will supplement the facilities of Gabriel Electronics in Needham, Massachusetts.

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Private offices at Admiral Corp. get a new look by installation of special overhead lighting by Luminous Ceilings, Inc. Plastic hides factory type windows, eliminates outside glare



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with a clear,
clean-cut voice



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MODEL 90
MOBILES**

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Condensed Specifications

SR-90R Carbon—Furnished with DPST push-to-talk switch, normally open . . . one pole in microphone circuit and one pole in external relay circuit. 4 conductor unshielded KOILED KORD (11" retracted, 5' extended.) Response, 200 to 4000 cps. Level -38 db. 80 ohms nominal DC resistance . . . List price . . . \$26.50.

SR-90D Dynamic — Response, 200 to 9000 cps. Level: -48 db at high impedance. SPST push-to-talk switch, normally open, for on-off control of external relay. 200 ohms impedance furnished with 4-conductor, 2 shielded, 5' attached cable. High impedance furnished with 3-conductor, one shielded, attached 5' cable. List price . . . \$29.50

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Toronto, Ont., and Branches

INDUSTRY NEWS

(Continued from page 38)

Fred W. Troester has been added to the sales staff of the Chemical Mfg. Div. of the M. W. Kellogg Co. subsidiary of Pullman Inc. to handle sales of their line of fluorocarbon materials in the Pacific Coast area.

Joseph T. Zuravleff has been transferred to the Chicago district sales office of the Erie Resistor Corp. to represent the company's electronics division in that area.

George H. L. Norman has joined Sprague Electric Co., North Adams, Mass., as coordinator of the company's activities in the field of electronic computer components. **Leo J. Dornbos** has been named manager of Sprague's Cleveland office which serves the Northern Ohio and Western Pa. territories.



G. M. I. Norman

Reed V. Bontecou has been appointed manager of marketing for receiving tubes at General Electric, Owensboro, Ky. He previously was product manager for GE tube products in Schenectady. **Richard A. Norman** was named to a parallel position for cathode ray tubes in Syracuse where **Harry R. Hemmings** has become manager of mfg. **Willard L. Male** replaces Mr. Hemmings as Buffalo plant manager, and **Milton J. Strehel** has become marketing manager for industrial and transmitting tubes in Schenectady.

J. N. Kammerer has become field sales engineer for Stupakoff Ceramic & Mfg. Div. of the Carborundum Co. in the Philadelphia district, serving the greater Philadelphia area, Delaware and Maryland.

S. Perry Jenkins, formerly chief engineer of WRLB-TV, has become district sales engineering manager of Standard Electronics Corp., subsidiary of Claude Neon, Inc., Newark, N.J. He will coordinate the sales service activities of the company in the southeastern section of the country.

(Continued on page 168)

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and you buy
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And 20-20 Plus transformers.

Consistent quality.
Uniform response.

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High efficiency.

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When superlative performance is desired, the Peerless 20-20 PLUS is the answer. The 20-20 PLUS has all the famous features of the 20-20 line PLUS wider frequency range, PLUS improved efficiency, PLUS smaller size, PLUS increased power rating, PLUS greater value. You can depend on Peerless for the best.

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Speed-Chassis

The Speed-Chassis is a flexible breadboard assembly with interchangeable socket arrangements which can be mounted on a relay rack. A shield can and panel are available to make successful breadboard assemblies both permanent and neat.

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For further information write for Specification Sheets E201-2 and E201-3.

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puts two instruments
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Now users of the light, compact ARC Type 15D navigational receiving equipment can employ a single panel instrument that performs the work of two units previously used. The cross-pointer meter and the course selector have been combined into one part that fits a standard 3 1/2" instrument hole.

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Radio
Corporation**



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- For Airborne Reception of
- Omni-Directional Ranges
 - Visual-Aural Ranges • Runway Localizers • GCA Voice
 - Simultaneous Voice



R-138 Receiver with D-10A Dynamotor
B-13 Converter, E-14 Rack and M-10 Mounting



A-13B Antenna

New GE Division

Formation of the Chemical and Metallurgical Div. within the General Electric Co. has been announced by Robert Paxton, executive vice president. The new division includes the former Chemical Div. and the Carboly Dept. Concurrently, Mr. Paxton announced the appointment of Robert L. Gibson as general manager of the Chemical and Metallurgical Div. Mr. Gibson will make his headquarters in Pittsfield, Mass. The Chemical and Metallurgical Div. will be made up of 5 operating departments: Carboly, Plastics, Silicon Prods., Chemical Materials, and Laminated and Insulating Prods.

**Electronic Tube Corp.
Bought by K. C. Meinken**

Kenneth C. Meinken, former president of National Union Corp., has purchased the Electronic Tube Corporation of Philadelphia and has been elected by the board of directors to the presidency of the corporation.

**Ward Establishes
Antenna Research Lab.**

Ward Products Corp. of Cleveland, Ohio, announces the establishment of a new antenna research laboratory in Ashtabula, Ohio, for the design and testing of all types of television and automotive antennas. Laboratory testing facilities include the latest type of equipment for the measurement of impedance, V.S. W.R. and gain characteristics of antennas, in accordance with the standards set up by the antenna industry. A pattern range has also been constructed in the laboratory. The new laboratory will supplement the facilities of Gabriel Electronics in Needham, Massachusetts.

NEW LOOK IN LIGHT



Private offices at Admiral Corp. get a new look by installation of special overhead lighting by Luminous Ceilings, Inc. Plastic hides factory type windows, eliminates outside glare



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clean-cut voice



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MODEL 90
MOBILES

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SR-90R Carbon—Furnished with DPST push-to-talk switch, normally open . . . one pole in microphone circuit and one pole in external relay circuit. 4 conductor unshielded KOILED KORD (11" retracted, 5' extended.) Response, 200 to 4000 cps. Level -38 db. 80 ohms nominal DC resistance . . . List price . . . \$26.50.

SR-90D Dynamic — Response, 200 to 9000 cps. Level: -48 db at high impedance. SPST push-to-talk switch, normally open, for on-off control of external relay. 200 ohms impedance furnished with 4-conductor, 2 shielded, 5' attached cable. High impedance furnished with 3-conductor, one shielded, attached 5' cable. List price . . . \$29.50

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INDUSTRY NEWS

(Continued from page 38)

Fred W. Troester has been added to the sales staff of the Chemical Mfg. Div. of the M. W. Kellogg Co. subsidiary of Pullman Inc. to handle sales of their line of fluorocarbon materials in the Pacific Coast area.

Joseph T. Zuravleff has been transferred to the Chicago district sales office of the Erie Resistor Corp. to represent the company's electronics division in that area.

George H. L. Norman has joined Sprague Electric Co., North Adams, Mass., as coordinator of the company's activities in the field of electronic computer components. Leo J. Dornbos has been named manager of Sprague's Cleveland office which serves the Northern Ohio and Western Pa. territories.



G. H. L. Norman

Reed V. Bontecou has been appointed manager of marketing for receiving tubes at General Electric, Owensboro, Ky. He previously was product manager for GE tube products in Schenectady. Richard A. Norman was named to a parallel position for cathode ray tubes in Syracuse where Harry R. Hemmings has become manager of mfg. Willard L. Male replaces Mr. Hemmings as Buffalo plant manager, and Milton J. Strehel has become marketing manager for industrial and transmitting tubes in Schenectady.

J. N. Kammerer has become field sales engineer for Stupakoff Ceramic & Mfg. Div. of the Carborundum Co. in the Philadelphia district, serving the greater Philadelphia area, Delaware and Maryland.

S. Perry Jenkins, formerly chief engineer of WRLB-TV, has become district sales engineering manager of Standard Electronics Corp., subsidiary of Claude Neon, Inc., Newark, N.J. He will coordinate the sales service activities of the company in the southeastern section of the country.

(Continued on page 168)

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and you buy
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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.

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Freed Magnetic Amplifiers, Saturable Transformers and Reactors are designed for efficient operation and long life. They can be used wherever reliable, rugged and maintenance free systems are required.

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SATURABLE TRANSFORMERS — Controlled with dual triode; plate supply can be either DC or AC; no rectifiers; AC or DC control signals.

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DRIFT-FREE MAGNETIC AMPLIFIERS — For Control Systems of high stability with rigid "drift-free" requirements.

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1718 Weirfield St.
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INDUSTRY NEWS

(Continued from page 166)

Richard T. Orth, formerly vice-president and general manager of the Radio Corp. of America Tube Div., has become vice-president of the Westinghouse Electric Corp. electronic tube division. He will succeed E. W. Ritter, who planned the division's two new plants at Elmira and Bath, N.Y.

E. L. Dibble has been appointed general sales manager of consumer products by National Carbon Co., Div. of Union Carbide and Carbon Corp. Mr. Dibble will be located in the New York office where he will direct the sales of the company's automotive service products.

Verne Smith is the new director of sales at Drake Mfg. Co., Chicago, Ill., manufacturers of socket and jewel light assemblies.



V. Smith

Emmet N. Hughes, former West Coast division manager of Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill., has been made western sales manager in charge of all West Coast sales operations, including the Rocky Mountain states. **John K. Lincoln**, has been made Eastern sales manager in charge of all sales in all states east of the Rocky Mountains. Mr. Hughes will be headquartered in Los Angeles. Mr. Lincoln will be located at the company's executive offices in Freeport.

F. C. Tucker has been made eastern sales manager for the plastics department of General Electric Co., Pittsfield, Mass. Mr. Tucker will be responsible for the sale of the department's custom-molded plastics products for the refrigeration, electronics, electrical, and other industries. The newly created post covers New York, Pennsylvania, and the Atlantic Seaboard.

William A. Gothard has been elected president and general manager of Gothard Manufacturing Co., Springfield, Ill., succeeding his father, R. W. "Duke" Gothard, who will supervise the West Coast activities of the company.

Instrument Switches



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in a hurry...

Custom built from a large
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CALDWELL-CLEMENTS'

TELE-TECH

& Electronic Industries

In 3 Sections • Section 2

October • 1954

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Start *right* — *right from the start*, specify Du Mont color television broadcasting equipment. Enjoy the technical and economic advantages of equipment designed with you in mind. As proved in monochrome operation, Du Mont television broadcasting equipment combines the most economical operation with outstanding performance and greatest flexibility in future expansion.

Pickup equipment	COLOR MULTI-SCANNER FOR FILM AND SLIDES • ELECTRONIC MASKERS
Color terminal equipment	COLOR SWITCHING EQUIPMENT • ENCODERS • MULTI-CHANNEL WAVEFORM MONITORS • COLOR MONITORS • UNENCODED COLOR PATCH PANELS AND CORDS • COLOR STABILIZING AMPLIFIER
For color conversion of existing sync generator	SUB-CARRIER GENERATOR • BURST KEY GENERATOR • POWER SUPPLIES
Color sync generator	INCLUDES: MONOCHROME SYNC GENERATOR • SUB-CARRIER GENERATOR • CONVERGENCE AND BURST KEY GENERATOR
Color test equipment	COLOR BAR GENERATOR • STEP-WAVE GENERATOR • VECTORSCOPE • LUMICHROME FILTER • CONVERGENCE AND LINEARITY GENERATOR • ENVELOPE DELAY MEASURING SET • DIFFERENTIAL PHASE MEASURING SET
Transmitter equipment	COLOR NOTCH FILTERS • 4.75 MC VIDEO CUTOFF FILTER AND EQUALIZER • HIGH AND LOW FREQUENCY EQUALIZER

COLOR TV TER

ACHROMATIC: Shade of grey from black to white, color absent.

BRIGHTNESS: Attribute of visual perception in accordance with which an area appears to emit more or less light.

CAMERA SPECTRAL CHARACTERISTIC: Sensitivity of each camera color channel with respect to wavelength.

CARRIER CHROMINANCE SIGNAL: Sidebands of modulated chrominance subcarrier, plus any unsuppressed subcarrier, added to monochrome signal to convey color information.

CHROMA: Color quality characterized by its saturation only.

CHROMATICITY: Quality of chromatic or achromatic color defined by hue and saturation only.

CHROMATICITY DIAGRAM: See Fig. 1. Graph showing relation of color primaries and result of primary combinations. Coordinates identify relative content of primaries in a color.

CHROMINANCE: Colorimetric difference between a color and reference color (Illuminant C white in NTSC system) of equal luminance. Refers to hue and saturation only.

CHROMINANCE CARRIER REFERENCE: Continuous signal having same frequency as chrominance subcarrier and fixed phase with color burst. It is phase reference of carrier chrominance signal for modulation or demodulation.

CHROMINANCE COMPONENT: Any component of two-dimensional chrominance vector. I and Q signals add to produce complete chrominance signal in NTSC system.

CHROMINANCE PRIMARY: One of two non-physical transmission primaries, I and Q, which have zero luminance.

CHROMINANCE SUBCARRIER: 3.579545 mc signal modulated by chrominance video signals, whose modulation sidebands are added to monochrome signal to convey chrominance.

CHROMINANCE VIDEO SIGNALS: Voltage output from red, green or blue section of color TV camera or receiver matrix.

CIE: Committee Internationale d'Eclairage. Also ICI, International Commission of Illumination.

COLOR BREAK-UP: Spurious color caused by difference in observation condition from one field to next. Eg., blinking eyes, moving head rapidly.

COLOR BURST: See Fig. 2. Eight sine wave cycles (min.) of chrominance subcarrier added to horizontal blanking pedestal to sync transmitter and receiver color carrier oscillators.

HOW COLOR TV WORKS: Briefly, the studio camera camera green and blue. These are combined into two specially-ph equivalent to monochrome for transmission. To synchronize placed on the back porch of the horizontal sync pulse. Democ sion primaries back to vi

COLOR DIFFERENCE SIGNAL: Combination of I and Q signals in proper polarity which are added to Y monochrome signal to produce signals representing tristimulus values (red, green, blue) transmitted. Resulting signals applied to picture tube.

COLOR EDGING: Spurious color at boundaries of differently colored picture areas. Includes fringing and misregistration.

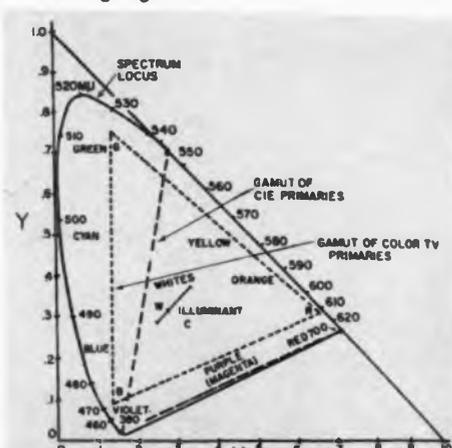
COLOR FRINGING: Spurious colors introduced into picture by change in position of televised object from field to field.

COLOR GAMUT: Restricted range of colors which can be matched by primaries.

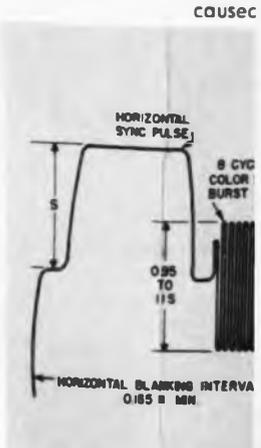
COLOR PHASE: Phase difference between I or Q and carrier chrominance signal.

COLOR PICTURE SIGNAL: Monochrome component plus subcarrier modulated with color information, excluding synchronizing signals.

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(1) XYZ CHROMATICITY DIAGRAM



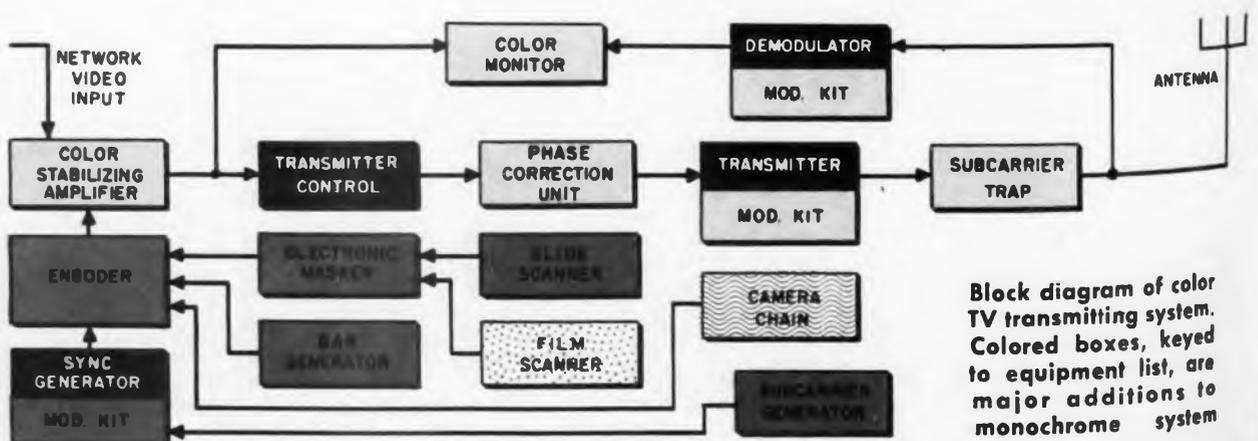
(2) COLOR SYNC S

EQUIPMENT FOR BROADCASTING NETWORK COLOR TV PROGRAMS

COLOR MONITOR: Allows visual monitoring of composite signals. Off-air signal must first pass through high-quality demodulator.

COLOR STABILIZING AMPLIFIER: Corrects color TV signal same as in monochrome systems (removes surges, limits levels, cleans up sync, etc.), but also passes subcarrier burst unaltered and compensates for system nonlinearity.

MODIFICATION KITS: Relatively simple additions to several standard monochrome units which correct characteristics, thereby enabling unit to handle color TV signals. Modification kits include those for demodulator, slot diplexer, calibration monitor, stabilizing amplifier, and visual modulator.



Block diagram of color TV transmitting system. Colored boxes, keyed to equipment list, are major additions to monochrome system

COLOR TV BROADCA

PHASE CORRECTION UNIT: Provides phase or envelope pre-distortion for signal fed to transmitter to correct for phase and linearity distortions in transmitting and receiving systems.

SUBCARRIER TRAP: Transmission line stubs which attenuate lower sideband of chrominance subcarrier.

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TEST EQUIPMENT

BAR AND DOT GENERATOR: Used for adjusting convergence in color monitor. Will provide test signals when equipment is installed for station to originate color signals.

BURST OSCILLATOR: Provides continuous subcarrier signal, and input to signal analyzer. Useful for distant phase intermodulation tests.

OSCILLOGRAPH: Wideband scope has excellent transient response for waveform analysis, and 10 mc bandwidth.

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COLOR TV RECEIVI

ADDER: Amplifying stage which combines red, green or blue signal from matrix network with Y luminance signal, and feeds result to corresponding color output stage.

CHROMA CONTROL: Variable resistor which controls saturation by varying level of chrominance signal fed to demodulators.

CHROMINANCE DEMODULATORS: I and Q demodulators which

PHASE SPLITTER: Stage which takes I and Q signals from demodulators and produces four signals, positive and negative I and Q, and feeds them to matrix.

PURITY CONTROL: Variable resistor which controls dc through purity coil mounted around picture tube neck.

QUADRATURE AMPLIFIER: Stage which shifts chrominance subcarrier 90° and applies resulting signal to Q demodulator.

OR TV

GY, EQUIPMENT & SYSTEMS

With the tempo of color television an ever increasing factor, this handy reference glossary speeds and makes easier a transitional understanding of this subject. Data for the accompanying chart compiled from NTSC records and manufacturers' equipment specifications.

TERMINOLOGY

camera chain produces three color video voltages, red, specially-phased color signals and one luminance signal to synchronize and transmit the colors, a short carrier burst is used. Demodulation process at receiver changes transmission back to visible colors.

COLOR SIGNAL: General term for any signal, excluding luminance or monochrome, which controls chromaticity values.

COMPATIBILITY: Nature of color TV system which permits normal monochrome reception of color transmissions by unaltered monochrome receivers.

COMPOSITE COLOR SIGNAL: Color signal, including blanking, luminance and chrominance information, and sync signals.

CONSTANT LUMINANCE TRANSMISSION: Method of color transmission by which carrier chrominance signal controls chromaticity of produced image without affecting luminance. Luminance is controlled by monochrome signal.

CONVERGENCE: Meeting and crossover of three electron beams in color picture tube at common point on shadow mask.

CROSS-COLOR: Interference in receiver chrominance channel caused by cross-talk from monochrome signal.

FREQUENCY INTERLACE: Also frequency interleave. Carrier chrominance signal frequency chosen so that I and Q sidebands are interwoven with luminance sidebands in same bandwidth in manner which causes no mutual interference.

HUE: Dominant wavelength which distinguishes a color as red, yellow, etc. Often synonymous with term "color," but does not include grey. Varying saturations may have same hue.

I SIGNAL: Fine chrominance transmission primary 0-1.5 mc wide, which combines with Q signal to convey chrominance information. Comprises sidebands produced by modulating subcarrier 57° from reference burst. Called in-phase signal.

LUMINANCE: Standardized brightness.

MIXED HIGHS: Method of reproducing very fine picture detail by transmitting high frequency components as part of luminance signal for achromatic reproduction in color picture.

NTSC: National Television System Committee.

MONOCHROME SIGNAL: Part of TV signal which has major control of luminance of color picture and conventional picture on black-and-white receiver.

PRIMARY COLORS: Red, green and blue, which can be combined to reproduce various hues. No two primaries can be mixed to form third.

PURITY: Physically complete saturation of a hue, free of white and uncontaminated by other colors.

Q SIGNAL: Coarse chrominance transmission primary 0-0.5 mc wide, which combines with I signal to convey chrominance information. Comprises sidebands produced by modulating subcarrier 147° from reference. Called quadrature signal.

SATURATION: Chromatic purity or degree of dilution of a color by white. Pale shades have low saturation.

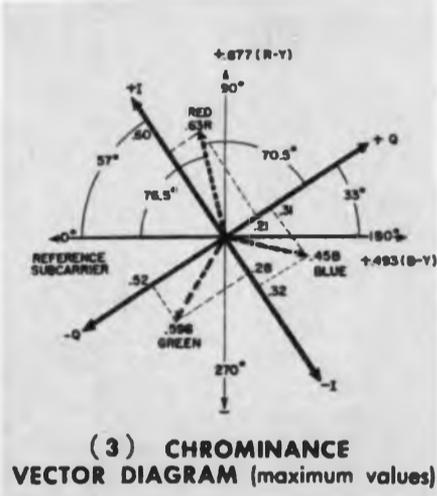
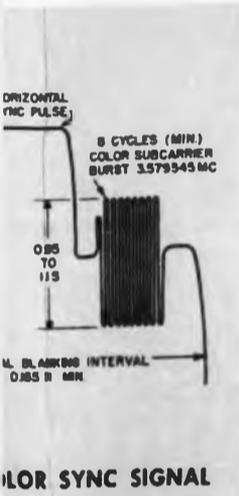
SUBCARRIER: See "Chrominance Subcarrier."

SYNC SIGNAL: See "Color Burst."

TRANSMISSION PRIMARIES: I, Q and Y signals which may be combined to produce picture, chrominance and luminance.

VECTOR DIAGRAM: See Fig. 3. Phase relations of chrominance components.

Y SIGNAL: Luminance transmission primary 1.5-4.2 mc wide, which is equivalent to a monochrome signal. For color pictures it contributes finest details and brightness information.



BROADCAST EQUIPMENT

SIGNAL ANALYZER: Measures phase of subcarrier frequency. Employed with step wave generator in checking phase intermodulation.

STEP WAVE GENERATOR: Generates signal for measuring system amplitude linearity and phase intermodulation. Also, subcarrier may be superimposed on step wave, for highly accurate determination of subcarrier amplitude variations.

VECTOR DISPLAY UNIT: Shows vector diagram of chrominance signal with respect to color burst on CRT. Also useful for adjusting encoders and making phase modulation tests.

SUBCARRIER GENERATOR: Produces chrominance subcarrier frequency for synchronizing locally generated color pictures. Temperature-controlled oscillator is employed for extreme accuracy. Unit operates in conjunction with burst generator.

EQUIPMENT FOR BROADCASTING COLOR FILM ON TV

COLOR FILM EQUIPMENT: Employs flying spot scanner, dichroic mirrors and circuits similar to slide scanner. Projector is either continuous type using revolving mirrors or prisms, or fast pull-down type. 16 mm is most common type.

EQUIPMENT FOR BROADCASTING COLOR TV STUDIO ORIGINATIONS

COLOR CAMERA CHAIN: For live programs originated in the studio or outdoors, two types of camera systems are available. One employs three monochrome pick-up tubes, such as image orthicons or smaller industrial TV types, and a dichroic mirror optical system which splits the light into red, green and blue components. Each component goes to a different pick-up tube, and simultaneous RGB video signals are generated. The other camera chain system employs a single monochrome image orthicon with a rotating color wheel containing RGB filters. The field sequential signals thus generated are fed into a sweep converting device which converts the signals to simultaneous RGB video. It should be noted that an experimental single tricolor pick-up tube not requiring optical color splitting has been demonstrated.

NOTE: The equipment described here is divided into four groups which a station may add in sequence to build a color TV facility. Devices not containing special designs dictated by the novel aspects of the color signal (eq., power supplies, jack panels) are not shown here, but are required.

EQUIPMENT FOR BROADCASTING COLOR SLIDES & TEST SIGNALS

COLOR SLIDE EQUIPMENT: Comprises flying spot scanner with CRT light source, pick-up heads, amplifiers and correction circuits. In scanning process dichroic mirrors divide light passed through 2 x 2 in. slide into red, green and blue.

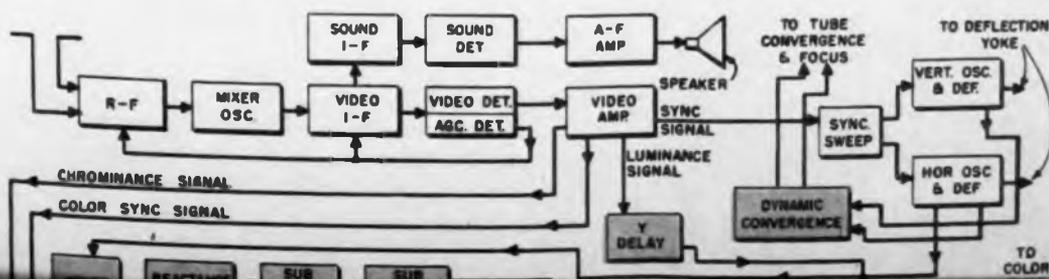
ELECTRONIC MASKER: Unit compensates for photographic color contamination by feeding some complementary color signals into other channels to cancel out undesired effects.

ENCODER: Combines red, green and blue video signals in matrix to produce transmission primaries, I and Q chrominance components and Y luminance component. Composite output is fed to transmitter. Also produces burst for color synchronization. Input may be from bar generator, slide, film or camera chain.

FIELD KEYS: Sequentially switches three unencoded color signals at field rate for display on an oscillograph. Useful for balancing level of RGB channels.

MODIFICATION KIT: Used to alter standard sync generator to operate with color subcarrier burst.

RECEIVING SYSTEM



with color burst. It is phase reference of carrier chrominance signal for modulation or demodulation.

CHROMINANCE COMPONENT: Any component of two-dimensional chrominance vector. I and Q signals add to produce complete chrominance signal in NTSC system.

CHROMINANCE PRIMARY: One of two non-physical transmission primaries, I and Q, which have zero luminance.

CHROMINANCE SUBCARRIER: 3.579545 mc signal modulated by chrominance video signals, whose modulation sidebands are added to monochrome signal to convey chrominance.

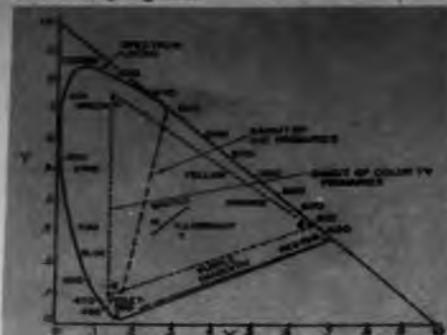
CHROMINANCE VIDEO SIGNALS: Voltage output from red, green or blue section of color TV camera or receiver matrix.

CIE: Committee Internationale d'Eclairage. Also ICI, International Commission of Illumination.

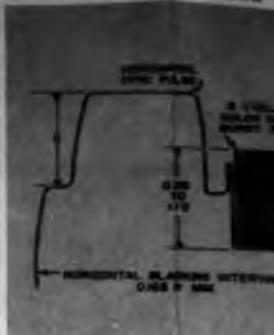
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COLOR BURST: See Fig. 2. Eight sine wave cycles (min.) of chrominance subcarrier added to horizontal blanking pedestal to sync transmitter and receiver color carrier oscillators.

carrier modulated with color information, excluding synchronizing signals.



(1) XYZ CHROMATICITY DIAGRAM



(2) COLOR SYNC

EQUIPMENT FOR BROADCASTING NETWORK COLOR TV PROGRAMS

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PHASE CORRECTION UNIT: Provides phase or envelope pre-distortion for signal fed to transmitter to correct for phase and linearity distortions in transmitting and receiving systems.

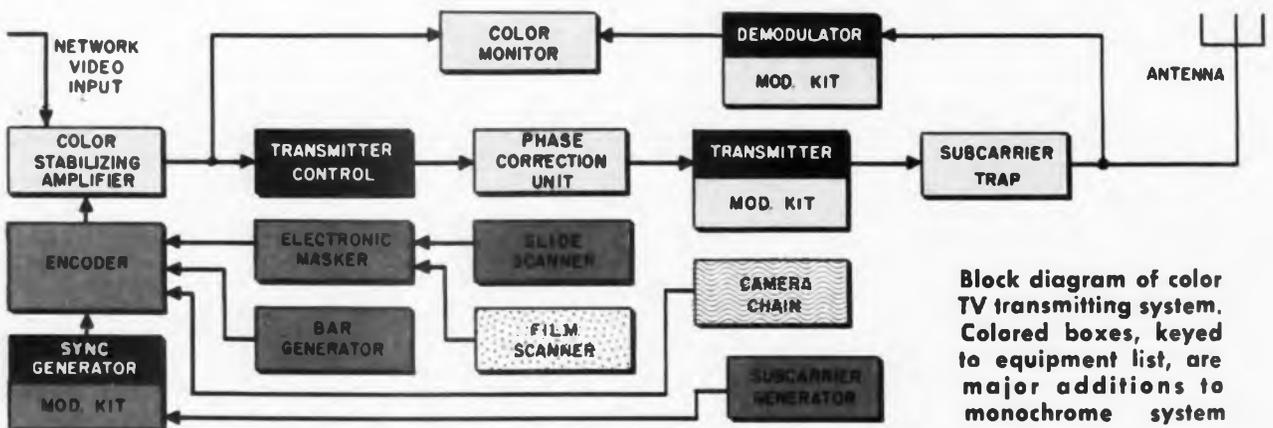
SUBCARRIER TRAP: Transmission line stubs which attenuate lower sideband of chrominance subcarrier.

TEST EQUIPMENT

BAR AND DOT GENERATOR: Used for adjusting convergence in color monitor. Will provide test signals when equipment is installed for station to originate color signals.

BURST OSCILLATOR: Provides continuous subcarrier signal, and input to signal analyzer. Useful for distant phase intermodulation tests.

OSCILLOGRAPH: Wideband scope has excellent transient response for waveform analysis, and 10 mc bandwidth.



Block diagram of color TV transmitting system. Colored boxes, keyed to equipment list, are major additions to monochrome system

ADDER: Amplifying stage which combines red, green or blue signal from matrix network with Y luminance signal, and feeds result to corresponding color output stage.

CHROMA CONTROL: Variable resistor which controls saturation by varying level of chrominance signal fed to demodulators.

CHROMINANCE DEMODULATORS: I and Q demodulators which combine subcarrier reference signals from color sync and carrier chrominance signal from chroma bandpass amplifier circuits to derive I and Q color video voltages.

CHROMINANCE GAIN CONTROLS: Variable resistors in red, green and blue matrix channels which individually adjust primary signal levels.

COLOR DECODER: Section including demodulators and phase splitters which derive red, green and blue signals from composite color video signal.

COLOR KILLER: Circuit between color sync and video sections which cuts off chrominance channel when monochrome signal is being transmitted.

CONVERGENCE CONTROL: Variable resistor in high-voltage section controls voltage applied to three-gun picture tube.

DELAY LINE: Transmission line or similar delay device in luminance channel which delays Y signal to compensate for phase differences in transmission primary channels.

FILTERS: Bandpass devices used to separate luminance and chrominance signals at video frequencies.

MATRIX: Circuit section which combines I, Q and Y signals and transforms them into individual red, green and blue signals which are applied to picture tube grids.

PHASE DETECTOR: Circuit which derives dc correction voltage to maintain subcarrier oscillator in sync with color burst reference.

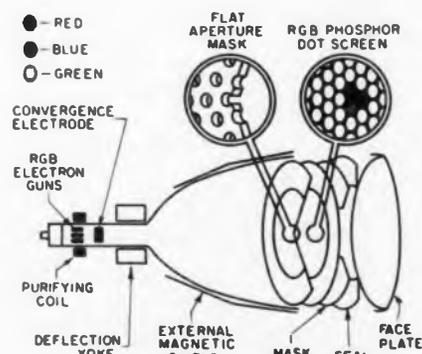
PHASE SPLITTER: Stage which takes I and Q signals from demodulators and produces four signals, positive and negative I and Q, and feeds them to matrix.

PURITY CONTROL: Variable resistor which controls dc through purity coil mounted around picture tube neck.

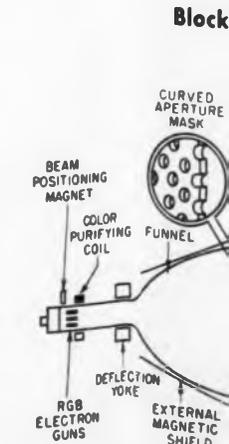
QUADRATURE AMPLIFIER: Stage which shifts chrominance subcarrier 90° and applies resulting signal to Q demodulator.

REACTANCE TUBE: Section which utilizes correction voltage from phase detector to control subcarrier oscillator frequency.

SYNC SECTION: Circuit comprising keyer, burst amplifier, phase detector, reactance tube, subcarrier oscillator and quadrature amplifier.



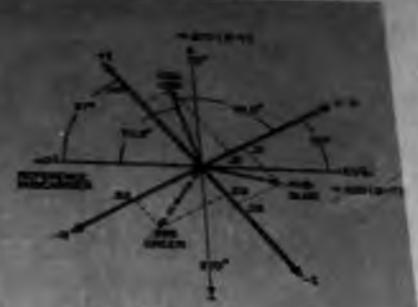
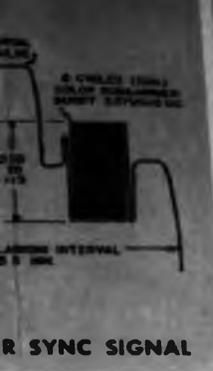
FLAT APERTURE MASK COLOR TUBE: Beams from three electron guns are converged through each of 200,000 holes in aperture (or shadow) mask to strike color phosphor dot triads. Relative positions of guns, holes and phosphor dots determine that each gun always energizes the same color.



CURVED APERTURE MASK COLOR TUBE: Operation is basically same as flat aperture mask. Curved mask permits phosphor dots to be directly on faceplate, thereby increasing efficiency.

COLOR TV RECEIVING

CROSS-COLOR: Interference in receiver chrominance channel caused by cross-talk from monochrome signal.



(3) CHROMINANCE VECTOR DIAGRAM (maximum values)

PRIMARY COLORS: Red, green and blue, which can be combined to reproduce various hues. No two primaries can be mixed to form third.

PURITY: Physically complete saturation of a hue, free of white and uncontaminated by other colors.

Q SIGNAL: Coarse chrominance transmission primary 0-0.5 mc wide, which combines with I signal to convey chrominance information. Comprises sidebands produced by modulating subcarrier 147° from reference. Called quadrature signal.

SATURATION: Chromatic purity or degree of dilution of a color by white. Pale shades have low saturation.

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SYNC SIGNAL: See "Color Burst."

TRANSMISSION PRIMARIES: I, Q and Y signals which may be combined to produce picture chrominance and luminance.

VECTOR DIAGRAM: See Fig. 3. Phase relations of chrominance components.

Y SIGNAL: Luminance transmission primary 1.5-4.2 mc wide, which is equivalent to a monochrome signal. For color pictures it contributes finest details and brightness information.

BCAST EQUIPMENT

SIGNAL ANALYZER: Measures phase of subcarrier frequency. Employed with step wave generator in checking phase intermodulation.

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COLOR FILM EQUIPMENT: Employs flying spot scanner, dichroic mirrors and circuits similar to slide scanner. Projector is either continuous type using revolving mirrors or prisms, or fast pull-down type. 16 mm is most common type.

EQUIPMENT FOR BROADCASTING COLOR TV STUDIO ORIGINATIONS

COLOR CAMERA CHAIN: For live programs originated in the studio or outdoors, two types of camera systems are available. One employs three monochrome pick-up tubes, such as image orthicons or smaller industrial TV types, and a dichroic mirror optical system which splits the light into red, green and blue components. Each component goes to a different pick-up tube, and simultaneous RGB video signals are generated. The other camera chain system employs a single monochrome image orthicon with a rotating color wheel containing RGB filters. The field sequential signals thus generated are fed into a sweep converting device which converts the signals to simultaneous RGB video. It should be noted that an experimental single tricolor pick-up tube not requiring optical color splitting has been demonstrated.

NOTE: The equipment described here is divided into four groups which a station may add in sequence to build a color TV facility. Devices not containing special designs dictated by the novel aspects of the color signal (e.g., power supplies, jock panels) are not shown here, but are required.

EQUIPMENT FOR BROADCASTING COLOR SLIDES & TEST SIGNALS

COLOR SLIDE EQUIPMENT: Comprises flying spot scanner with CRT light source, pick-up heads, amplifiers and correction circuits. In scanning process dichroic mirrors divide light passed through 2 x 2 in. slide into red, green and blue.

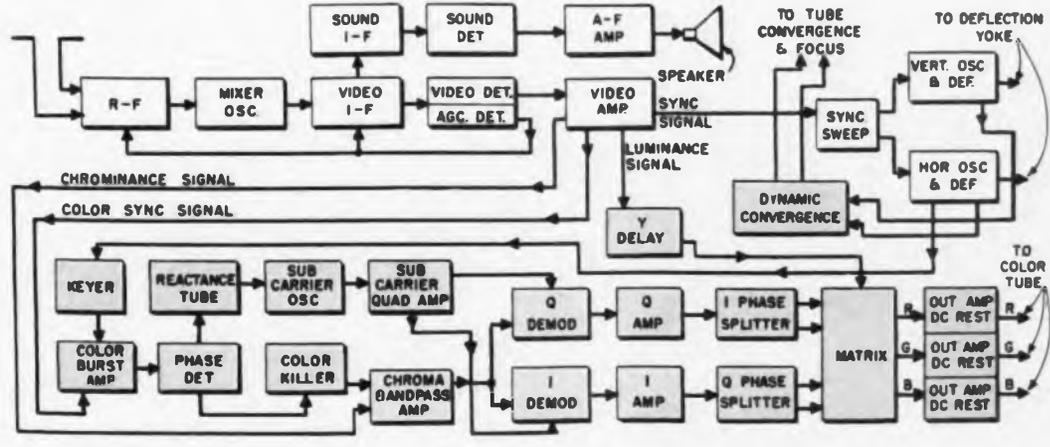
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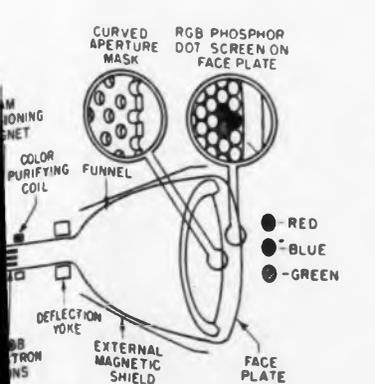
FIELD KEYS: Sequentially switches three unencoded color signals at field rate for display on an oscillograph. Useful for balancing level of RGB channels.

MODIFICATION KIT: Used to alter standard sync generator to operate with color subcarrier burst.

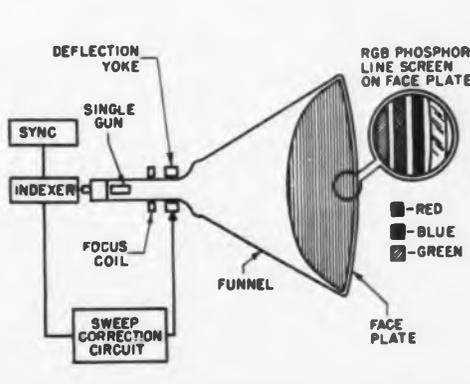
CEIVING SYSTEM



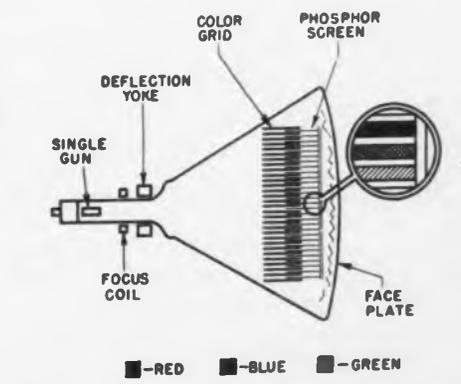
Block diagram of color TV receiver. Colored boxes are major additions to standard monochrome receiver



CURVED APERTURE MASK COLOR TUBE: This is basically same as for flat mask type. Mask permits phosphor dots to be placed on faceplate, thereby eliminating separate plate.



INDEX COLOR TUBE: This experimental type employs a single gun scanning vertical color phosphor lines. One color line has secondary emission characteristic which causes beam current to change slightly when energized. Circuit indexes this change, and corrects beam sweep to strike correct line.



POST DEFLECTION COLOR TUBE: Single electron beam is deflected by grid near screen as it scans, causing beam to strike desired horizontal color phosphor lines. By timing polarity switching sequence properly, color synchronization is achieved.

Anyway you look at it...

★ Excellent color fidelity. Special Masking Amplifier plus overall quality of system results in superlative reproduction.

★ Continuous film movement. No intermittent action. Optical immobilizer eliminates claws and shutter.

★ Film may be run forward or backward. Stopped at any point. Speed may be varied.

★ Sensitivity of system faithfully reproduces all tonal gradations through gamma-corrected amplifier.

★ No shading adjustments necessary. Picture free from edge flare and shading. Completely automatic from remote panel.

★ Entirely new standard of operating economy for both color and monochrome operation.



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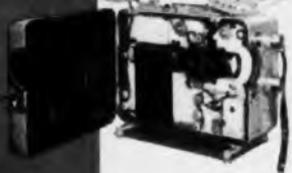
YOU'RE YEARS AHEAD with the DUMONT COLOR MULTI-SCANNER



16 mm. COLOR FILM



COLOR TRANSPARENCIES



16 mm. FILM
MONOCHROME



MONOCHROME
TRANSPARENCIES



MONOCHROME OPAQUES

... FOR COLOR

Here is the one system that puts you years ahead — whether for investment or value. The Du Mont Color Multi-Scanner permits you to be ready for the day you start color broadcasting, and at the same time provides a means of monochrome film, slide and opaque pickup surpassing all other systems in quality of performance, operating economies and dependability. Yes, it's ... anyway you look at it ... you're years ahead with the Du Mont Color Multi-Scanner — the only continuous-reel scanner now being delivered commercially!

Permits the average television station to prepare for color now, without the large investment required in specialized color equipment. The cost of the system may be amortized over both current monochrome broadcasting operations and future color operations.

The Color Multi-Scanner eliminates registration and other technical problems inherent in triple pick-up tube camera designs. The single scanning tube along with the unparalleled sensitivity of the Du Mont Multiplier Phototube results in a color signal source far surpassing that of other systems.

... FOR MONOCHROME

The Color Multi-Scanner can go right to work on monochrome transmission. Utilization of the same equipment provides fine quality black and white reproduction. At the flick of a switch—your choice of color or monochrome—it's as simple as that!

The Color Multi-Scanner is basically the same as the famous Monochrome Multi-Scanner with the exception of a light-splitting mirror system and additional amplified channel amplifiers. All operational advantages and economies have been retained.

... AND OTHER DUMONT COLOR EQUIPMENT

Incorporated in the Du Mont Color Multi-Scanner and available as a separate unit for improving other color signal sources, the Du Mont Color Mixing Amplifier adds new realism to color signals. It compensates for the real-life deficiencies and adds new qualities to any color setup.

Get details on the complete line of Du Mont color transmitting accessories. All systems in color or monochrome ... it's Du Mont to be first with the Best!



Once again
we're taking television
out of the
knothole class...

Dr. Allen B. Du Mont said in the early days of television, "Who wants to look at the world through a knothole?"

It was Dr. Du Mont's vision that took television *out* of the knothole class.

Even before the first set was produced . . . he was planning *big* screens. The Allen B. Du Mont Laboratories made large-screen television from their very first set!

Now, once again, Du Mont has taken television out of the knothole class . . . This time it's *color* television! Long before the public became "color conscious", Du Mont research was working to bring you *big screen* color television.

Du Mont has consistently refused to settle for small screens. Now, Du Mont has pioneered in the development of large-screen color television with the introduction of the *first practical big-picture color tube* . . . hastening the day when color sets with popular-sized pictures will be available at a reasonable price.

Proof again that it is to Du Mont that the public and the industry alike can look for the vision so necessary to progress in the electronic age . . .

VISION IS THE **DU MONT**[®] DIMENSION

First with the Finest in Television
... Past, Present and Future!

Allen B. Du Mont Laboratories, Inc. Home Office: 760 Bloomfield Avenue, Clifton, New Jersey

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Franc
Ralph
Elect
Maj
Capt
1st Lt
J. L.
E. H.
Com
E. L.
1st Lt
Eliza
James
Aerie
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ELECTRONIC PROCUREMENT-PRODUCTION DIRECTORY

TELE TECH's 1954-1955 exclusive military procurement-production organization and directory of key personnel in Air Force, Navy and Army agencies.

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AIR MATERIEL COMMAND



Wright Patterson AF Base Dayton Ohio

DIRECTORATE OF PROCUREMENT & PRODUCTION

Responsible for all AF Procurement and Production other than research and development

DIRECTOR Maj Gen D H Baker MCP 27119
DEPUTY DIR Brig Gen H S Jones MCP 27119
SMALL BUSINESS M L Johnson MCP-5 23232

DEPUTY DIR OF PROCUREMENT

DIRECTOR Brig Gen W T Thurman MCFP 22200
ASSIST DEPUTY Col L E Fulton MCP 27119
CONTRACT MANAGEMENT BRANCH
Col H J Mattia MCPPC 25213

DEPUTY DIR OF PRODUCTION

DIRECTOR Brig Gen C H Mitchell MCPR 27214
ASSIST DEPUTY Col L H Garrett MCPR-1 27214

AERONAUTICAL EQUIP DIV

CHIEF Col E H Wilson MCPE 24101
DEPUTY W B Gould MCPE 22209

COMMUNICATIONS & PHOTOGRAPHIC BR

CHIEF Lt Col R E Hogan MCPEC 33118
DEPUTY K E Springer 33118
PROCUREMENT ASSIST E R Boggs 20222
PRODUCTION ASSIST Wayne Hardy 31367
24169

Communications & Navigation Section

MCPEC-C 26227
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TYPE	DESCRIPTION	MAX. RATINGS			TYPICAL CHARACTERISTICS								
		Vibration Output mVac	Bulb Temp. °C	Plate Volts	Heater		Plate		Grid Volts or R _k	Screen		Amp. Factor	Mut. Cond.
					Volts	Ma.	Volts	Ma.		Volts	Ma.		
CK5702WA	RF Amplifier Pentode	50	265	200	6.3	200	120	7.5	200 ohms	120	2.6	—	5000
CK5703WA	High Frequency Triode	10	265	275	6.3	200	120	9.4	220 ohms	—	—	25.5	5000
CK5744WA	High Mu Triode	25	265	275	6.3	200	250	4.2	500 ohms	—	—	70	4000
CK5783WA	Voltage Reference	50	175	—	Operating voltage approximately 86 volts between 1.5 and 3.5 ma.								
CK5784WA	RF Mixer Pentode	100	265	200	6.3	200	120	5.2	-2	120	3.5	—	3200
CK5787WA	Voltage Regulator	—	220	—	Operating voltage approximately 100 volts between 1 and 25 ma.								
CK5829WA	Dual Diode	—	220	360*	6.3	150			Max. I _o = 5.5 ma. per plate				
CK6021	Medium Mu Dual Triode	50	250	165	6.3	300	100	6.5	150 ohms	—	—	35	5400
CK6111	Medium Mu Dual Triode	50	250	165	6.3	300	100	8.5	220 ohms	—	—	20	5000
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CK6152	Low Mu Triode	25	265	250	6.3	200	100	10.0	270 ohms	—	—	17.5	5100
CK6247	Low Microphonic Triode	1.0	250	275	6.3	200	250	4.2	500 ohms	—	—	60	2650

*Peak inverse voltage

Note: All dual section tube ratings (except heater) are for each section.



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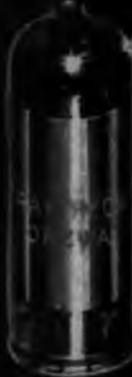
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ASST J C Young 741
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Storage Tube
Magnetic Deflection Type
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QK436

Klystron
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Power output—75 mw



RK3B24W

Half Wave-High Vac. Diode Rectifier
Max. Peak Inverse Voltage—20,000
Max. Peak Current—300 ma.



QK446

Traveling Wave Oscillator
Frequency Range—2,000 to 4,000
Voltage Tunable
Power output—0.1 to 1.0 watts



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See Page 4 of this directory for more detailed listing of Raytheon Magnetrons and Klystrons.

QK329

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RK2J51

Magnetron
Tunable—8500 to 9600 mc
Peak pulse power—45 kw



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