

FEBRUARY 21, 1958

# electronics

business edition

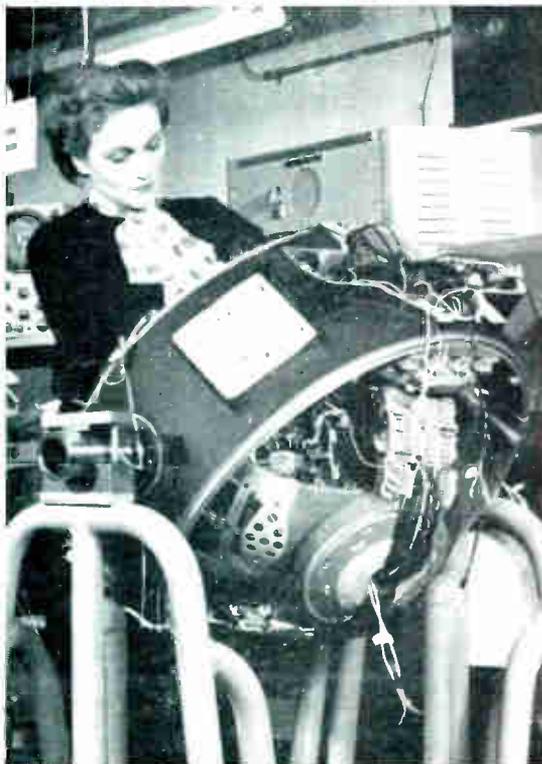
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## Bomber Systems Shun Radiation

Stellar-inertial systems guide

and drop bombs in B-58, WS-110A... p 15



## Looking Inside Missile 'Brain'

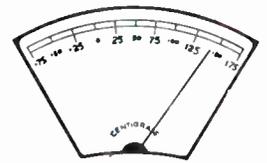
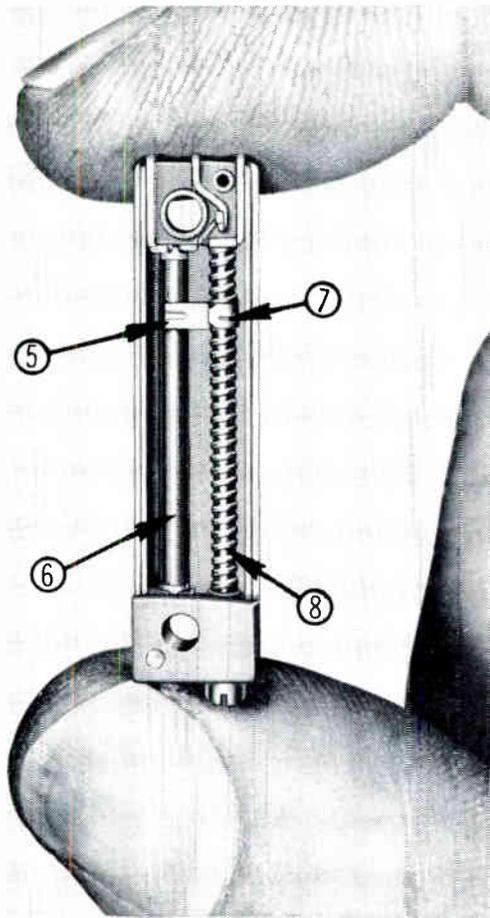
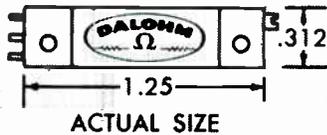
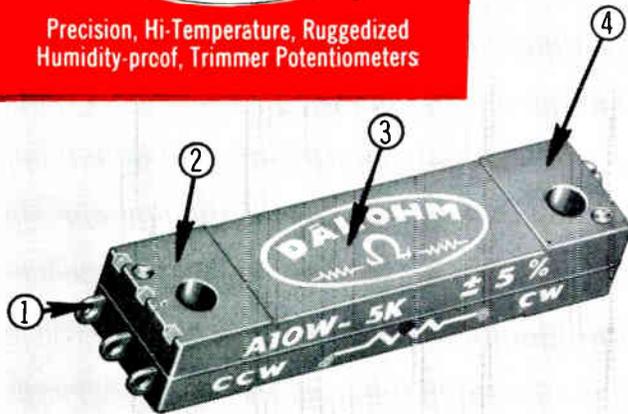
You take a guided tour through an

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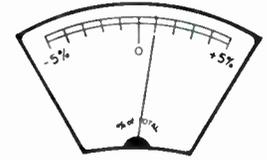
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**HI-RESISTANCE**  
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# NEW 1958 A10-W TRIMMER ASSURES 100% RELIABILITY

1. Three precious metal, non-corrosive terminals are color coded for accuracy. New size permits easy installation in small space. Available in standard type (illustrated above), printed circuit type with 90° terminals and two types with wire leads.
2. Mounting pads, an integral part of case, provide secure mounting base on uneven surface. Mounted with two #2-56 screw holes for either stacked or multiple arrangements.
3. Case and bonding agents are high temperature materials that withstand maximum operating temperature with ease.
4. New design of case provides complete dependable sealing at all perimeters.
5. Excellent resolution is achieved with revised slider contact, which also assures good resistance contact at all times.
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7. Trimmer adjustment assembly, slider and excursion screw, are specially plated to allow smooth operation. This also reduces chances of small particles of metal separating due to mechanical wear and short circuiting the unit internally.
8. Trimmer adjustment screw, which can be adjusted throughout a 25 turn range, is completely insulated from circuit. Unique safety clutch prevents internal damage from over-exursion during adjustment.

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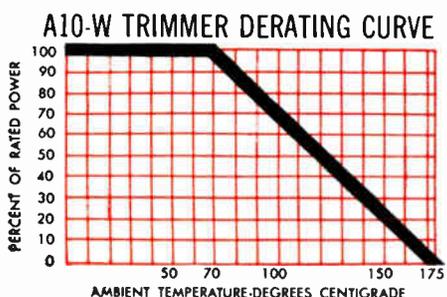
- Powered at 1 watt, derated to 0 @ 175° C.
- Standard resistance range: 10 ohms to 100,000 ohms, with forty standard selections. • Standard tolerance: ± 5%.
- Special resistance values available, also lower resistance to ± 1%.
- End resistance: Not greater than 4% total maximum. • Temperature coefficient of wire: 0.00002/° C.
- Resolution: .092% to .910%. • Sub-miniature size: .220 X .312 X 1.250 inches.
- Case unit air evacuated and replaced with special silicone compound allows added protection against failure due to heat, humidity and vibration.

Exceeds trimmer potentiometer specifications as required by MIL. SPECS.: JAN-R-19, MIL. STD.-202, MIL-E-5272A and MIL-R-12934.

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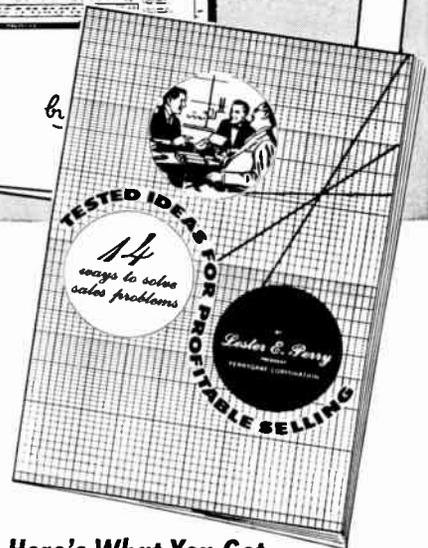
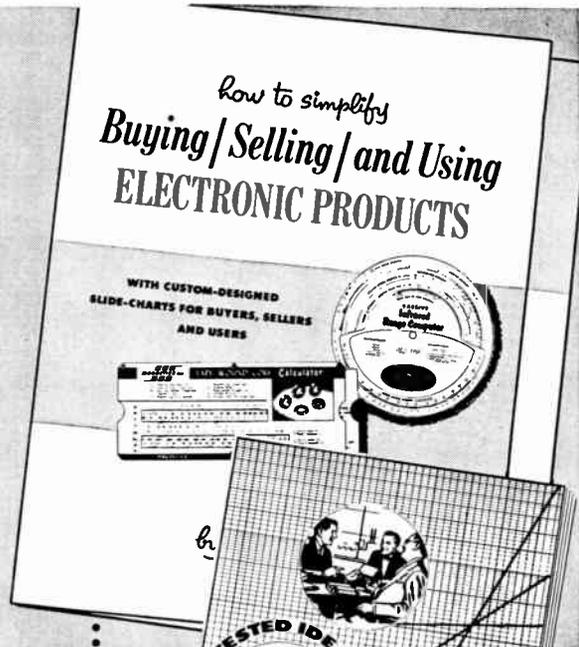
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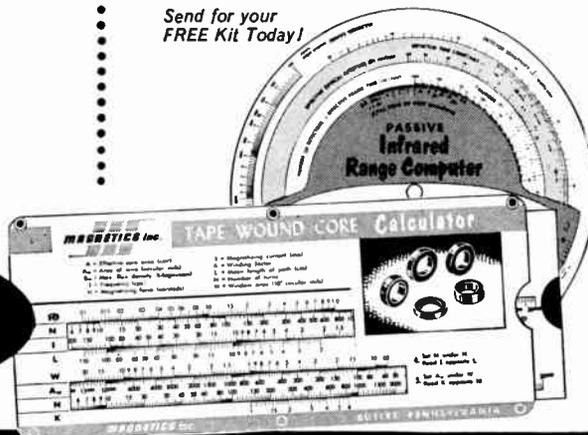
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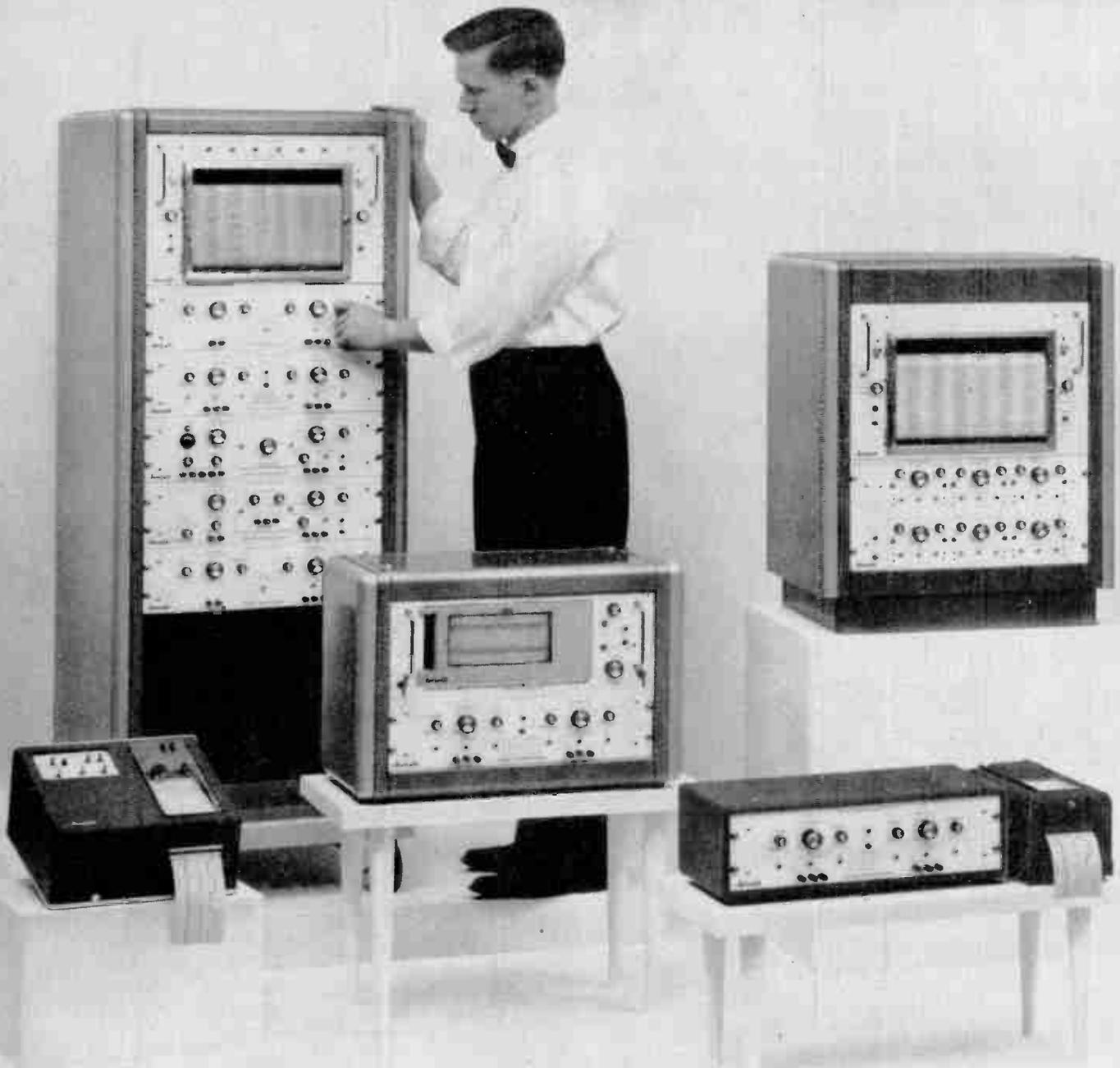
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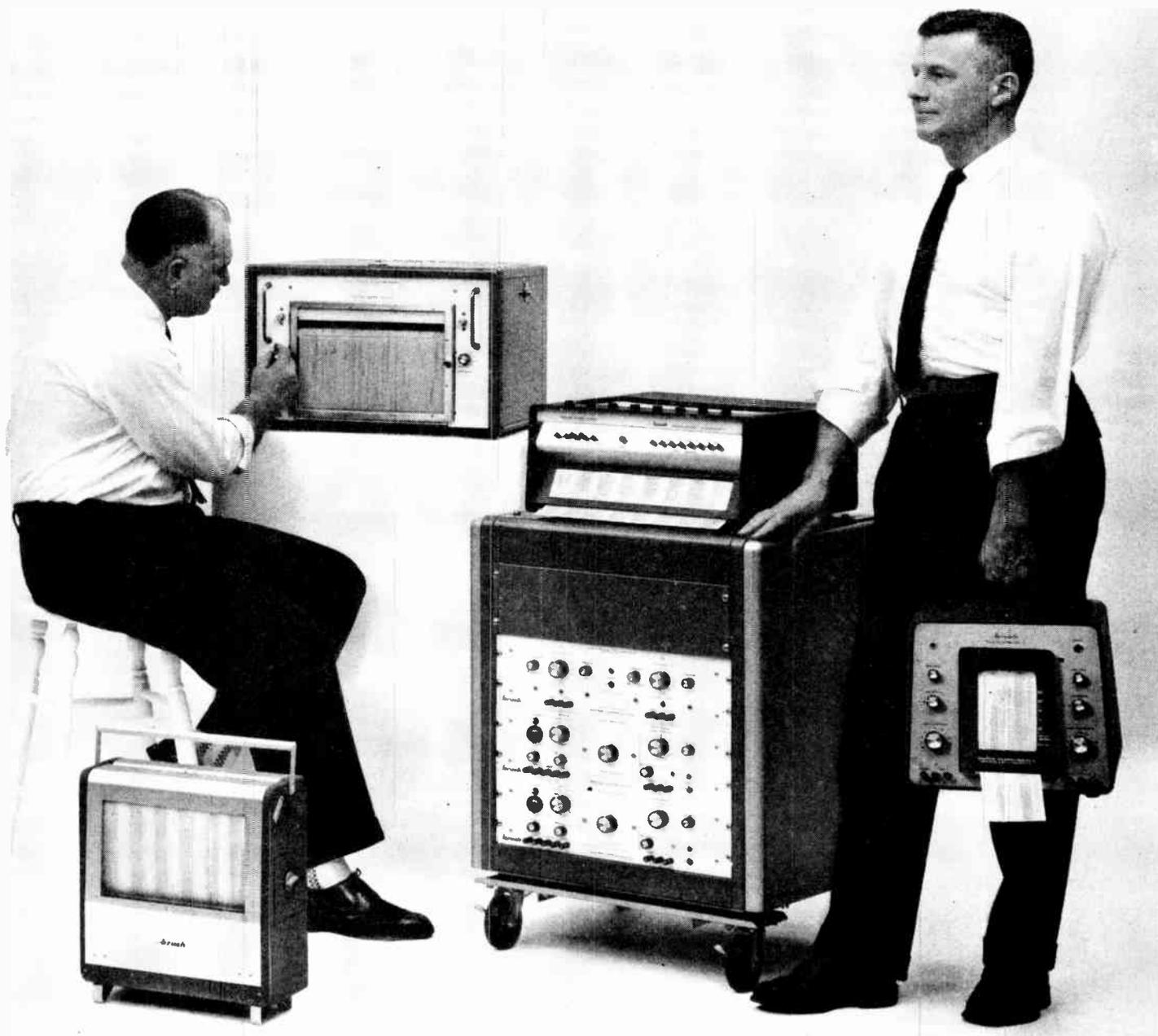
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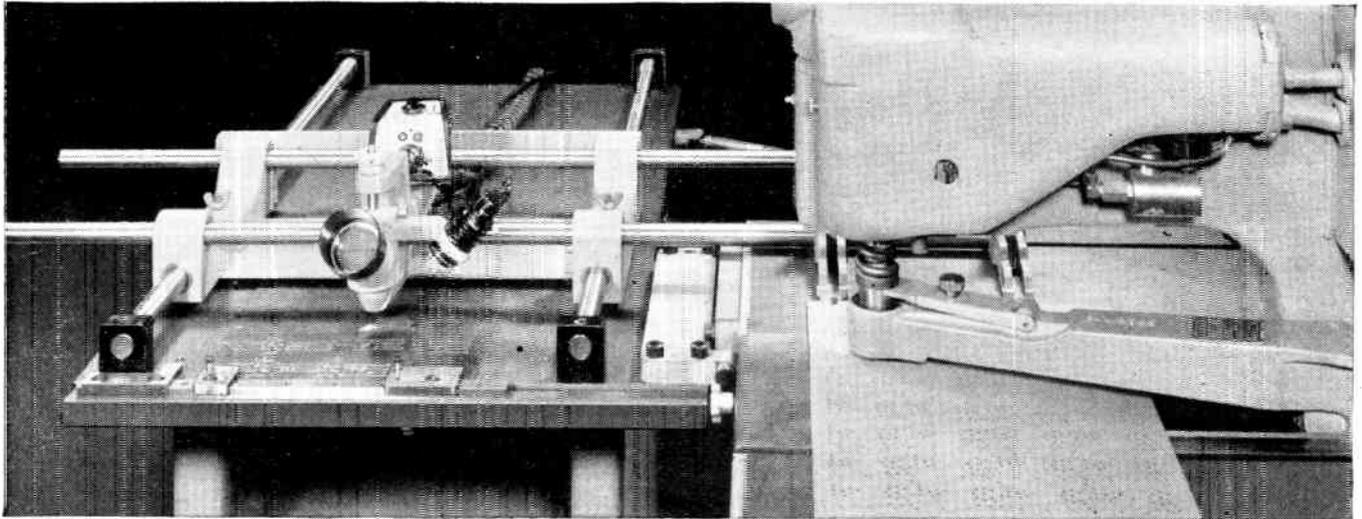
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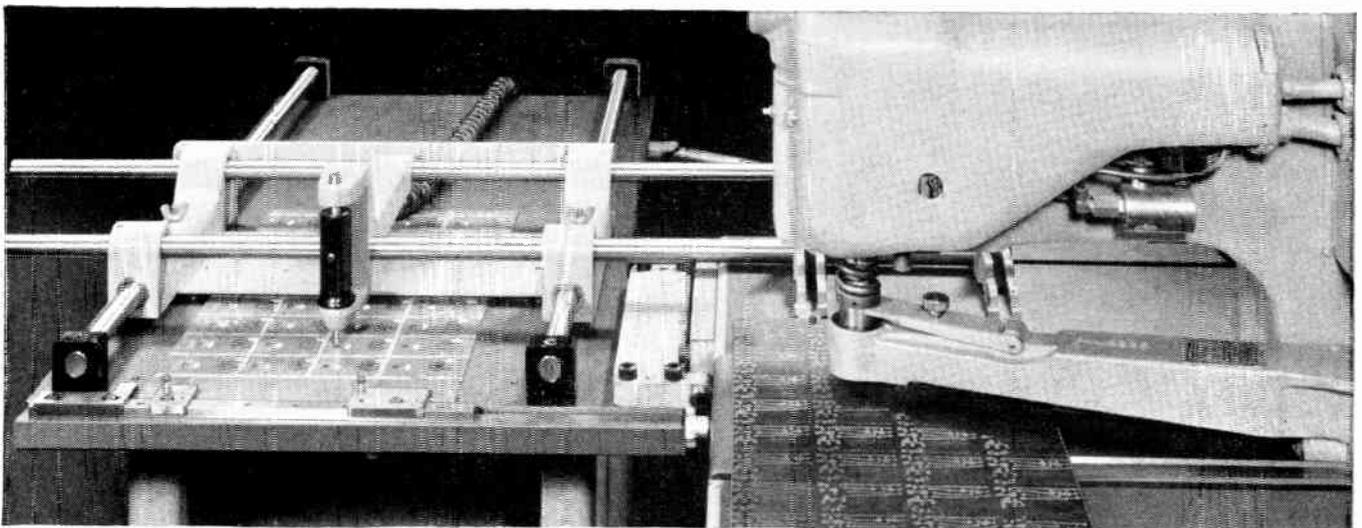
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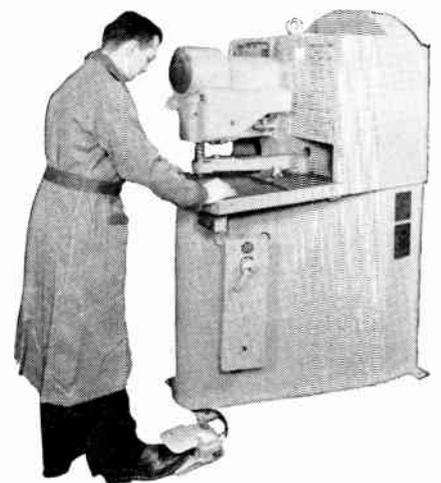


## The DUPL-O-SCOPE

Firms punching and notching printed circuit boards — or any sheets up to  $\frac{1}{4}$ " mild steel — know how profitable it is with a Strippit Fabricator-Duplicator. Now, it's even faster with the new Dupl-O-Scope, which eliminates the template drilling and layout step!

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# Street Goes Scientific

**Six hundred Wall Street security analysts due to attend course on electronics fundamentals**

WALL STREET'S going to school—to learn about electronics.

This newest development has an interesting angle. For years Wall Street has been advising electronics execs to learn more about finance. Now the advice is taking hold of the givers.

In any case, everyone figures to gain.

The street's security analysts have analyzed their own deficiencies and see a need to broaden their knowledge of the science of electronics.

Six hundred analysts are due to take a course in fundamentals of electronics. It's to be given by Daystrom executives, starting in April, under auspices of New York Society of Security Analysts.

First half of the eight hour course will deal with the nature of electricity, electrons and electronic devices. Last half will consider computers, industrial controls, communications and missile guidance systems and research developments.

Interest in the course is so strong that it will have to be repeated several times in New York City to accommodate all those who wish to attend. In addition, it will be given on the West Coast and probably in several other financial centers.

Significance of this analyst interest is that once again it shows the strong interest of the investment community in the electronics industry.

An indirect result foreseen is that industry execs who expect to address analysts' luncheons in the future had better get set for sharper questions—the boys will be better-informed.

# Pru Leads Lenders

LEADING INSURANCE INDUSTRY lender of long term loans to electronics firms is the Prudential Company, one recent tabulation shows.

Covering the last six months of 1957, the tabulation was made by the Investment Dealers' Digest.

The New Jersey based insurance firm participated in advances of \$87 million to five electronic companies in the last half of '57.

Total long term loans by insurance companies to our industry in the same period amounted to about \$121 million. Terms of the loans ranged from 5 to 15 years.

The Pru, with one other firm, advanced \$60 million to AMI Pinspotters. By itself, Prudential loaned \$20 million to Perkin-Elmer, \$5 million to Tung-Sol Electric, \$1.6 million to Aircraft Radio and \$1 million to Aeroquip Corp.

Second most active insurance firm in electronics lending was Massachusetts Mutual Life. It loaned \$20 million to Cook Electric, shared in a \$5 million loan to Rome Cable and loaned \$2.5 million to Monroe Calculating.

# SHARES and PRICES

TRANSDUCER MANUFACTURING is a fast-growing area of the electronics business which is expecting great gains in coming years because of higher military budgets and increased emphasis being placed on missiles.

These electromechanical de-

vices translate force into an electrical current to operate electronic systems. They sense and measure motion or force, such as pressure, acceleration, displacement or vibration so that electronic systems can measure data, control processes, record information, or actuate mechanisms.

They are widely used in the

airframe, missile and rocket industries. They are also used in the nuclear energy field for atomic research and for monitoring reactors. They are employed in automation industries for data-handling input devices and for process control systems, and in the medical field for blood pressure and heart research activities.

Typical Transducer Manufacture <sup>1</sup>	Recent Price	Indicated Dividend Rate	Percent Yield	Earned Per Common Share		Traded	1957-1958 Price Range
				1957	(Period)		
Borg-Warner.....	28 <sup>5</sup> / <sub>8</sub>	2.00	7.0	2.49	(9 mos)	2.49	NYSE 25 <sup>7</sup> / <sub>8</sub> -46
Cons. Electrodynamics.....	29 <sup>1</sup> / <sub>8</sub>	0.40	1.4	0.55	(9 mos)	0.91	NYSE 25 <sup>1</sup> / <sub>8</sub> -54 <sup>3</sup> / <sub>8</sub>
Du Mont Labs.....	4 <sup>3</sup> / <sub>8</sub>	.....	.....	d-0.45	(6 mos)	d-0.23	NYSE 3 - 6 <sup>1</sup> / <sub>8</sub>
Fairchild Camera.....	28 <sup>1</sup> / <sub>8</sub>	0.50	1.8	1.00	(9 mos)	1.99	ASE 16 -28 <sup>1</sup> / <sub>8</sub>
Giannini & Co.....	14 <sup>1</sup> / <sub>4</sub> <sup>1</sup>	.....	.....	0.58	(6 mos)	1.82 <sup>2</sup>	OTC .....
Manning, Maxwell & Moore....	26	1.40	5.4	2.94	(9 mos)	2.38	NYSE 20 -37 <sup>3</sup> / <sub>8</sub>
Statham Instruments.....	13 <sup>1</sup>	.....	.....	0.30	(6 mos) <sup>3</sup>	NA	OTC .....
Van Norman Industries.....	7 <sup>3</sup> / <sub>4</sub>	.....	.....	d-0.01	(9 mos)	0.72	NYSE 4 <sup>5</sup> / <sub>8</sub> -13 <sup>1</sup> / <sub>2</sub>

<sup>1</sup> bid

<sup>2</sup> 28 weeks

<sup>3</sup> ended Nov. 30

# MERGERS, ACQUISITIONS and FINANCE

• **Temco Aircraft**, Dallas, Tex., agrees to acquire 80 percent of the stock of **Fenske, Fedrick and Miller** of Los Angeles through a stock exchange. Selling shareholders will receive 22,228 Temco shares, currently being traded at 11½, for 26,134 shares of FF&M. Present FF&M officers will be retained and present facilities will continue to be used.

FF&M holds patents for automatic air and sea traffic control systems, automatic missile test equipment, telemetering calibration instruments and missile guidance components. It also has exclusive patent rights for an automatic multichannel plotter-display system.

• **Eric Resistor**, Eric, Pa., acquires the assets of **Hupp Instrumentation**, Los Angeles, Calif., through a cash purchase. Terms of purchase were not revealed. Ross F. Hupp, founder of the instrument firm, has joined the

Eric organization. Hupp's manufacturing facilities will be combined with **Erie's Electro-Mechanical Division** in Hawthorne, Calif. Hupp's primary products are electronic timers and counters. An expansion of its line is planned to meet the needs of missile systems and industries moving into automatic controls.

• **Vertol Aircraft**, Philadelphia, Pa., plans to purchase **Allied Research Associates**, a Boston research firm, and its affiliate **A.R.A. Productions**. Proposed price is \$750,000 plus 32,500 shares of Vertol stock. Vertol was recently quoted at 17¾ bid and 19¾ asked on over-the-counter markets. Allied does basic research in aeronautical and physical sciences. Present contracts include work in aeronautics, astronautics, physics, chemistry, electronics and meteorology.

• **Servomechanisms**, Hawthorne, Calif., arranges with a syndicate of

three banks for a revolving credit of up to \$7.5 million which will extend to Dec. 31, 1959. Although **Servomechanisms** has several companies under consideration for acquisition, it reports that no acquisitions are imminent as none have reached the decisive stage.

• **Dictaphone Corp.** of New York City completes private placement through **Merrill, Lynch, Pierce, Fenner & Beane** of an issue of \$4 million sinking fund notes due Dec. 1, 1977.

• **Cornell-Dubilier Electric**, S. Plainfield, N. J., drops its quarterly dividend payment to 20 cents per share. In previous quarters the company paid dividends of 30 cents per share.

• **Dresser Industries**, Dallas, Tex., increases its regular quarterly dividend payment from 45 to 50 cents per share and plans stock on a \$2.00 yearly rate.



## FIGURES OF THE WEEK

### RECEIVER PRODUCTION

(Source: EIA)	Jan. 31, '58	Jan. 24, '58	Feb. 1, '57
Television sets, total	119,748	103,444	101,932
Radio sets, total	245,861	232,845	302,356
Auto sets	79,890	80,036	127,822

### STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Feb. 5, '58	Jan. 29, '58	Feb. 6, '57
Radio-tv & electronics	46.90	46.14	46.24
Radio broadcasters	59.66	59.08	61.71

## FIGURES OF THE YEAR

	1957	1956	Percent Change
Receiving tube sales	456,424,000	464,186,000	- 1.7
Transistor production	28,738,000	12,840,000	+123.8
Cathode-ray tube sales	9,721,008	10,987,021	- 11.5
Television set production	6,399,345	7,387,029	- 13.4
Radio set production	15,427,738	13,981,800	+ 10.3

## LATEST MONTHLY FIGURES

### EMPLOYMENT AND PAYROLLS

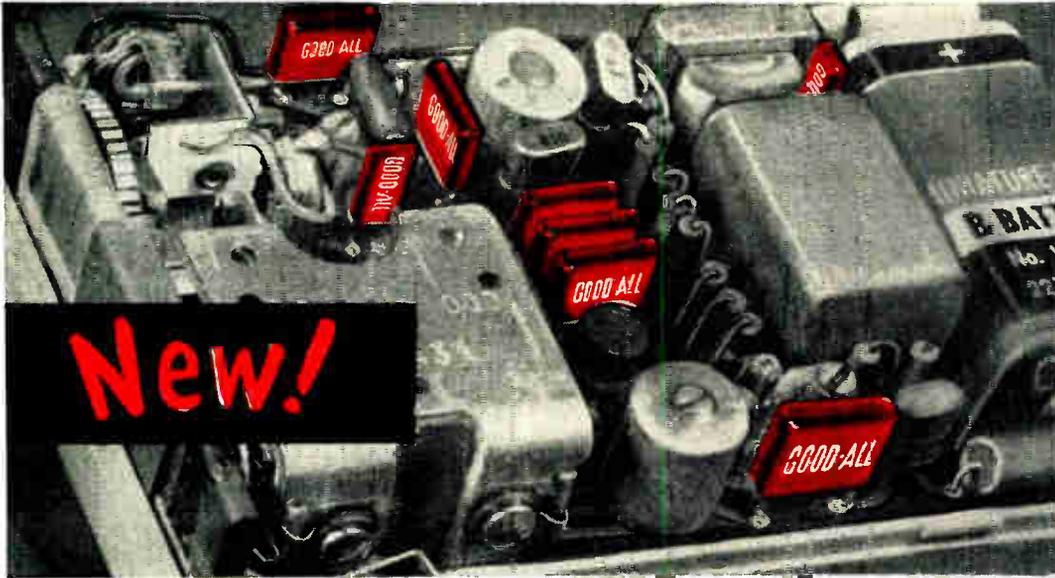
(Source: Bur. Labor Statistics)	Oct. '57	Sept. '57	Oct. '56
Prod. workers, comm. equip.	412,000-p	417,900-r	413,100
Av. wkly. earnings, comm.	\$76.44 -p	\$78.40 -r	\$78.12
Av. wkly. earnings, radio	\$74.40 -p	\$76.02 -r	\$75.70
Av. wkly. hours, comm. ...	39.0 -p	40.0 -r	40.9
Av. wkly. hours, radio ...	39.0 -p	39.8 -r	40.7

### TRANSISTOR SALES

(Source: EIA)	Dec. '57	Nov. '57	Dec. '56
Unit sales	2,773,000	3,578,700	1,608,000
Value	\$6,619,000	\$6,989,000	\$4,691,000

### TUBE SALES

(Source: EIA)	Dec. '57	Nov. '57	Dec. '56
Receiving tubes, units	27,736,000	39,950,000	34,340,000
Receiving tubes, value	\$24,881,000	\$33,166,000	\$29,111,000
Picture tubes, units	644,026	772,801	795,476
Picture tubes, value	\$12,971,487	\$15,138,438	\$13,423,157



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LINE"

**SPACE SAVING CAPACITOR**

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**ECONOMICAL** ... Competitive in price with ceramic discs in the capacity range of 0.1 MFD and above.

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(FOR 50 VDC RATING)

CAP. (MFD.)	A	B	D	E	CAP. (MFD.)	A	B	D	E
.01	.310	.800	.187	.187	.1	.650	.850	.375	.225
.022	.359	.800	.187	.187	.15	.671	.900	.375	.260
.033	.531	.650	.312	.171	.22	.718	.900	.375	.296
.047	.531	.700	.312	.203	.33	.812	.950	.500	.312
.068	.531	.781	.312	.218					

**SPECIFICATIONS**

**Insulation Resistance**—Greater than 75,000 meg-ohms when measured at 100 volts D.C. at 25° C for a maximum of 2 minutes.

**Capacity Tolerance**—Standard tolerance is 20%.

**Winding Construction**—Extended foil (non-inductive) MYLAR\* Dielectric.

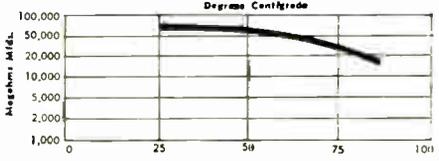
**Lead Variations**—formed or straight leads.

**Dissipatin Factor**—Less than 1% at 1,000 cycles per second at 25° C.

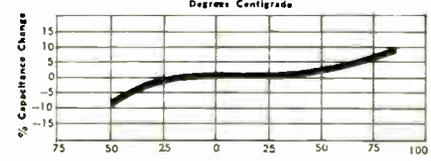
**Dielectric Strength**—100 volts D.C. for 1 to 5 seconds thru a minimum current limiting resistance of 20 ohms per volt.

**Temperature Range**—May be operated at full rated voltage to 85° C. Derate to 50% when operating at 125° C.

**Insulation Resistance vs. Temperature**  
Degrees Centigrade

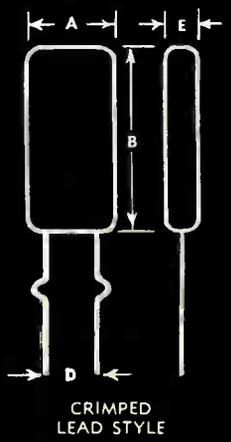


**Capacitance Change vs. Temperature**  
Degrees Centigrade



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## WASHINGTON OUTLOOK

It is now becoming clear that the Pentagon's new Advanced Research Projects Agency will farm out to the individual military services procurement responsibilities for most if not all of the development projects in the anti-ICBM and space fields. The Air Force, for instance, will continue to administer contracts for the ballistic missile detection program and the Army for the Nike-Zeus antimissile missile project.

ARPA has been set up "for the direction and performance of certain advanced research and development projects." But since it will pull the purse strings on anti-ICBM and space development, it will possess more power than any other Defense Dept. coordinating office—more power than the Asst. Secy. of Defense for Research & Engineering has over electronics, or the Pentagon's Director of Guided Missiles has over missile systems.

ARPA has a budget of \$10 million over the next four months and has a \$340 million fund now pending before Congress for fiscal 1959 starting July 1. The first prime contract on the ballistic missile detection system, however, is expected to total \$329 million alone so ARPA will also have considerable authority over funds appropriated directly to the services. The contract, now being processed, goes to RCA as the prime, and to Western Electric, General Electric and several other electronics firms as the major subcontractors.

Roy W. Johnson, a vice president of General Electric, has been named as \$18,000-a-year director of ARPA. During 1951-57, Johnson was in charge of some of GE electronics business. He is retiring from the company after a 28-year career, mostly in merchandising and advertising for consumer appliances.

- The creation of ARPA does not resolve the debate in Washington whether the Pentagon or a civilian agency should pull the strings on the overall program to explore space. ARPA does have a mandate to direct the development of space weapons indefinitely but it will coordinate general space science research only for the next year.

At least two Congressional committees and a Presidential study group headed by James Killian, the White House Special Assistant for Science and Technology, are now working on plans for future assignment of authority over general space science research. To observers it seems inevitable that a civilian agency will eventually be given control.

- Growing evidence of the electronics industry's dominant role in the missile program keeps piling up. Here are the latest Pentagon disclosures of electronic missile projects:

Sperry Gyroscope is working on "all critical R&D components" for the Army's Sergeant surface-to-surface missile; Texas Instruments and W. L. Maxson on guidance for the Navy's new Corvus air-to-surface missile; Ramo-Wooldridge is developing the electronic systems for the Air Force's surface-launched Bull Goose and air-launched Green Quail diversionary or electronic countermeasures missiles; GM's AC Sparkplug div. on inertial guidance for the Air Force's Mace tactical missile, successor to Matador; RCA, Texas Instruments and Arma on the guidance for the Air Force's Rascal, which is an air-to-ground missile.

## GENERAL TRANSISTOR'S PRODUCTION

# Breakthru

PNP	NPN	NPN
2N 315	2N 356	2N 444
2N 316	2N 357	2N 445
2N 317	2N 358	2N 446
		2N 447

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## EXECUTIVES IN THE NEWS



### Ramo: space and the violin

PRESIDENT of Ramo-Wooldridge's new Space Technology Laboratories is Simon Ramo, 45, heading up an organization of some 600 engineers and scientists. Chief aim will be exploration of magneto-hydrodynamics, hypersonics, electromagnetic propulsion, other frontier-breaking—and jaw-breaking—fields. STL is mostly a USAF contractor, like parent R-W, which has overall technical responsibility for USAF's ballistic missiles program.

Utah-born Ramo, with degrees from Utah U and Caltech (where he met partner Dean Wooldridge), worked for ten years with GI's research groups on microwave theory and electron optics. In 1946, he went west to Hughes Aircraft, found them receptive to a pet theory: that scientific methods work in operational planning and management control. By 1953, he was a v-p and director of operations.

Ramo-Wooldridge was organized in 1953. Its new offshoot will be an all-R&D outfit with the accent on systems engineering. This broad approach puts slipstick engineers, applied and pure scientists into common harness to bring varied insights to bear on knotty problems.

"Thor, Atlas and Titan," Ramo thinks, "are not the ultimate in space weapons." He feels that current work in space technology is building "a reservoir of new inventions" and that "basic concepts in these areas will provide even more potent weapons in the future."

In private, he spends a lot of time thinking up new ways to improve the nation's educational system. He enjoys just relaxing with wife Virginia and two sons. In other moods, he plays the violin, prefers chamber music, finds friends in the Westwood, Calif., area (where he lives) who join him in impromptu programs.

### COMMENT

#### Ex-Im Survey

Your special market report on the export market ("Recent Ex-

port/Import Trends," Jan. 24, p 25) deserves special commendation. I don't think this information has ever been presented so coherently in one place before.

I was especially impressed by the

neat balance struck by whoever prepared the article between statistical data and industry opinion. This is the kind of thing that makes *ELECTRONICS* so valuable to anyone who wants to understand where the technology is going.

STEWART FABREGA

UNIVERSITY OF PENNSYLVANIA  
PHILADELPHIA, PA.

Many thanks indeed for those kind words.

### Crevasse Detector

Merely as a matter of record, the crevasse detector ("Crevasse Detector Blazes Glacial Trails," Jan. 17, p. 63) was conceived and developed by Southwest Research Institute. The work was performed under contracts with the U. S. Army Research and Development Laboratories.

WM. A. MUSSEN

SOUTHWEST RESEARCH INSTITUTE  
SAN ANTONIO, TEXAS

### Oscillations

In looking over my paper ("Designing Oscillators for Greater Stability," Nov. 1 '57, p. 180), I have found some minor errors.

The word *careful* in the 7th line of the section "Amplitude Limiting" should be *carefully*. In par. 2 of the same section, the ratio  $d\theta/df$  should be  $d\phi/df$ .

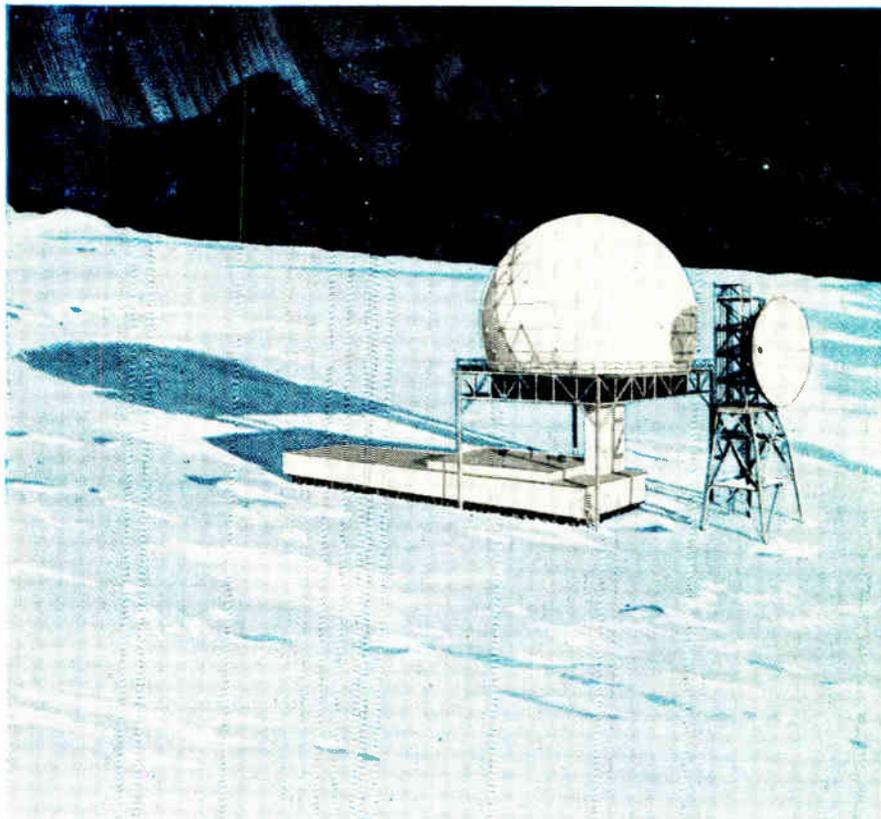
On p. 181, in the 6th line of the section "Network Selection," *infinite* should read *finite*. In col. 2 on this page, the paragraph under equation (2), the ratio  $d\theta/df$  should again be  $d\phi/df$ . In col. 3, equation (5) the factor  $2r_s^{3/2}$  should be  $2r_s^{3/2}$ .

None of these errors is serious excepting that the ones involving  $d\theta/df$  could lead to a misunderstanding of some of the paper.

SAMUEL N. WITT JR.

GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA

Apparently what we thought was infinite care in proofreading turns out to be finite after all.



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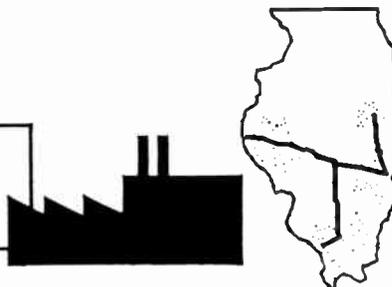
Census Bureau figures show the population center of the United States is in the area served by Central Illinois Public Service Company . . . a growing industrial area which still has an abundance of good plant sites. Here is a resident working force of semi-skilled, professional and management-trained people to help maintain your production schedules.

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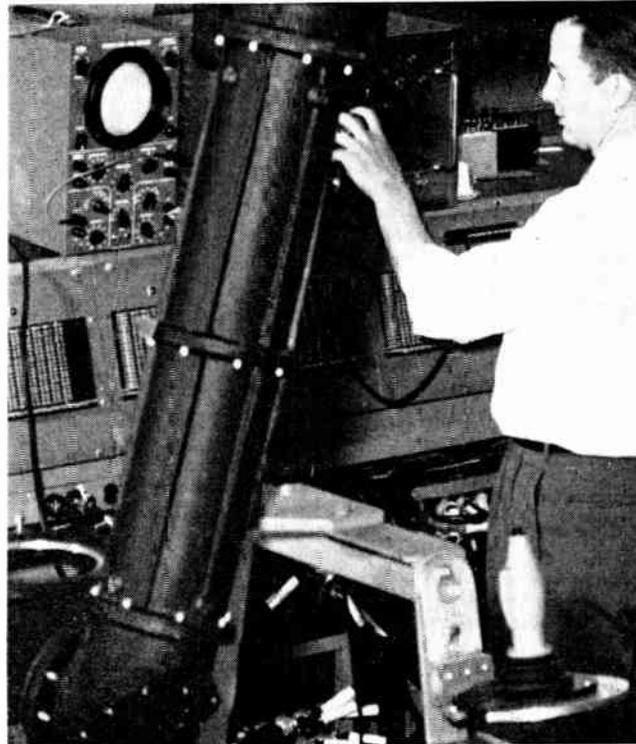
*\*The more than 500 central and southern Illinois communities served by CIPS.*



### CENTRAL ILLINOIS PUBLIC SERVICE COMPANY

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**New systems, now evolving from B-52's radar bombing/navigational equipment will rely principally on stellar-inertial guidance as . . . .**



## Bombers Shun Radiation

THERE'S a new trend in bombing/navigational systems for manned aircraft: nonradiating inertial guidance. And in vehicles that remain airborne long enough for the inertial to accumulate errors, star trackers and astro compasses are used to correct the inertial system.

Although SAC's currently operational bombers (Boeing's B-47 and B-52) use radar for navigation and bombing, the new bombers (Convair's B-58 and North American's WS-110A) will principally use stellar-inertial bomb-nav systems. Contracts for these four systems have already passed \$1 billion.

Even though details of both new systems are classified, it is possible to come up with a fairly accurate picture of each by taking out the radiation-emitting elements of the B-47's and B-52's systems and replacing them with silent ones—such as star trackers, astro compasses and inertial.

Sperry developed the K-system (see photo, p 16)

for the B-47, also used in first models of the B-52; prime contractors for b-n system for the B-58.

IBM, second-source producer of the Sperry-developed K-system for the B-47, developed, and is producing ASQ-38 b-n system used operationally in the B-52; holds prime contract for ASQ-28 b-n system for the WS-110A. (ELECTRONICS, Jan. 31, '58). (Confusingly enough, the larger number "ASQ-38" is used to label the earlier plane—the B-52).

- ASQ-38 (B-52): Heart of the system is the ASB-4, bomb-nav computer, (shown on cover) which began in 1946 as a Perkin-Elmer study contract under direction of Wright Air Development Center. In 1951 IBM took the job of projecting the computer into an integrated system.

The ASB-4 consists of four elements: bombing and navigational computers—both are basically 400-cycle analog systems, although there is a digital portion in the navigation computer; a high-speed bombing

radar (IISBR) developed by Raytheon; and radar presentation supplied by IBM.

These four elements are capable of taking care of the bombing and navigational problems. Among the features the ASB-4 offers are stabilized tracking, ability to determine wind and altitude, take fixes which fed into the nav computer result in ground speed and track information, and provisions for determining and flying a great circle course from present position to destination.

Along with the ASB-4, other ancillary devices go to make up the complete ASQ-38 system.

Kollsman's MD-1 astro compass has ability to track a star and solve spherical triangulation problems automatically.

Kearfott's AJA-1 true-heading indicator converts magnetic heading indications into true heading by correcting for variation and earth rotation.

GPL's APN-89 Doppler radar navigation equipment.

Data from these three ancillary devices are fed into the ASB-4 computer for correcting its dead-reckoning navigation. Besides these sources of correction, the ASB-4 has a periscope for visual observations which translated into coordinates can be fed manually into the computer (photo, p 15). Another version of the ASB-4, designated the ASB-9 and also used in the B-52, does not have the periscope.

GE X-Ray division's O-32 radar scope recording camera takes photographs of the bombing radar scope for reconnaissance and later study.

Since radiation-emitting equipment can be turned



Go No-Go equipment tests ASB-4 prior to take off. Lights and meters on panel indicate automatically the reliability status of components



K-system bombing/navigational computer used in B-47 medium bombers and early B-52 heavy bombers

on and off at the operator's discretion, danger of enemy detection and/or jamming can be held to a minimum.

For navigating to target, wind data is obtained a few minutes after reaching flight altitude by either the ASB-4's high-speed bombing radar or else the Doppler ASP-89. This data is stored in the nav computer and used for continual dead-reckoning navigation until such time as new information is introduced. If Doppler radar is turned on over enemy territory at all, the time needed to get fresh data would be extremely brief. Bombing radar would be needed only at the crucial moment. Return to home base could again be accomplished by the last wind data stored in the computer.

Production contracts to date for the ASQ-38 have already passed the \$200 million mark—most of which represents equipment not yet produced.

Work on an advanced concept of the ASB-4 for an improved ASQ-38 for the B-52 is currently active under a portion of the \$280 million in contracts that also include the R&D program for the ASQ-28.

In the advanced ASB-4 improvements will be made in the computers, accuracy, maintainability, reliability and miniaturization. The present ASB-4 weighs over 1,700 lbs. The complete ASQ-38, about 3,000 lbs.

• ASQ-28 (WS-110A): Like the ASQ-38, core of

the ASQ-28 will be IBM's bombing and navigation computers.

Inertial, backed up by Autonetic's star tracker, will augment radar equipment. Elements used in the B-52's ASQ-38 that will conceivably go into the ASQ-28 are Kollsman's automatic astro compass and Kearfott's true-heading indicator.

Doppler and search radar will probably be installed for use over friendly territory.

Painstaking effort goes into the reliability program. Twenty-five percent of the total effort expended on one weapon system development is for reliability. Philosophy regarding the ASQ-38 has been to design reliability into the system instead of merely testing for it later.

Electronic units are designed for a minimum average life of 2,000 hours with a design objective of 5,000 hours. All electronic units are packaged in cylindrical, copper, hermetically-sealed cans and cooled by forced air to limit the maximum hot-spot temperature. All resistors are derated by a factor of three to four. Eighty-five percent of the tubes are operating at less than 50 percent of rated plate dissipation. Filament voltage is regulated to two percent, at the filaments.

The system's failure reporting system—from the time the black box is tested in the factory throughout its useful life—will soon occupy a model 704 computer 40 hours a month.

For maintainability, IBM's go-no-go testers (see photo) allow all pluggable ASB-4 units to be tested. Lights and meters on a control panel enable a rela-

tively unskilled man to run equipment.

- **K-System for B-47 and early B-52:** Developed and produced by Sperry. Second-source producers were A. C. Spark Plug, National Cash Register and IBM. Multiple prime and subsystem sources were Eastman Kodak, General Mills, Motorola, Farrand and Western Electric (developed radar).

Over one million factory workers in 36 states at 3,050 companies have contributed to the K-System. More than 70,000 individual parts make up a single system. Original prototype cost nearly \$½ million.

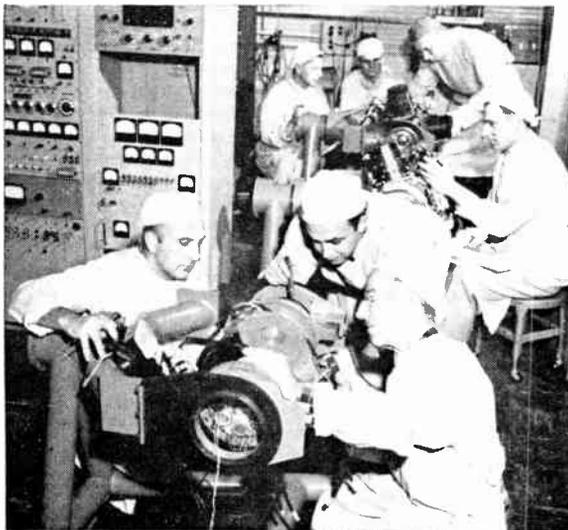
- **Bomb-Nav system for the B-58:** Based on the concept of a missile, plane was built around a b-n system. Like ASQ-28, Sperry's system for B-58 is operationally nonradiating. Basic navigation is Sperry's inertial aided by Kollsman's astrotracker.

As in the WS-110A, Doppler and search radar will be installed. Raytheon is making two radar sets for B-58 and RCA is supplying a radio altimeter.

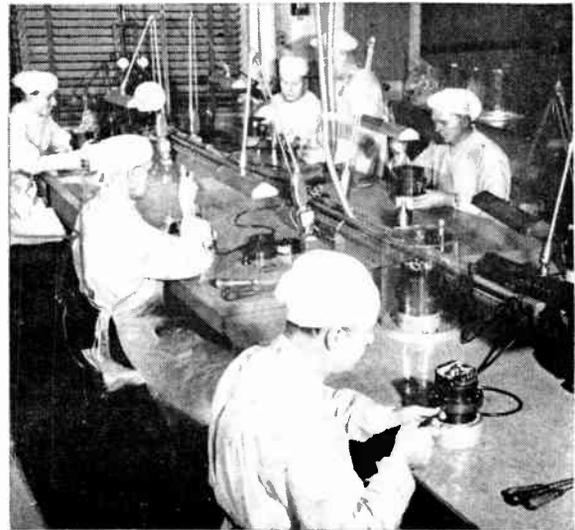
The B-58's system is smaller and lighter than the K-System. Computers in the K-System were semi-analog containing certain mechanical elements. B-58's computation system is completely analog. Currently, however, the feasibility of switching from analog to digital is being studied. Instead of feeding in continuous data to an analog, selected samples would go into a digital system. One asset: reduction in component-to-component coupling problems.

Requirements of the B-58's system are complicated by the weapon's triple mission: pods for reconnaissance, bombing and com.

## Guidance for Explorer's Rocket



Stable platform for Jupiter C Army satellite vehicle's inertial-guidance system gets final production check



Gyro assembly line at Ford Instrument where inertial-guidance system for Jupiter C is in production

# If They Shake Up Pentagon—

- 1. One Assistant Defense Secy. may award all procurement and research and development contracts**
- 2. Contracting procedures will become more uniform**
- 3. There will be freer exchange of technical data, less duplication**
- 4. Decisions on contracts, payments, facilities will come faster**

WASHINGTON—The capital is studying a slew of informal military reorganization proposals which could eventually lead to consolidation of much of the Defense Dept.'s wide-ranging activities in electronic procurement and research and development.

Officials stress that all such organizational changes will be slow in the making. The first steps will be limited to the area of policy-making. But longer-range, the effect may be broader.

As far as can be determined now, the old-line agencies will continue to award contracts and monitor projects: the Army Signal and Ordnance Corps; the Navy Bureaus of Aeronautics, Ordnance, Ships and Supplies & Accounts and its Office of Naval Research; the Air Force's Air Materiel and Air Research and Development Commands.

Among these agencies, the total bill now runs to about \$3.7 billion for military electronic production and at least \$450 million for research and development related to electronics. The biggest electronics contracting agencies are the Air Materiel and Air Research and Development Commands.

As military unification efforts become intensified, some of the electronics branches of the nine agencies may be merged or eliminated.

An ultimate objective of the most ardent proponents of military unification would be the abolishment of the Army, Navy and Air Force Departments as separately administered agencies.

This would be accompanied by the appointment of Under Secretaries of Defense for Air, Ground and Sea. Then, the existing Assistant Defense Secretaries for Supply and Logistics, Research and Engineering, Manpower, and the like, would be given direct operating powers and would not be restricted—as they are now—to policy-making or coordinating tasks.

Under such an arrangement, the wide-ranging military agencies now awarding procurement or research and development contracts would probably

be pulled together under the aegis of one Assistant Defense Secretary.

As the situation stands now, of course, each service acts on its own. Admittedly, there has been the strong trend toward more unified operations. But still, the delineation of policy and operating responsibility in the Pentagon remains fuzzy.

While the services generally require approval from the Defense Secy.'s office on what one top Pentagon official calls "anything substantive," the Secretary's office and the Joint Chiefs have tended to dally and to compromise on important and controversial issues. All of which leads back to the fundamental criticism that the Pentagon's organizational hodge-podge is mostly at fault for the major weaknesses in the U. S. defense program.

Whether a radical shake-up comes or not, to electronics companies, the impact of the military unification trend is likely to show up this way. There will be:

More uniform contracting procedures and provisions for both procurement and research and development projects.

Greater coordination between contracting agencies engaged in electronics work. This will allow for broader dissemination of technical information between the services and their individual contractors and for eventual reduction in the number of duplicating projects.

Faster and more decisive action on contract awards, progress payments, facility requirements, and the like.

The first move toward serious military reorganization—the Pentagon's highly-touted plan to set up an Advanced Research Projects Agency—became a reality Feb. 7. The space agency was established and Roy W. Johnson, GE vice president, was named director. (See p 10.)

The new agency will be responsible for overall

direction of such things as space weapons and military satellites.

Defense Secy. Neil McElroy, who announced the move, said: "Roy Johnson will bring to this important assignment impressive experience and ability as an administrator. He was in charge of General Electric's electronic business for six years starting in 1951, is accustomed to working productively with the scientific people and knows organization thoroughly.

"In the new agency he will be backed up by the most highly qualified scientist we can find and the head of the group that will provide technical direction to the programs assigned to the agency."

Johnson, 52, will formally assume the ARPA directorship April 1. Prior to that date, plans call for him to spend two or three days a week on his new assignment. Johnson has been a GE vice president since 1948.

Before McElroy's two pronged announcement, there was increasing feeling in Congress—and in the scientific community—that space flight development

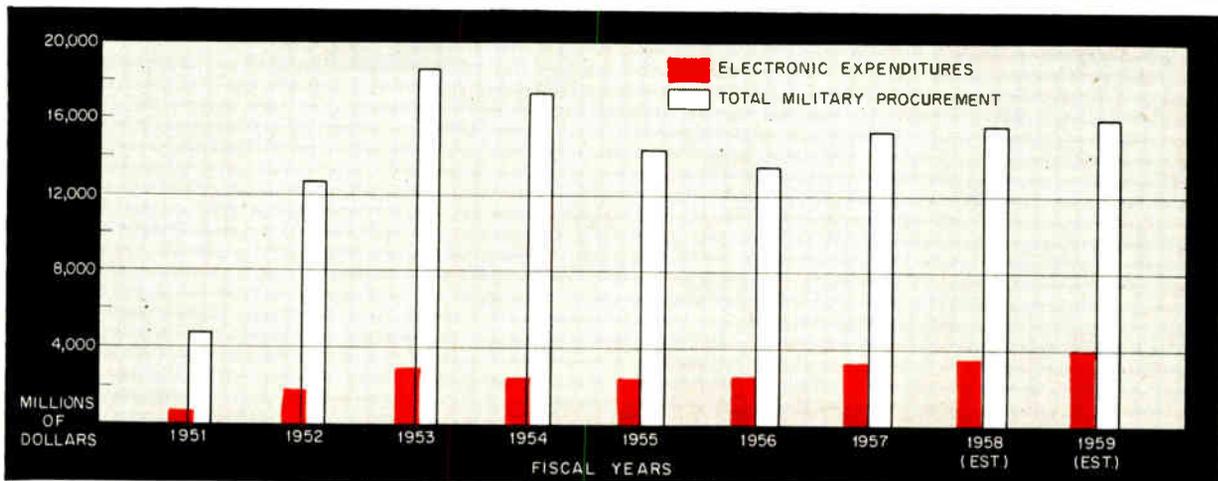
should be controlled by the Natl. Advisory Committee on Aeronautics or a brand new civilian agency outside the Pentagon.

Also, there were reports the Defense Dept., in the face of criticism from the three services, had been whittling down the authorities originally conceived for ARPA. Some doubt exists as to ARPA's role in contracting for space work. However, the agency currently has \$10 million to get underway with and promise of more—maybe 20 times as much—for next year.

The administration's second significant move toward military reorganization is billed as a fiscal measure: the request for authority to transfer up to \$2 billion in defense appropriations from one service to another. But its importance is that the Defense Secy. will obtain more influence than ever in controlling individual service projects.

ARPA and the budget transfer authority are simply the start of an increased drive to strengthen centralized Defense Dept. control.

## PRODUCTION and SALES



## Military's \$4 Billion To Set Record

ELECTRONICS INDUSTRIES ASSOCIATION expects a substantial increase in the electronics share of military spending in fiscal 1959 and the establishment of a military procurement record for electronic purchases.

EIA estimates electronics buying by the military in the period will approximate \$4 billion. The estimate is nine percent greater than the \$3.6 billion estimated by EIA for fiscal '58, and 14 percent greater than the \$3.5 billion ex-

penditure for military electronics in fiscal '57.

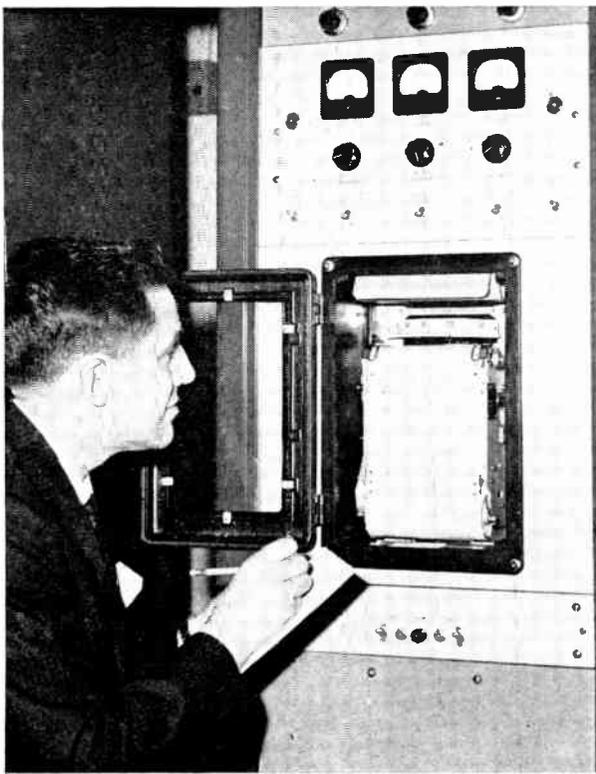
Electronics' share of military procurement in fiscal '59 would be 25 percent of the total, the largest cut of the military procurement pie ever to be given to electronics manufacturers.

Our share has grown by leaps and bounds from the 1951-1954 period. Then electronics spending ranged between 15 and 16 percent of total military spending. Electronics' share increased to 17 per-

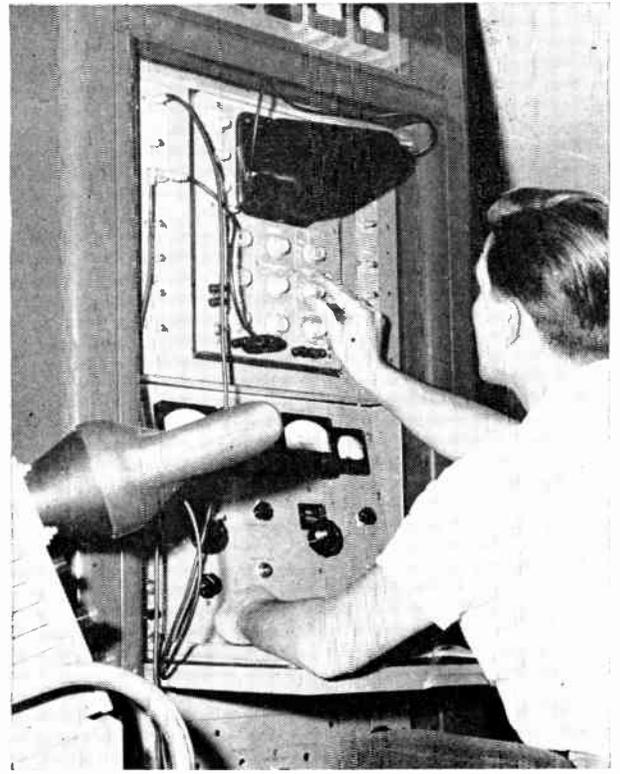
cent in fiscal '55, to 21 percent in '56 and 23 percent in '57 and '58.

Only a few years ago, in fiscal '51, military electronics spending totaled but \$747 million.

Korean War brought the first big jump as expenditures moved up to \$1.9 billion in '52 and more than \$3.0 billion in '53. Post-Korean period saw a drop to \$2.7 billion in '54 and \$2.5 billion in '55. However, in '56 electronics expenditures increased to \$2.8 billion. They have increased steadily since.



Monitor strip chart gives dosimetry record. Monitor computes beam current, beam energy and scanning current, sounds alarm on variation of 5 percent



Operators are former radarmen. In photo above, one makes use of scopes to adjust operating conditions. The beam frequency is 800 cps

## Electrons Sterilize Sutures

**Electronic irradiation now sterilizes catgut surgical sutures. Being used is linear accelerator with twin 2-megawatt S-band klystron tubes**

STERILIZATION of medical products with a microwave linear accelerator has now come into full-time commercial use at the Somerville, N. J., plant of Ethicon, Inc., division of Johnson and Johnson.

The linac, rated at 7 million electron volts, sterilizes 5 to 10 dozen catgut sutures a minute as they pass under the beam in a shielded room.

A prototype built by High Voltage Engineering Corp., the linac culminates a research project dating back to 1949. Intensive research started in 1953 with a 2-mev Van de Graaff generator.

The linac can be duplicated for "slightly under \$200,000", a sum, however, which doesn't cover development costs. It was designed for the job.

Twin modulators and two S-band, 2-megawatt klystrons supply power to the accelerator tube. The output is coupled, then divided for the buncher and accelerator waveguides.

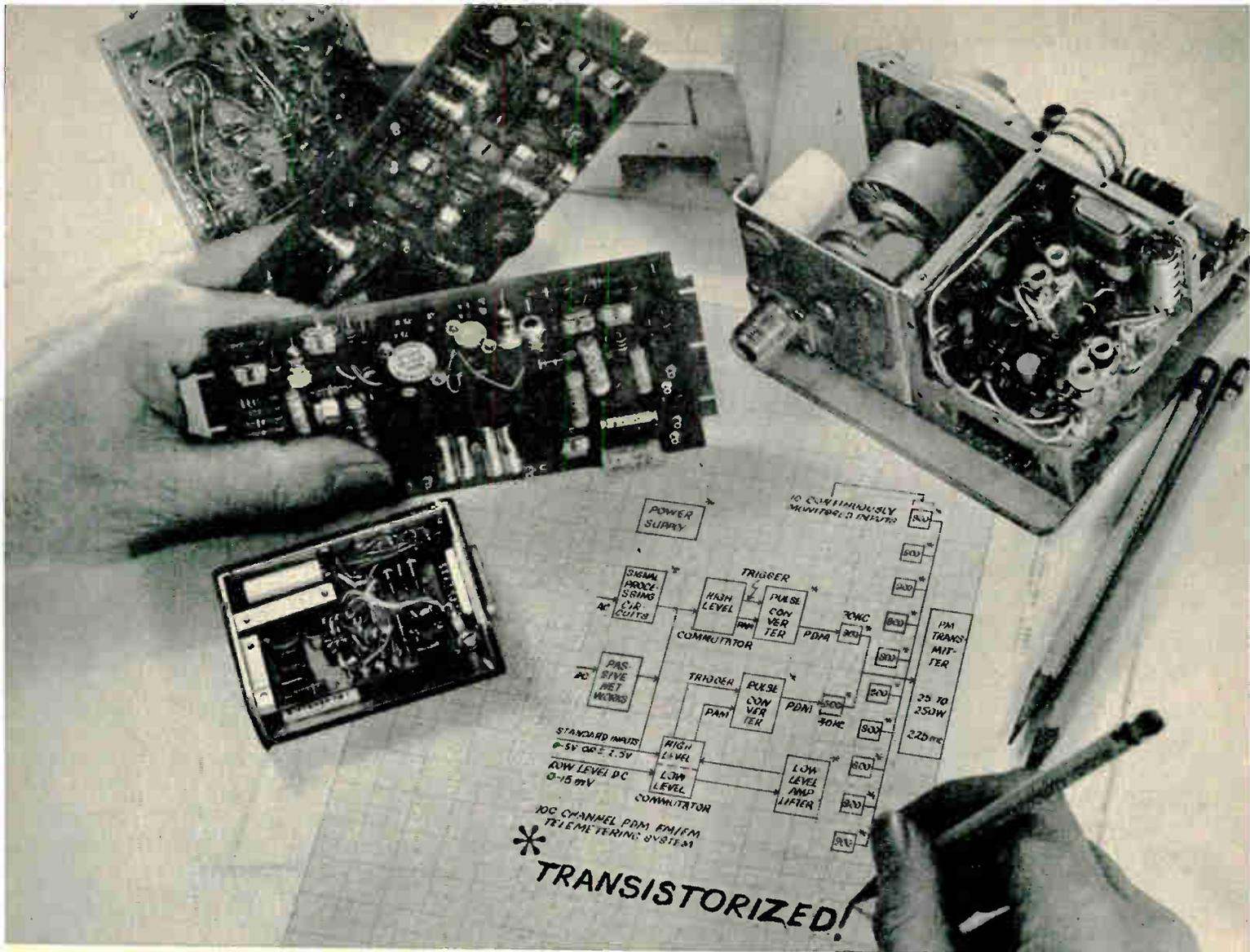
This arrangement, since the klystrons fire alter-

nately, doubles the duty cycle and boosts average power. The linac can run on one klystron, if necessary.

Until now, Ethicon sterilized catgut with heat, which saps catgut strength. Elaborate precautions are required to prevent recontamination during packaging. Irradiation permits sterilization after packaging, with a 50-percent safety margin in dosage, while retaining high suture strength.



Trays of sutures pass under beam. Photoelectric cell over tray prevents conveyor jams during remote operation

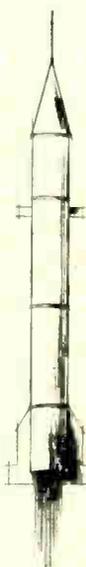


# you can help missiles 'think' better!

Experienced graduate engineers and physicists — supervisory level preferred — are invited to help "educate" America's missiles. You will be applying latest techniques and newest semiconductor devices in Texas Instruments plants equipped to build components and complete systems without subcontracting... telemetering, infrared, radar, sonar, and many other systems from research through development to manufacturing.

You will push beyond existing limitations into new concepts and new products. At TI, this pioneering approach has been so successful the company has grown 20-fold in the last 10 years to a current \$70 million volume... a growth accelerated by recognition of individual achievement... a growth you can share.

And you will work at a plant within the city but away from downtown traffic... live within 15 minutes of your work or your play — year-around recreational, amusement and cultural activities.



\*

This TI-transistorized telemetering system is more a "talker" than a "thinker." It provides four times the radiated power in a smaller package than comparable vacuum tube systems. Not "frozen" to old design standards, it is almost completely transistorized and is completely electronic with no moving parts... a typical example of Texas Instruments policy of advanced systems engineering.

**ELECTRONIC AND ELECTROMECHANICAL APPARATUS** — Radar, sonar, infrared, navigation, magnetics, telemetering, communications, computers, transformers. Write R. E. Houston.

**SEMICONDUCTORS AND OTHER COMPONENTS** — Transistors, transistor circuits, diodes, rectifiers, resistors, capacitors, test equipment, mechanization. Write W. E. Spaller.

**RESEARCH** — PhD level for research: semiconductor materials and devices, noise, surface, ferromagnetics, infrared, microwaves, magnetics, radiation damage, high speed data reduction, etc. **MANUFACTURING** — Engineers for production, planning, purchasing, cost analysis, etc. Write A. E. Prescott.



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# Moscow Steals Science Shows

**Top scientists ask reappraisal of American role in international scientific meetings. Important groups orbit around Moscow because U. S. bans Red Chinese. And . . . many conferences held here depend on different government agencies and private sources for funds**

ROLE OF THE SCIENTIFIC conference table in foreign affairs may be getting new study this year.

How the United States acts is of extreme interest to our industry for several reasons:

Information exchanges are getting more and more into basic research areas of interest to electronics.

Electronic instruments are often the new tools of scientists all over the world.

Knowledge gained from international studies will affect communications and other areas of electronic application.

Several of the most important international conferences of the year will be held in Moscow—the International Astronomical Union, Special Committee for the IGY and UNESCO's International Advisory Committee on Research in the Natural Sciences. Highly placed scientists say they know of no conferences of comparable importance and prestige scheduled to be held this year in the U. S.

Many international groups have not been able to consider meeting in the U. S. because their membership has included Red China's academy of sciences and certain other Communist scientists. These scientists have been denied entry into the U. S. so the organizations chose to meet elsewhere in keeping with their traditional international character.

View is held by many U. S. scientists that this ban has undermined our world scientific leadership. Russia has been quick to issue invitations to organizations, a few of whose members are persona non

grata here. This has dovetailed neatly with the Soviet propaganda aim of establishing Moscow as the world science capital.

Within the last year, the National Academy of Sciences urged the State Department to issue entry visas to Western scientists who were known or suspected Communists so they could attend conferences in the U. S. Matter was taken up with the Attorney-General and visas have already been issued.

Remaining is the ban on Chinese Communists. But hope is growing that a way will be found this year to admit Chinese Communists so that certain international scientific organizations will not continue to be prevented from meeting in the U. S.

There is also strong feeling that the National Academy of Sciences could "use a few million dollars a year" for organizing and helping other institutions organize international scientific conferences in the U. S., and "a few million more" to extend American participation in meetings abroad.

The Academy gets much of its financial support from contract work done for government agencies, through grants from philanthropic foundations and industrial solicitations.

It gets \$9,000 a year from Congress, the ceiling set in 1935, to cover dues and expenses connected with official U. S. participation in the International Council of Scientific Unions and the various international unions associated with the Council. In the last five

EASTERN EUROPEANS ATTENDING CONFERENCES IN U. S.				AMERICANS ATTENDING CONFERENCES IN EASTERN EUROPE			
Nationality of Conferees	Jan '56- June '57	June '57- Oct '57	Total	Location of Conference	Jan '56- June '57	June '57- Oct '57	Total
Soviets.....	76	30	116	USSR.....	40	41	81
Poles.....	34	10	44	Poland.....	1	4	5
Rumanians.....	9	12	21	Rumania.....	5	..	5
Czechoslovakians.....	16	8	24	Czechoslovakia.....	2	10	12
Hungarians.....	6	7	13	Hungary.....	8	..	8

Source: Department of State (latest available approximations)

years actual dues and expenses have arisen to about \$25,000, with the Academy making up the difference from grants.

With these expenses mounting at a faster rate than ever, the Budget Bureau recently agreed to a ceiling of \$65,000 up to 1965. It may be voted this Congress session.

**In recent years the National Science Foundation has paid foreign travel allowances to American scientists in need of funds to attend international scientific meetings. In fiscal 1957 this amounted to \$90,000. In fiscal 1958 NSF got \$125,000 for this purpose out of \$200,000 requested.**

Tab for international conferences held in the U.S. is picked up by NAS (which has had to raise \$100,000 in grants to put on a single big international conference), government agencies, armed services, industry, universities and societies—depending upon their interest in a particular conference and their resources.

For example, last September's "little Geneva" meeting at Columbia University, the International Conference on the Neutron Interactions With the Nucleus, was largely underwritten by the Atomic Energy Commission.

This meeting, a follow-up to a part of the 1955 international conference in Switzerland, was actually held under the auspices of the International Union of Pure and Applied Physics. Six Russian scientists of the Soviet Academy of Sciences were among the more than 150 scientists who attended.

A few weeks ago two Russian scientists in the field of electron physics attended the Conference on the Physics of Electronic and Atomic Collisions at New York University.

The Russians, N. V. Fedorenko and V. M. Dukelsky of the Academy of Sciences' Physical-Technical Institute, were said to be among the first Soviet scientists in the field of electron physics to visit the U.S.

The five-session meeting of more than 200 physicists was sponsored jointly by USAF Office of Scientific Research, Office of Naval Research and NYU.

**Conference has implications for radio propagation, aerodynamics of missile flight, use of gaseous discharges in devices like tubes and rectifiers and harnessing of thermonuclear power. Estimated cost of the sessions: \$6,000.**

Financial support for this conference came mostly from the sponsors, but needed additional funds came from Westinghouse Research Laboratories, General Dynamics Corp. and its General Atomics division. Air Force made Military Air Transport Service available to foreign scientists and National Bureau of Standards contributed office help.

## In '59 . . . Data Meeting

FIRST International Conference on Information Processing will be held next year under the sponsorship of UNESCO and a number of national computer societies, including the Joint Computer Committee of the U.S.

The Soviets, reportedly well advanced in the handling and processing of information, are expected to attend the conference to be held in Paris or Rome in June 1959. On the agenda: automatic machine translation; information storage and retrieval; pattern recognition and machine learning; mathematics, logic and common language; and real time problems in meteorology and economics.

Living and entertainment expenses of foreign scientists who attend meetings in the U.S. pose a special problem. When a government agency contributes funds for a scientific meeting, it cannot provide anything for the after-hours expenses of the visitors. Such international public relations must depend on the contributions of American companies and private societies.

Sources close to past international meetings say the Russian scientists who come here insist upon paying their own way, while some Americans who have had to scrape up funds to attend a conference in the USSR have been surprised at the generosity of their hosts—at no cost to them.

Despite all the trappings of friendship, however, there is clear enough evidence that Russian scientists at international conferences behave according to instructions from their superiors. Undoubtedly their instructions are based on definite national policy with regard to the meeting they are attending.

A government source says, for example, that Russians have been known to speak flawless English at one session, only to show up at another six months later with an interpreter and pretend they don't understand "hello."

Last year there were 421 international scientific conferences. More will probably be held this year. Since the spring of 1957 about 70 or 80 Soviet scientists have traveled to the U.S. A similar number of Americans have attended scientific meetings in the Soviet Union. Trend is towards more such visits, the National Academy of Sciences believes.

In recognition of the importance of science in the struggle for men's minds, therefore, top scientists feel it behooves the Administration to "reappraise" the place of scientific exchanges in foreign affairs.

# Production Inspection is Faster and Easier with a J&L Optical Comparator

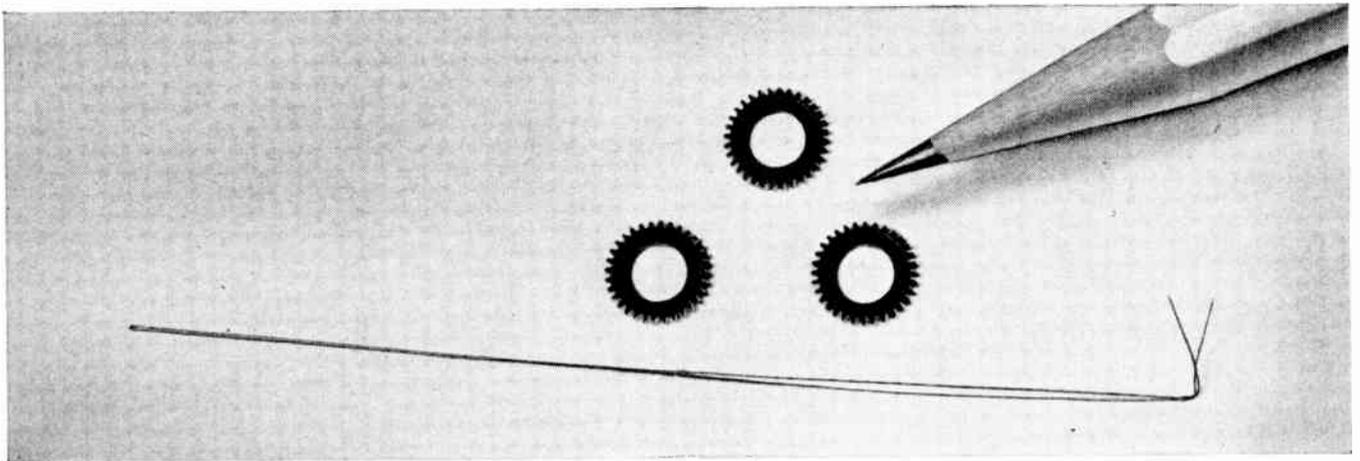
*... and its extreme versatility enables you to perform inspections that used to be "impossible"!*

More and more electronics manufacturers throughout the country are using Jones & Lamson Optical Comparators in their quality control operations. Small shops, as well as the giants, have learned that a J&L Comparator pays for itself in very short order.

The Comparator's ability to measure and inspect, through shadow magnification, all sorts of parts and objects

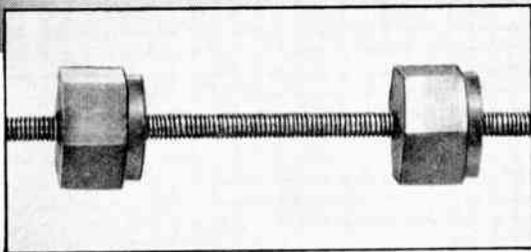
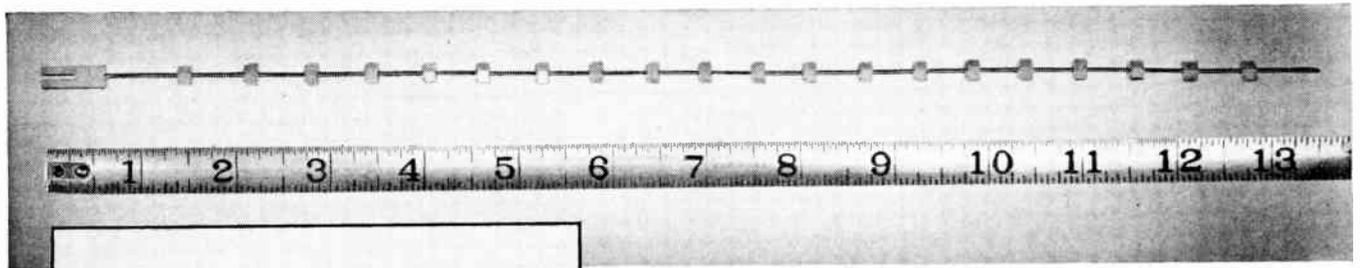
with extreme precision and speed makes it ideally suited for checking electronics components, especially those which are tiny or intricately contoured.

Investigate how the J&L Comparator can help you make your production operations more efficient . . . and more profitable. Write today for a free copy of our new illustrated catalog No. 5700.



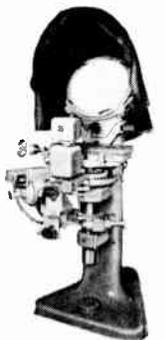
**For Instance** — A customer writes: "One of our assemblies, containing 32 separate circuits, measures only  $\frac{5}{16}$ " dia. by 1" long. The parts which go into this assembly must have perfect shape and tension, which are impossible to check by mechanical

means. Two such parts are these .005" dia. gold wires, and precisely toothed brush spacers. Since using the J&L Optical Comparator in our inspection, assembly failure due to malfunction of either of these two parts has virtually disappeared."



This precisely-threaded rod (used in calculating machines) is of .047" dia. stock, 120 pitch, with continuous threading along its entire 12" length. Threading accuracy and critical dimensions are measured and checked speedily and efficiently with a J&L Comparator.

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# Stock Options Tempt Execs

- Salaries alone are not enough to keep and recruit top management men today because of high personal income tax rates
- Stock options give fast-growing electronics industry an edge in bidding for key management people

"SALARIES ALONE are not enough to keep and recruit top management nowadays." Norman Schaffer said last week. He is president of Consolidated Diesel Electric, diversified electrical-electronic equipment manufacturer of Danbury, Conn. His firm recently established a restricted stock option plan for officers and key executives.

Reason, Schaffer explains, is that present personal income tax rates make a mockery of executive salary increases. For instance, an executive at the \$40,000 salary level gives the tax collector more than 50 percent of his first \$10,000 increase, about 60 percent on the second \$10,000 and nearly 70 percent on the third \$10,000.

Consequently, salary increases at top management levels have lost their incentive, he says. The old idea that money and more of it will hold top management men and attract new ones has been thrown out the window.

The best way to put monetary incentives back into an executive compensation plan is with a restricted stock option plan, Schaffer claims.

If tax code provisions are followed, profits from stock options are taxed as capital gains and are limited to 25 percent. Also, the executive who makes a sizable investment in his company identifies his personal progress with company progress.

In general, here's the way restricted stock option plans work:

They are usually restricted to officers and key employees. They are given the right to buy a certain number of shares in the company at a specified price, most often 95 percent of market. Kicker in the deal is that once set, the price remains firm, but the executive has lots of time to pick up the option, up to 10 years.

If the stock goes up his chances of making a profit at little risk are excellent. Only risk he takes is that after picking up the option he must hold the stock for six months before selling. He is also prohibited from selling the stock within two years of the day the option was granted.

In the electronics industry, where \$3 stock may climb to \$30 in a few years, the profit possibilities

are tremendous. For this reason stock options are of special interest to us. They allow small growth companies, unable to offer big cash rewards, to compete for executive talent with big cash-loaded companies, says V. Henry Rothschild, New York attorney.

Some may agree with these thoughts in theory, but wonder about recent comments that "stock options ain't what they used to be" because of decline in stock market prices. The profit prospect has been taken out of many option plans, they say.

Claims that the drop in stock market prices has shaken confidence in stock option plans are fantastically inaccurate, rebuts Dean Rosensteel, director of American Management Association's Executive Compensation Service. Executives who participate in a stock option plan are not interested in short-term speculative profits, he claims. He points out that stock options are as popular today as ever and that the number of new plans is steadily increasing.

Although a stock option is an effective management technique, the plan should be carefully drawn to get maximum benefits, Schaffer advises.

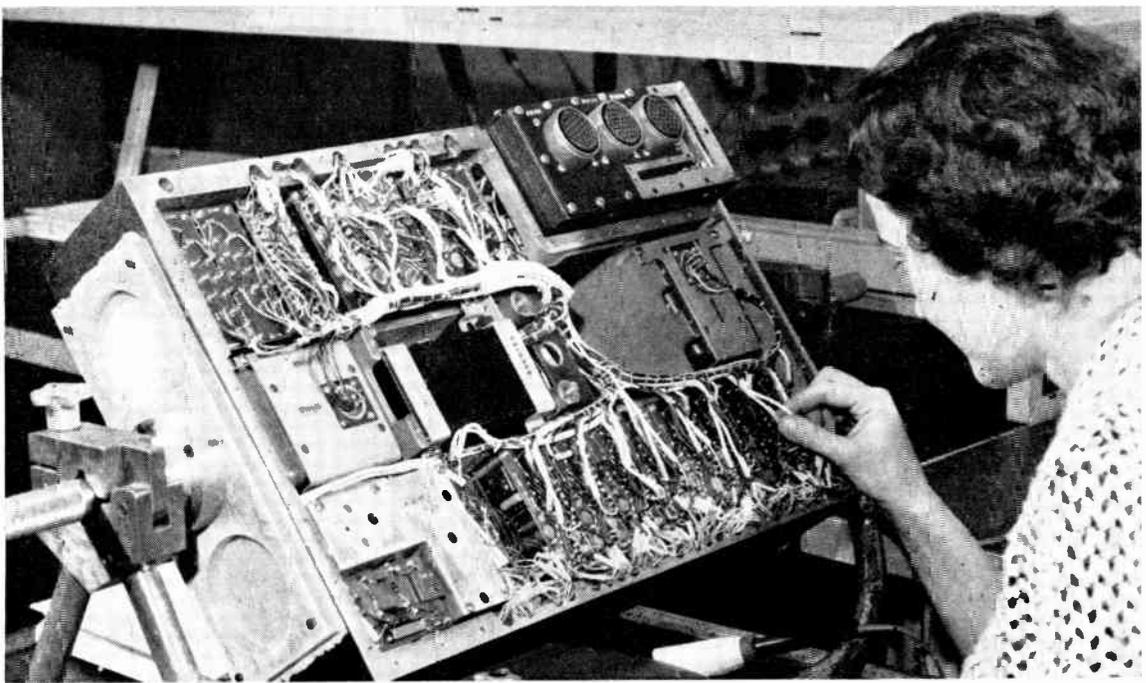
He suggests:

Restrict stock options to the small group of executives who can influence a company's profits and future.

Hold back on the amount of stock you ultimately plan to issue. At the time a plan is set up a firm doesn't know how many men it will need in future years. Also, an individual's capacity to grow is difficult to predict.

Protect your firm against the possibility of a man taking his stock profit and leaving in a few years. Con Diesel protects itself by requiring that an optionee exercise no more than 25 percent of his option in any one year.

AMA's Rosensteel says companies which make the most effective use of stock option plans are those which realize that options are an extra attraction for executives, and not a substitute for a well-rounded executive compensation plan, including a fair salary structure, insurance programs and retirement plans.



Woman technician solders wire harness for telemetering unit used only in test flights. It has 35 plug-in modular amplifier units using printed circuits. Gear monitors 100 separate intelligence signals

# Making A Missile Brain

**Marriage of production methods and laboratory research pays off today in volume output of inertial-guidance systems**

**Accuracy attained is 1,000 times greater than in finest watch made.**

**I-g system is 100 times more accurate than needed to orbit satellite**

WHEN THE FIRST Thor ballistic missile roared into the sky over Cape Canaveral—under direction of its all inertial-guidance 'brain'—AC Sparkplug engineers knew they had succeeded in their plan . . . "push the production plan right up to the back door of the laboratory." The Thor IRBM's are now taking their places at USAF bases here and abroad.

Today the marriage of lab and shop methods is

paying off in volume output of i-g systems at General Motors' AC Sparkplug division plant at Oak Wood, Wis. The structure covers 225,000 sq. ft.

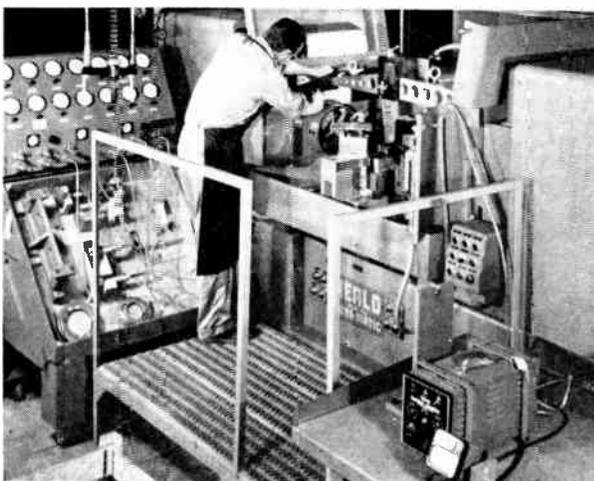
Laboratory conditions dominate the plant. There are specialized sections for gimbal assembly and wiring, accelerometer testing, system testing, synchro system assembly, gyro machining, deburring, gyro calibration, test and assembly, tool room, machine repair and conversion, tool and gage inspection, receiving inspection, gimbal machining, boring and drilling, gear cutting, heat treating and others.

Being produced are parts a thousand times more accurate than what is generally considered precision work. Much equipment, even if new, is rebuilt to the ultimate in machine-tool accuracies.

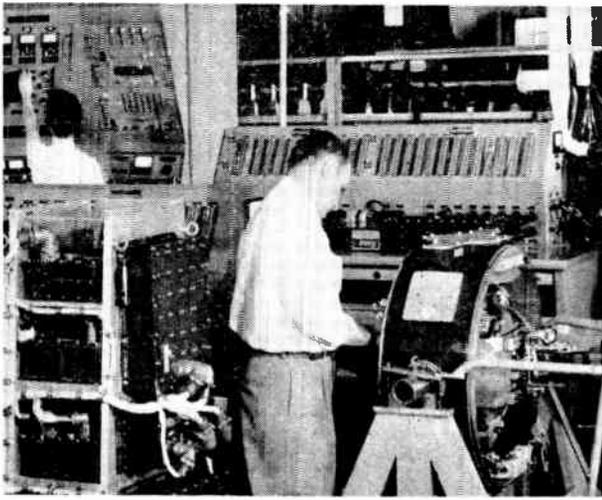
Guidance is 25 percent of a Thor missile's \$1-2 million cost. The i-g unit's power supply controls voltage magnitude to three thousandths of one percent—50 parts in a million. The unit goes into Thor, Matador Mace and Regulus II missiles.

Extreme accuracy needed, says Works Manager Roy McCullough, comes from "moving manufacturing up from its traditional position, last in line, so production problems can be tackled while R&D are in progress."

Gyroscopes are assembled under glass where a slight pressure of filtered air is maintained. A single dust speck could be cause to reject an assembly.



Gyro gimbals for guided missile are machined to ultra-close tolerances measured in millionths of one in. Electronic bridge gage (center) checks flatness, squareness



View of final airborne systems check-out area at i-g production plant. Gimbal system (right) that holds inertial gyros is on a wheeled frame

Electronic units similar to the most sensitive electrocardiograph check gyro characteristics. In test areas, raceways simulate missiles in flight and prove out every system produced.

Tools and sample parts are compared with precision templates by projecting their shadows magnified 100 times on an optical screen. In the standards room, temperature is controlled to  $\frac{1}{2}$  degree. Humidity is controlled to less than 20 percent. Electronic frequency standards are checked to within one part in one million.

A variation of 10 millionths of an in. makes a gyro useless for the i-g system. A one millionth of an in. wheel movement creates enough unbalance to cause rejection.

For close grinding, turning, lapping and boring operations, machines are usually warmed up two to three hours. Master gages are allowed to stabilize one to two hours before checking starts.

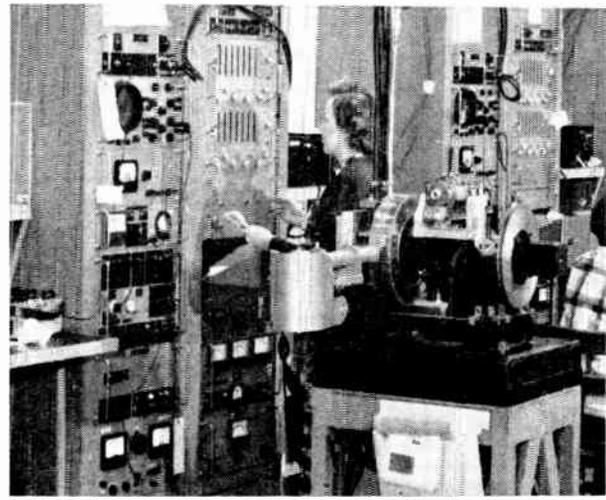
Progress made is so tremendous today's guidance system is 10 to 100 times more accurate than what is needed to put satellites into orbit.

Angular relationships between assemblies are held to several seconds of the circular arc—a circle contains 216,000 seconds of arc. Over 700 ft of wiring is used in each gimbal system.

The gimbal assembly holds three stabilization gyros which provide stable platform reference for computing work of the system. Unit also has three acceleration sensing gyros which detect changes of missile acceleration. Test synchros are centered to five millionths of an in. Deburring of parts is done under 330-power microscopes with dental tools.

Gyro assembly is done in a surgically clean, pressurized, air conditioned room. Electronic precipitators clean the air. Tools, parts and fixtures are cleaned ultrasonically.

To check system erection and alignment, an electronic console identical to ground support equip-



Testing gyro accelerometer which senses all changes in speed or direction of missile and sends signals to airborne electronic computers

ment used in the field is employed. System can be balanced to detect weight of dime on edge of a gimbal. Alignments of 50 millionths in. are made.

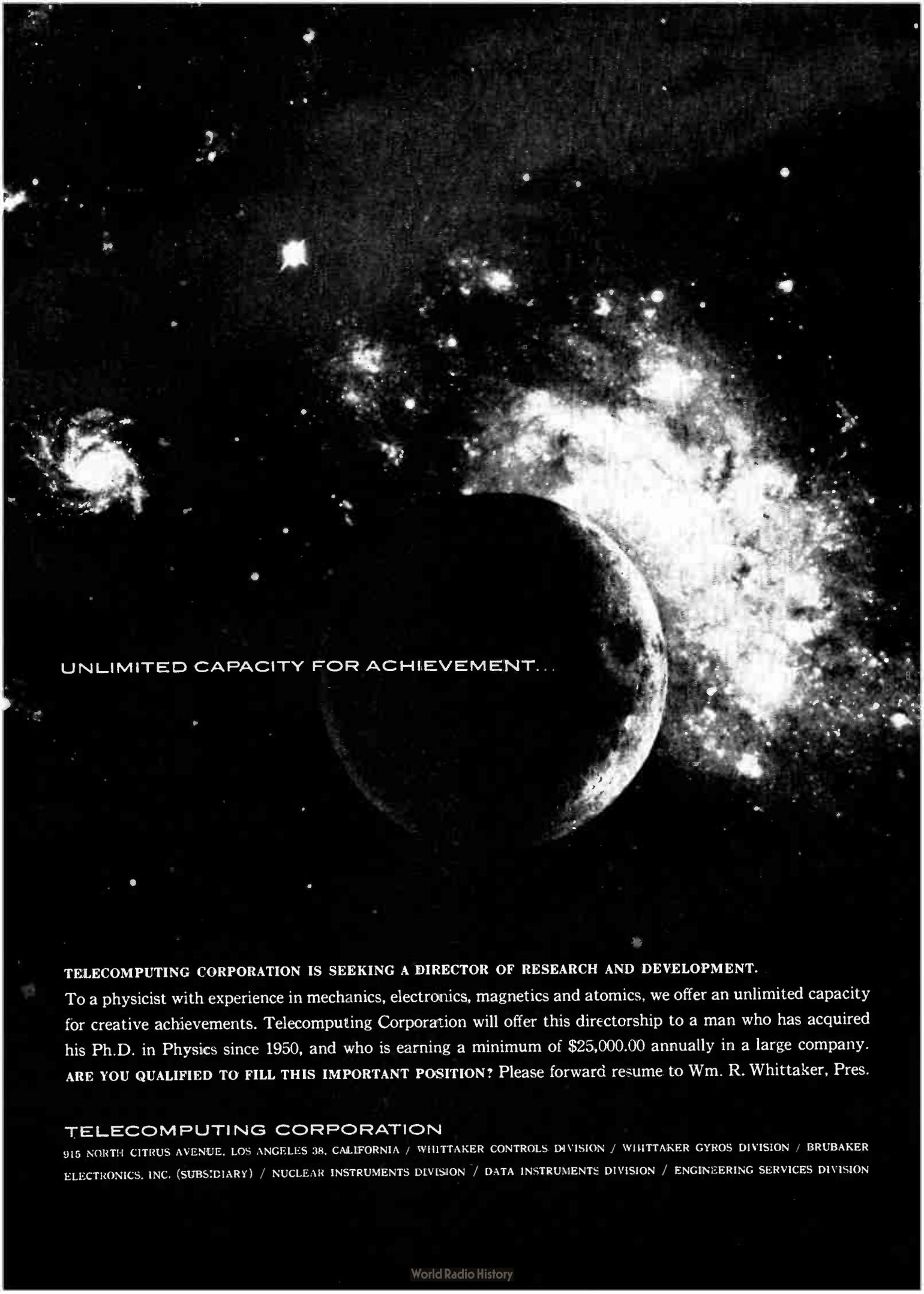
Azimuth theodolite used to align i-g systems uses optical and electronic systems. Digital voltmeters accurate to one 10 millionth of a volt are used to monitor steering signals sent to the ballistic missile's autopilot.

Phase angles and wave shapes are checked by special oscilloscopes. Sanborn recorders make permanent copies of various signals present during the guided portion of the ballistics flight. In production, an electronic bridge gage checks flatness and squareness of the machine ways.

Testing must verify a gyro drift error of no more than one gyro revolution in more than 10 years. Accelerometer gearing, gyros and electrical parts are required to test to 1,000 times greater accuracy than the finest watch made.



Flight test equipment for inertial-guidance systems. Frequency standard includes a master electronic clock. It is accurate to one second per day

A black and white photograph of a galaxy, likely the Milky Way, with a large planet in the foreground. The planet is dark and occupies the lower right portion of the frame. The galaxy's spiral arms are bright and detailed, stretching across the upper and right portions of the image. The background is filled with numerous stars of varying brightness.

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**WHITTAKER GYROS DIVISION:** Since 1939 more than 350,000 Whittaker gyros have been sold for installation in a wide variety of military products. This division originated the electrically-driven gyro being used on guidance systems and on missiles currently in production.

**BRUBAKER ELECTRONICS, INC.** (Subsidiary): A leader in research and development in advanced electronics systems, encompassing the fields of safety controls for military and commercial aircraft—airports—communications—radar—IFF and navigation aids. Today, every ship of the U.S. Navy is Brubaker equipped.

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**NUCLEAR INSTRUMENTS DIVISION:** For many years this division has been engaged in the production of maximum reliability equipment for testing nuclear weapons. It is geared to undertake basic design and manufacture of missile instrumentation test equipment, develop prototypes and apply engineering techniques to assembly line production under the most rigid quality controls.

**ENGINEERING SERVICES DIVISION:** This division is currently engaged in the reduction of large amounts of flight test data being generated by the daily missile firings on the integrated Holloman-White Sands Range. The Engineering Services Division of Telecomputing is capable of performing this function anywhere in the world.



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## Use Sound To Detect Aerial Targets?

USE OF SOUND FOR DETECTING and homing in on aerial targets merits serious consideration, says Capt. Grayson Merrill, USN (Ret). Speaking before Long Island Section of IRE, he described a proposed missile having two feeler-like antennas projecting forward from its head. To prevent pickup of its own sound, missile would be operated at supersonic speed. System is said to be virtually impossible to jam, since all known aircraft emit high-intensity noise which would be exceedingly difficult to disguise.

Merrill also pointed out that little or nothing is being done with detection devices in certain other areas of the spectrum, including visible light, radar frequencies above the K band and ultraviolet. He suggested that equipment be developed to detect visible light reflected by an aircraft moving against a background of earth or sky. Once the target is detected, conventional tracking and control methods could be used to keep the missile on course.

- **Stringent requirements** of stereo disk recording may cause phonograph record manufacturers to revert to technique abandoned nearly 20 years ago. Prior to World War II all masters were cut on wax, but when source of Montan Wax, an essential ingredient, was cut off in wartime, industry shifted

to cellulose-nitrate lacquer as the recording medium.

Recently Jerry D. Minter, audio engineer who described intermodulation distortion, noted that certain records from England and Germany looked suspiciously as if they had come from wax originals.

Further research turned up a recordist whose father had been associated with Edison and who still retained many secrets of the wax recording days. Testing some modern formulations, the experimenters found that wax recordings exhibit lower intermodulation, frequency response up to 35 kc, less groove echo and hence more potential recording time. Major companies are much interested

- **Automatic car guidance** may be with us in the near future. Last week, GM demonstrated an electronically-controlled automobile that can actually travel over a highway on a prescribed path and over a wide speed range.

An electromagnetic arrangement similar to RCA's (ELECTRONICS, Feb. 7, p 44) provides the control. A guidance wire imbedded in the highway magnetically couples a roadside transmitter to the control device in the car. All dynamic characteristics of the car are regulated externally, allowing the driver complete freedom from all of the normal driving activities.

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## TECHNICAL DIGEST

- **Transistor detector circuit** derives necessary energy from incoming carrier, eliminating need for local power supply yet providing power rectification, signal detection and signal amplification. Developed by Dr. H. E. Hollmann of Dresser Dynamics, new Transector can get enough power from final i-f stage of superhet to drive small loud-speaker and provide ave voltage directly at transistor junction.

- **One-shake gate former circuit** generates square pulses having short and precise durations, by adapting secondary-emission r-f pentode to receive input trigger pulses. Positive feedback loop connected from dynode to control grid maintains conduction in response to trigger pulses. Short-circuited delay line controls conducting time of tube.

Spurious oscillations are squelched in feedback loop. AEC has released U. S. Patent 2,803,748 on circuit for public use.

- **Analog computer** serves as high-accuracy, high-input-impedance meter for measuring vacuum tube characteristics at Texas Engineering Experiment Station, permitting measurements to micromicroamperes for grid current characteristic curves needed in designing logarithmic multipliers. High-gain chopper-stabilized amplifier in computer holds grid at a-c ground for all values of plate and cathode voltage. D-c grid voltage is accurately measured with digital voltmeter.

- **Frequency pulling** of single-cavity ammonia maser oscillators is greatly reduced by using two identical cav-

ities, soldered together and coupled through hole in common wall. The molecular beam crosses only one of the cavities. Swiss research indicates twin cavity design is little affected by temperature even when made of brass, whereas single cavity is critical despite use of Invar.

- **Omnidirectional antenna coverage** needed for Tacan and air traffic control equipment on aircraft is achieved with two-antenna system developed by SRI, one on top and one underneath aircraft. Cyclic switch connects traffic control beacon to antennas in alternation at rate of about 50 cps so equipment is never disconnected from most effective antenna for more than 1/100th second. Diversity switch connects Tacan to antenna providing stronger signal.



Symbols can be superimposed on radar presentation to aid flight controllers at busy air terminals

## Modified CRT May Aid Air Traffic

ANOTHER electronic development may help control air traffic around busy terminals. A console system has been developed by the Stromberg-Carlson Div. of General Dynamics to ease the burden on controllers.

The console is designed around a tube that simultaneously displays radar or tv images with identifying letters, numbers and symbols superimposed.

The traffic controller will see a radar blip of a plane and beside it a series of numbers and letters denoting its identity, type, destination and position.

The system will also contain tabular displays of numbers, letters and symbols on conventional Characteron tubes. These will replace the flight strips now used. With the present arrangement, controllers must write flight information on strips of paper and move them manually as flights move in and out.

The console will comprise a radar display in the center of a rectangular crt with an inbound flight strip on one side and outbound on the other. A keyboard will be provided to insert information on the flight strips.

The consoles contain circuitry

for use with data-processing equipment so that they can be integrated with computers when the computers become available. Flight strip information can then be put under computer control.

The system is arranged so that a series of consoles can be used independently of each other to cover different areas. Failure of one console will not affect the others.

In operation, aircraft desiring departure will call the outbound controller, who will insert plane number and information about the flight with the keyboard. The clearance request will also go automatically to the air route traffic control for confirmation.

After clearance, the plane will be followed on its path to the departure gate by radar in the center of the display. The radar blip will have a tracking symbol and alphanumeric data about the flight superimposed.

A similar sequence will take care of inbound flights.

The consoles are designed so that they can also be used in conjunction with computers for planning flights by air route traffic controllers. Data on altitude, speed and departure time of proposed flights will be fed into the system, which will reveal

any conflicting traffic from other flight plans. This will enable the controller to deny or modify requests.

The type C19Q tube uses the same inputs as a conventional cathode-ray tube. The time between radar pulses is used to form characters. Brightness and size of the characters can be changed at will by the operator.

Random characters can be displayed on the Stromberg-Carlson tube at the rate of 50,000 per second. Average tube life is said to be several thousand hours.

## Ferrite Microwave Amplifier Developed

Ferrite sample in microwave cavity that is resonant at two frequencies is key to experimental microwave amplifier-oscillator with expected low-noise characteristics

SOLID-STATE microwave amplifier using a ferrite material as the active element has been successfully operated at Bell Labs. Although still in the laboratory stage, it has possibilities as an amplifier for very weak microwave signals such as may be encountered in the

## Earthbound Turntable Tests Thor Gyros



Inertial guidance system for Thor and other missiles puts stringent requirements on rate gyros. These must detect accelerations from one cycle every 14 years to 15 g's. Special turntable at GM's AC Spark Plug Div. is earthbound and rotates exactly once a day, while gyro is held stationary

fields of radio astronomy, microwave relaying and radar. It operates at room temperature and is expected to have a much lower noise level than conventional microwave amplifiers.

This amplifier has certain superficial similarities to the solid-state spin oscillator that was proposed by Bloembergen of Harvard and first made to oscillate by Scovil, Feher and Seidel of Bell. Both types must be supplied power from an oscillator operating at a higher frequency than the signal to be amplified, but the principles of operation of the two devices are quite different.

The present device requires that a ferrite sample be placed in a microwave cavity that is simultaneously resonant at two signal frequencies. Microwave power at a frequency equal to the sum of the two signals is then pumped into the cavity.

A d-c magnetic field, properly oriented and of sufficient intensity to cause gyromagnetic resonance at the sum frequency, must also be applied. Through nonlinear cou-

pling in the ferrite, amplification or oscillation will be exhibited at either of the lower frequencies, or frequency conversion of a microwave signal can take place between these two frequencies.

In one experiment, the two signal frequencies were each made approximately 4,500 mc to simplify the circuitry. The pumping power of 9,000 mc was fed into the resonant cavity, and the signal power taken in and out by means of coaxial cable. With sufficient pumping power, oscillations took place at 4,500 mc. When the pumping power was reduced somewhat, amplification was observed at 4,500 mc.

In the experimental setup, the d-c magnetic field (about 2,500 gauss) was provided by an electromagnet, but a permanent magnet could be employed if desired. The field is parallel to the plane of the strip-line cavity and oriented at an angle of about 45 degrees with the cavity.

In another experiment, a cavity was designed to be resonant at the two frequencies of 4,000 and 4,800

mc, with the pumping frequency set at 8,800 mc. Oscillations and frequency conversion were observed at both the lower frequencies.

## Transistors Regulate High Power

TRANSISTOR applications in circuits handling large amounts of power are growing. The Bogen division of the Siegler Corp. has gotten a Navy Bureau of Aeronautics contract to develop a transistorized aircraft converter that has a 100-ampere capacity.

The converter changes 400-cycle power from aircraft inverters to 28-volt regulated d-c. The d-c is used to operate some aircraft accessories and to recharge the plane's batteries.

According to H. Sullivan, the firm's research director, the completely transistorized regulator in the supply will not be the conventional series type. However, conventional silicon transistors will be used in a new circuit arrangement that permits the 100-amp capacity.

## MEETINGS AHEAD

Feb. 20-21: Conf. on Transistor and Solid State Circuitry, PGCT, AIEE, Univ. of Penn., Phila., Pa.

Mar. 3-5: Fourth Annual Electronics Conf., American Management Assoc. concurrent with AMA Annual Exhibit of Electronic Data Processing Equip., Statler Hotel, N. Y. C.

Mar. 17-21: 1958 Nuclear Congress, Engineers Joint Council, AICE, and Atomfair, Atomic Industrial Forum, International Amphitheatre, Chicago.

Mar. 24-27: IRE National Convention, All Prof. Groups, Waldorf-Astoria Hotel and N. Y. Coliseum, N. Y. C.

Apr. 2-4: Conf. on Automatic Optimization, PGAC, ASME, AICHE, ISA, Univ. of Delaware, Newark, Del.

Apr. 2-4: Southwest District Meeting of AIEE, Mayo Hotel, Tulsa, Oklahoma.

Apr. 8-10: Symposium on Electronic Waveguides, Microwave Research Institute of Brooklyn Polytechnic Inst., held at Engineering Societies bldg., New York City.

Apr. 10-12: Tenth Southwestern IRE Conference and Electronics Show, St. Anthony Hotel and Municipal Auditorium, San Antonio, Texas.

Apr. 14-16: Conf. on Automatic Techniques, IRE, ASME, Statler Hotel, Detroit, Mich.

Apr. 17-18: Second Annual Tech. Meeting, Institute of Environmental Engineers, Hotel New Yorker, N. Y. C.

Apr. 18-19: Twelfth Annual Spring Tech. Conf. on Television and Transistors, Engineering Society of Cincinnati Bldg., Cincinnati.

Apr. 20-24: Scientific Apparatus Makers, 40th Annual Meeting, El Mirador Hotel, Palm Springs, California.

Apr. 21-25: Society of Motion Picture and Television Engineers, 83rd Convention, Ambassador Hotel, Los Angeles.

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# Film Pots: Over 500 C

Vacuum deposited potentiometer elements give resolution with high temperature materials

FILM POTENTIOMETERS, which combine sensitivity with ability to withstand high temperatures, are now gaining favor as missile and aircraft equipment components. They have been in limited use for several years.

The hold-up, according to one producer, was the lack of other high-temperature components. That hurdle has apparently been cleared because film pots are emerging from limited to volume production.

The temperature advantage stems from the construction method. Nichrome or platinum alloys are bonded to a substratum. The materials don't have to be formable and varnishes and binders are not required.

Servomechanisms Corp. is completing this month a Signal Corps facility to produce 5,000 film pots a month. It has been producing in volume a pot-motor unit for airborne computers.

Nichrome pots, the firm reports, operate at 200 C and will take 400 C. Some platinum units have stood 650 C. Servomechanisms uses

a linear contact method which results in a noise increase reported as only one or two percent a million cycles.

Fairchild Controls' design employs platinum alloy film with a five to eight-fingered contact to reduce static noise. Applications include a toss-bombing system and other instrumentation. Standard units operate at temperatures to 225 C. A recently-made all metal and ceramic pot operates at 400 C and some have gone to 500 C.

Technology Instrument's Acton Labs is producing a design which seals a nichrome film under a foil. The foil prevents wear and dirt from deteriorating the film. The contact is positioned over the foil and then depressed. Eliminating a sliding contact, Acton says, avoids the effects of vibration.

Markite Corp. has been making for several years a voltage divider pot with a strip of conductive plastic considered substantially infinite in resolution. Helipot came out last year with a glass film resistance element which is fused to a ceramic frame.

publications gives brightness without brittleness. Mirror finishes may be obtained with higher currents, but at the expense of ductility.

The brightening agent in the wood tar has not been isolated and is not found in all tars. Since the tar darkens the electrolyte, prompt cleanup is required to avoid stains on plated parts.

## Silicon Supply To Pass Needs

SEMICONDUCTOR SILICON producing capacity is likely to exceed demand next year. Everybody, one firm says, is building now to handle the market expected in two or three years.

Intentions to price-cut in 1958 are denied. Prices are considered realistic in view of processing costs. But in 1959? "With so many guys in there, somebody will cut price or get out," one producer tells *ELECTRONICS*.

What used to cost \$430 in 1952 is now around \$250. A better grade (two or three parts per billion of boron) now costs \$360 a pound. Some expect simplified processing to drive that below \$200 by 1960, but prices have held firm during the past year.

Two firms have revealed new capacity under construction: du Pont, 50,000 pounds a year, and a Puerto Rican subsidiary of Grace, 20,000 pounds. In addition to these companies, Merck and Westinghouse recently started up new plants and Texas Instruments plans an expansion.

Consumption estimates are: 1956, 10,000 pounds; 1957, 20,000; 1958, 35,000; 1959, 70,000, and 1960, 100,000.

A German process adopted by Merck and Westinghouse yields silicon with boron content of only one part in six billion and resistivity (p-type) of 1,000 ohm-cm. Neither has announced a price and Westinghouse is primarily producing for its own use.

Sylvania is working toward a one part in 10 billion process. Under government contracts, GE is researching a 1,000 ohm-cm process

## Tar Brightens Tin Plate

WOOD TAR, MIXED INTO tin plating solution, allows electrodeposition of bright tin coatings, according to research conducted by the Tin Research Institute in England.

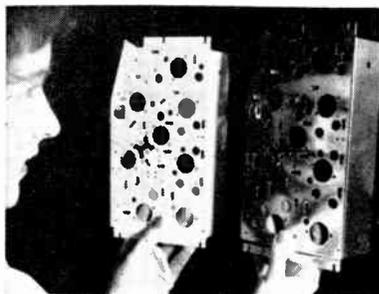
Development of the process has not been completed and it is not established commercially. But it is sufficiently advanced for electronic industry use, reports the Institute's office in Columbus, Ohio.

A large variety of metal parts, including chassis, have been plated in the laboratory with good results. The method serves for any application where a matte coating must be flow-brightened in oil.

There is no difference in porosity of bright and matte coatings of the

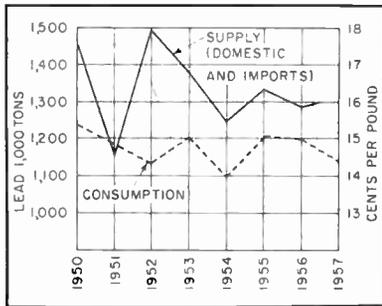
same thickness. The bright deposit solders well.

The current density range recommended in the Institute's technical



Highly reflective tin coating on right was produced by new plating method. Chassis on left has matte coating from ordinary tin bath

and Philco is trying for a 500 ohm-cm method. Eagle-Picher and Foote Minerals have high purity research projects.



Price hangs at 13 cents a pound as overseas abundance depresses domestic market. To bolster prices . . .

## Lead Producers Seek Tariff

FURTHER REDUCTION in lead prices may come unless Congress acts on a raise in the tariff sought by domestic lead producers. They want a sliding tariff that would put a 17 cents floor under U. S. prices.

Lead, firm at 16 cents a pound in 1956, plunged last year. The December-January price of 13 cents is the lowest since early 1954.

Overseas prices have slumped below nine cents. Well over a third of U. S. consumption comes from imports, due to the lower prices which lead commands overseas.

The long-standing tariff rate is one and  $\frac{1}{2}$  cents a pound. That and transportation costs usually allow a price differential of two to 2.5 cents between here and Europe.

The greater spread in prices is keeping domestic lead sales depressed. A tariff of around six cents a pound would be needed to offset present foreign prices and put lead back at 16 or 17 cents.

Trade sources are hopeful about getting something near that. Although Congress has been slicky about upping tariff supports in general, the administration is showing a favorable attitude towards lead and a few other metals in trouble.

Some lead producers blame U. S. stockpiling—or the present lack of it—for their predicament.

## More Uses for Solid-State Art

SOLID-STATE COMPONENTS regarded as research possibilities a short time ago are being discussed today as working elements in operating circuits.

This fact highlighted the 1958 Transistor and Solid-State Circuits Conference which opened yesterday in Philadelphia.

An outstanding paper was delivered by C. J. Kraus of IBM on an 8 by 8 superconductive memory plane. The two basic principles of superconductivity used in the memory: (1) the resistance of many metals decreases to zero at temperatures slightly above absolute zero; and (2) the zero-resistance state can be destroyed by a magnetic field. This was incorporated in the cryotron by D. A. Buck.

By connecting several cryotrons a basic computer-type circuit can be constructed. Fabrication of an 8 by 8 superconductive memory plane is a conventional process which can be readily accomplished by step-by-step vacuum-metalizing techniques. A further advantage is that the individual planes (comprised of passive elements) operate in an inert atmosphere, making high reliability a natural consequence of design.

Q. W. Simkins of Bell Labs. discussed the fan-out, fan-in and speed capabilities of the transistor-resistor-logic building block and the flexibility possible in its application. He showed that in many applications trl compares favorably with other forms of semiconductor logic circuit.

A paper on devising switching circuits which better utilize the capabilities of existing devices was delivered by A. K. Rapp and M. M. Fortini of Philco Corp.

One of the major factors limiting the switching speed of saturating transistor circuits is the delay caused by minority-carrier storage. These stored carriers are most quickly removed by applying a reverse-bias voltage to the base emitter diode. Instead of turning off the conducting transistor by merely bringing its base to ground as in conven-

tional gating, Rapp and Fortini suggested circuits to bring the base to an off-bias voltage.

## Special Users Hit FCC Plan

MEETING this week of the Special Industrial Radio Service Association saw storm warnings raised against FCC's proposed Business Service which may replace the Special Industrial Service.

SIRA's executive chairman told the sixth annual meeting in Detroit the proposal would "create havoc" among present licensees. He called the Business Service which could license "anyone engaged in lawful business" a glorified citizens' band.

Members were cautioned against making hasty changes in coming two-year adjustment period.

FCC protection offered during this transition includes favoring narrow-band over broad-band users, delaying business application grants, and giving special consideration to cases involving costly changes.

Unofficially FCC says it's not likely that the Special Industrial Service will be abolished. A smaller spectrum area having more "split" channel space may define a new shape for the SIS band.

## Control Wiring Failed Vanguard

BROKEN WIRE or connector in Vanguard's electronic control system is believed by the Naval Research Laboratory to have been the cause of its failure in flight Feb. 5.

Preliminary findings, said NRL last week, indicate a wiring defect somewhere between the automatic pilot in the second stage rocket and the hydraulic servo system in the first stage.

As for the Atlas ICBM destroyed in flight Feb. 7, there were rumors in the industry this week that a spurious radiation signal sent it off course.

# Money On the Way

**Extra military appropriations already being felt. First new dollars going to firms with hardware ready**

FIRST TO FEEL the effects of the \$1.26 billion supplemental appropriations bill for fiscal 1958 are the subcontractors who can supply the primes with already existing hardware from their shelves.

In fact, actual payment to subs in some cases has already been made due to obligation of funds for projects in anticipation of the President's signing the bill.

The primes, who are buying and paying their subs for equipment, will be the last to endorse a government check for deposit. Progress payments may be made by the Department of Defense to the

primes, if so stipulated in the contract, but final payment is not made until the project is delivered. The lead time on many projects frequently runs into years.

Component suppliers to ballistic missile producers will get the most (\$683 million is earmarked for production step-up of ballistic missiles), next is ballistic missile detection (\$329 million), SAC alert and dispersal (\$219 million), and space (\$10 million).

Companies that stand to gain immediately are producers of accelerometers, gyros, servo components, transistors, magnetrons, transformers, resistors, potentiometers, switches, relays and test equipment.

Though passage of the appropriations bill for fiscal 1959 will probably not be taken up by Congress until the end of the session, the electronics industry will play a major role.

## MILITARY ELECTRONICS

• Army wants to launch two earth satellites weighing from 300 to 700 lbs before year's end. Satellites would be equipped with tv and electronic recording equipment.

• Low-flying anti-aircraft missile Hawk gets \$13,249,594 Army contract boost to Raytheon. Twenty percent of contract will go for subcontracting missiles and ground support equipment still in the prototype stage.

• New remote control, fire control director for use with both guns and guided missiles has been developed jointly by BuOrd and GE. Designated the Gun and Guided Missile Director, Mark 73, the system, to be used in connection with Navy's Tartar anti-aircraft missile, provides automatic tracking and target illumination in conjunction with radar and computer. GE's contract amounts to over \$5 million.

• CAA will install TI 440 scan converter units next month at 13 air route traffic control centers. Besides providing bright displays of

basic radar information, the 440 retains radar targets on the display up to 30 minutes by showing a trailing blip. Equipment was sold to CAA by Electronics Corp. for a total of \$535,500.

• Besides Nike-Zeus, three other anti-ballistic missile systems are being developed independently by Stavid, Boeing and Sylvania.

• USAF's anti-aircraft missile, Bomarc, is being updated at Boeing. New model will use a solid propellant motor and will have "substantially more range."

• Sylvania has responsibility under multi-million-dollar subcontract for data processing phase of RCA's long range ballistic missile detection radar system.

USAF says cost of overall system will be close to \$700 million.

• Nickname for North America's air-to-surface missile (ELECTRONICS, Oct. 10, 1957) to be carried by the B-52 is Hound Dog. Missile will carry a nuclear warhead for "hundreds of miles."

## CONTRACTS AWARDED

University of Michigan will continue R&D work for 12 months on electronic countermeasures for Army Signal Supply Agency with a \$½ million boost.

New Mexico College of Agriculture and Mechanic Arts gets an estimated \$806,706 contract with the Purchasing and Contracting div., White Sands Proving Grounds, N. Mex., for data reduction services.

Telecomputing Corp. will also supply White Sands with data reduction services under an estimated \$2,446,821 contract.

Hughes gets two USAF contracts: \$21,188,717 for additional production of airborne control and weapons systems for jet interceptors; and \$19,278,275 for advanced versions of the Falcon air-to-air guided missile, GAR-3 and GAR-4.

Servomechanisms gets a \$1,041,371 contract with USAF for manufacture of completely transistorized

Central Air Data Computers, type MG-3, for retrofit program of the B-66.

Raytheon will sell 40 Mariner's Pathfinder 1402 radar sets to the Military Sea Transportation Service for use on ships supplying DEW line. Total contract: \$385,000.

Consolidated Diesel Electric will supply Chance-Vought and Martin with portable test rigs for testing all hydraulic components of the Regulus II and the Lacrosse respectively.

Burrongs announces USAF contracts totaling more than \$37,300,000 for electronic guidance computers for the Atlas.

Giannini gets two contracts for accelerometers with Corps of Engineers, totaling \$232,422.

Firestone Tire & Rubber gets \$1,195,365 contract with Los Angeles Ordnance District for handling and launching equipment for the Corporal.

National Co. wins \$471,060 contract with Army Signal Supply Agency for frequency standard equipment.

Adler Electronics will supply Army Signal Supply Agency with modification services for 299 signal generators, AN/URM-48, under S216,297 contract.

Hallcrafters wins \$882,933 contract with AMC for countermeasure sets, AN/ALQ-18.

Ryan Aeronautical gets two contracts with BuAer for target drones, KDA-1 and KDA-2, totaling \$7,062,858.

Fitel-McCullough gets three contracts with Army Signal Supply Agency for electron tubes totaling \$491,408.

Monmouth Electric will supply Army Signal Supply Agency with 65 wind measuring sets, AN/MMQ-1 under S236,755 contract.



# VIRGINIA'S

**"Greate Road"  
to a great future  
for your plant**

"The Greate Road" of 1624 ran less than a mile between the old and new parts of Jamestown. Even half a century later, when Sir William Berkeley drove out in his coach, he could do little more than travel "The Iron Bound Road" six and a half miles to the present site of Williamsburg.

Virginia's highways of 1958 form a modern 49,000-mile network to serve your plant. Over them, the South's conservative, home-rooted manpower reaches your parking lot. And along the State's heavy-duty highways, truck lines complement railroads to bring you Virginia raw materials from mine, forest, farm and fishery . . . or speed your finished products overnight to great markets of the Northeast, South and Midwest.

Along Virginia highways you will find almost any combination of advantages your new plant needs. Ample industrial water. Abundant electric power. Coal and natural gas. For site-finding help in this land of mild climate, thrifty government, and pleasant living . . . write, phone or telegraph in confidence

## Virginia Department of Conservation and Development

DIVISION OF PLANNING AND ECONOMIC DEVELOPMENT

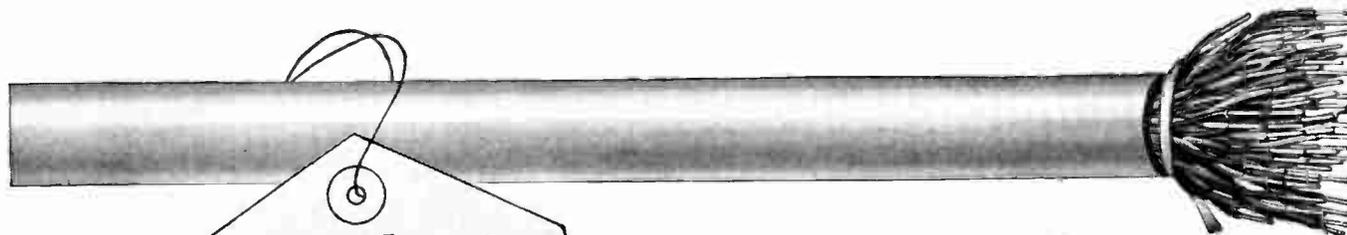
State Office Building, Richmond, Va. Telephone MI 4-4111, Ext. 2911



**If it's worth Engineers' time . . .**



**. . . It's worth Engineered Cable**



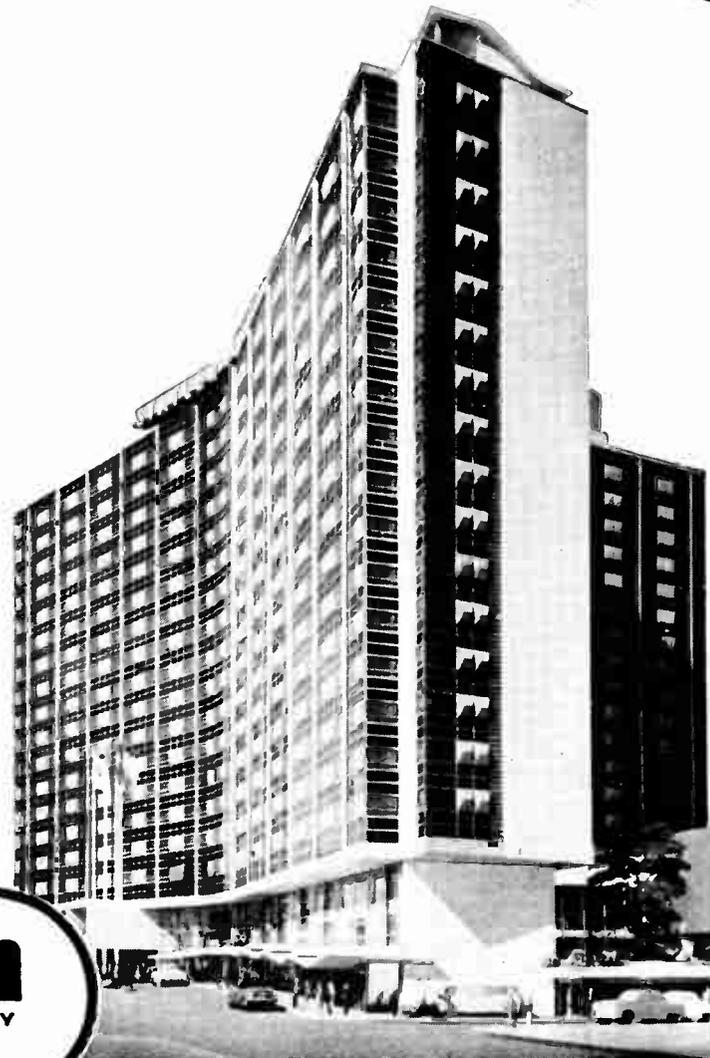
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to meet your needs for  
a permanent, trouble-  
free installation.

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Complete Belden Line"

*Intercommunications systems in  
the Statler Hilton in Dallas,  
and other leading hotels  
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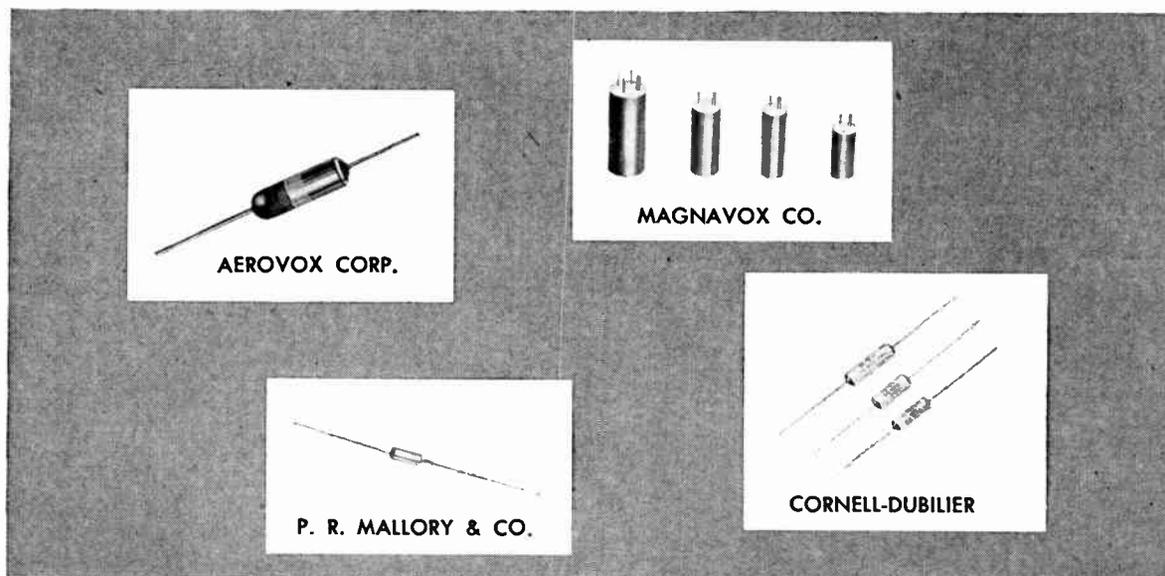
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**WIREMAKER FOR INDUSTRY  
SINCE 1902  
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Magnet Wire • Lead and Fixture Wire • Power Supply Cords, Cord Sets and Portable Cord • Aircraft Wires  
Welding Cable • Electrical Household Cords • Electronic Wires • Automotive Wire and Cable

# Capacitors Feature Small Size



## More Electrolytics Appear

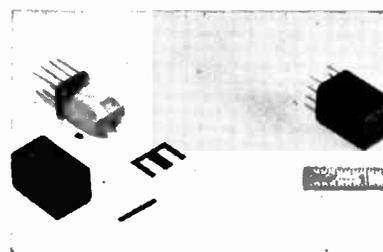
LATEST electrolytic capacitors on the market offer small size in addition to heat and moisture resistance. These features are made possible by use of new materials and configurations.

The Magnavox Co., Fort Wayne 4, Ind., (41), has developed miniature upright aluminum electrolytic capacitors. Each may contain up to three individual electrode elements. Ratings range from  $\frac{1}{2}$  to 680  $\mu\text{f}$ , and voltages from 4 to 150 v. Permissible operating temperature range is  $-20^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . Can heights range from  $\frac{1}{2}$  in. to  $1\frac{1}{4}$  in. and diameters from  $\frac{1}{4}$  in. to  $\frac{5}{8}$  in.

Type EC aluminum-foil electrolytics announced by Cornell-Dubilier Electric Corp., South Plainfield, N. J., (42), are designed for transistor applications. Smallest case size is 0.187 in. in diameter and  $\frac{1}{2}$  in. long, largest size only 0.375 in. by  $1\frac{1}{2}$  in. They are available in ratings from 3 to 75 v d-c working, and in capacitance from 1.0 to 250  $\mu\text{f}$ . The capacitor sections are sealed with a special cast resin, making them moisture-tight and heat-resistant.

P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind., (43), is producing the Tan-Sol type TAS solid electrolyte tantalum capacitors. The electrolyte is not subject to corrosion. The capacitors are of axial lead construction with hermetic glass-to-metal end seals. Leads are about  $1\frac{1}{2}$  in. long, of 0.020 in. wire, nickel-tinned. There are no external welds on the lead wires.

Now available from Aerovox Corp., New Bedford, Mass., (44), are the type WT wire tantalum capacitors, primarily designed for low voltage d-c applications such as transistorized audio amplifiers. They feature small size and operating temperature range of  $-20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  with adequate storage life. The anode tantalum wire extends through the teflon bushing to which a solderable lead is attached.



## Tiny Transformers handle a wide range

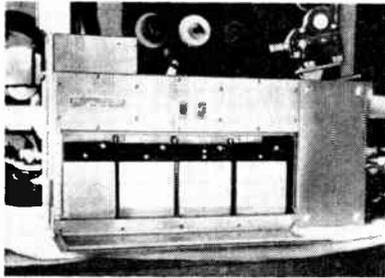
STROMBERG-CARLSON, A Division of General Dynamics Corp., Rochester 3, N. Y., is now producing miniaturized transformers for handling a wide range of audio and carrier frequencies, and designed especially for mounting on printed wiring boards.

Core structures of these new transformers are nickel-iron laminations for the audio frequency units, and ferrite for those in the carrier frequency ranges. Windings are of polyurethane-insulated copper wire, and are separated by Mylar.

Cases are made of injection-molded phenolic in two sizes,  $1\frac{1}{8}$  in. by  $\frac{3}{4}$  in. by  $\frac{3}{4}$  in., and  $1\frac{1}{16}$  in. by  $\frac{1}{8}$  in. by  $1\frac{1}{8}$  in. After assembly the units are filled with an epoxy

For more information use READER SERVICE CARD

casting resin. This construction provides excellent performance under extreme humidity and temperature conditions. **Circle 45 on Reader Service Card.**



### Processor develops film rapidly

FAIRCHILD CAMERA AND INSTRUMENT CORP., Robbins Lane, Syosset, L. I., N. Y., has available an automatic, self-feeding portable rapid film processing device able to develop, dry to dry, 16 mm film at the rate of up to 10 ft per minute, and still attain commercial quality. Ability of the Mini-Rapid 16 to develop an ordinary 100 ft roll of black and white film ready for projection on a screen within 20 minutes after shooting is expected to be of greatest value in engineering photographic work.

After insertion of the first two inches of film in through a slot from the feeding compartment (upper left) it travels automatically from left to right through a series of chemical baths. After last tank it enters a drying compartment and then emerges from the top where a roller winds it up ready for projection. **Circle 46 on Reader Service Card.**



### Multipair Cable reduces installation cost

CLAUDE S. GORDON CO., 3000 S. Wallace St., Chicago 16, Ill. Serv-Rite thermocouple extension wire

is now available in multipair cables with overall polyvinyl plastic sheath. It is claimed that when four or more pairs of wires are needed, the Serv-Rite cable greatly reduces the cost of installation compared to pulling individual pairs through conduit. Cable also permits the use of much smaller conduit than for the same number of individual pairs. Due to rigidity of the cable and its resistance to atmosphere and moisture it can be hung without conduit, or installed in open trough. It is also approved for direct burial. Many of the commonly used types are carried in stock for immediate delivery. **Circle 47 on Reader Service Card.**



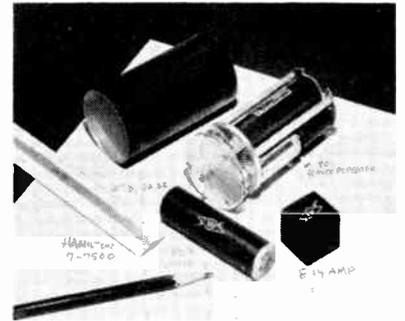
### Reference Supply is hermetically sealed

TRANSISTOR DEVICES, INC., 730 Boulevard, Kenilworth, N. J., announces a new unit to supply current to a load continuously. The 3 lb reference supply will replace up to four reference cells, is hermetically sealed, nonmicrophonic, and has instant operation.

The control permits adjustment to exact voltage specified, between 1 and 6 v at 0 to 5 ma.

Many applications of the device are possible in transistor and vacuum tube bias supplies, instrument supplies for medical and chemical purposes, and the replacement of batteries, since the unit does not run down, wear out,

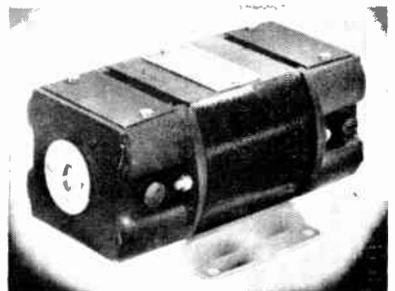
or leak corrosive chemicals. This unit sells for \$50. **Circle 48 on Reader Service Card.**



### Servo Repeater packaged system

WALDORF INSTRUMENT CO., Wolf Hill Road, Huntington Station, N. Y. Model W1801 servo repeater system includes a transistorized servo amplifier, motor, synchro, power supply and gear train, all in a housing 2 in. in diameter by 4 in. long. The only power supply requirements are 10 w, 400 cps, at either 115 v or 26 v. Total weight is 12 oz.

In a typical configuration with a gear ratio of 210 to 1 between the the motor and output shaft, the unit develops shaft position output exceeding 20 oz in. at a velocity constant of 60 sec<sup>-1</sup>. Static accuracy is within 0.1 deg of input from an external synchro or transducer. These characteristics are modified to conform to each specific application. **Circle 49 on Reader Service Card.**

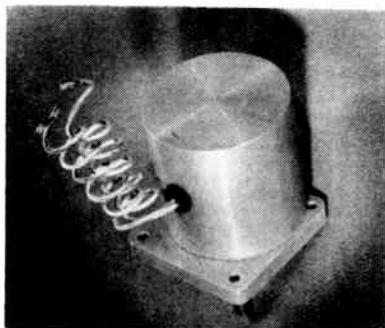


### Motors supply d-c voltage

CARTER MOTOR CO., 2711A W. George St., Chicago, Ill. The entire line of Genemotors has been redesigned for better performance

and easier maintenance. Generators are used as power supplies for mobile and marine radio equipment, as well as for laboratory and geophysical use. They supply a specified d-c voltage and are operated from d-c supply of whatever voltage is available.

Most significant of the new features of the 1958 Genemotors are two removable inspection covers, conveniently located at either end on top of the housing. They permit easy access to the brushes, commutators and bearings for inspection and service, and eliminate the necessity of disassembling the end covers for these operations. A fan-cooled Genemotor has also been added to the line. Circle 50 on Reader Service Card.

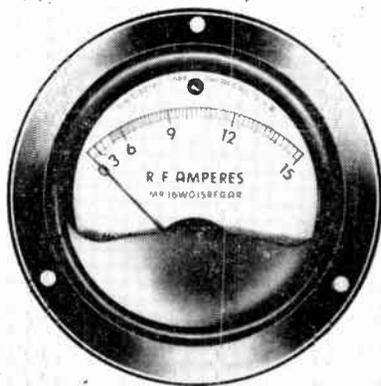


### Actuator Motor features high torque

VIKING TOOL AND MACHINE CORP., 20 Main St., Belleville 9, N. J. This actuator motor which operates to 500 P features high starting torque is suited for the following applications: rotary selector for wafer, coaxial or other types of switches; remote control switching and homing devices; valve operation; electric counters; power stepping switches; and indexing devices of all types. It is basically a compact, lightweight a-c rotary solenoid with a vibrating rate of 120 cps when operated on 60 cycle a-c. This rapid vibrating motion is translated into rotary stepping motion through a unique fast acting one way clutch.

The device features much higher torque for its size and input power than normal solenoids since it is always vibrating within the most efficient portion of a solenoid's stroke and does not have a re-

latively low torque initial pull-in. Inherently the device is moderate speed and at either 60 or 400 cycles will operate at free speeds of less than 300 rpm. Circle 51 on Reader Service Card.



### R-F Ammeters thermocouple type

SUN ELECTRIC CORP., Harlem and Avondale, Chicago 31, Ill., announces a new line of thermocouple type r-f ammeters. Described as having thermocouple characteristics of unusual sensitivity, the double wire construction makes possible the withstanding of greater overload, less power consumption, plus inherent cool-running, trouble-free operation. Meters are of ruggedized design, conforming to Specification MIL-M-10304 and are available for panel mounting in 1½, 2½, 3½ and 4½ in. diameters in ranges up to 0-15 amperes r-f. Circle 52 on Reader Service Card.

### Duplexer Tube used with hybrid couplers

MICROWAVE ASSOCIATES, INC., Burlington, Mass. A 500-kw dual TR tube (bandpass) intended for use with short-slot hybrid couplers has been introduced. The MA-306B duplexer tube was recently developed to satisfy a need for improved duplexer reliability and longer operating life at high incident peak and average powers in X-band pulsed radars.

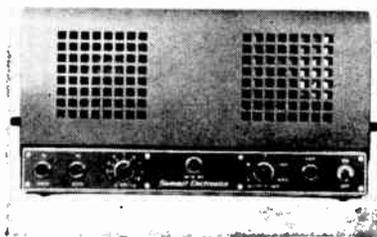
Special design features have been incorporated to sharply reduce arc loss. Input and output flanges mate with hybrid couplers in RG-51/U

and RG-52/U waveguide respectively.

Peak power rating is 500 kw; average power rating, 500 w; vswr 8490 to 9578 mc, 1.2 maximum; duplexer loss at 8490, 9,578 mc—1.2 db maximum; at 9,000 mc—1.1 db maximum; flat leakage power, 10 mw; spike leakage energy, 0.1 erg; arc loss, 0.6 db at 40 kw peak power; recovery time, 7.0 μsec at 500 kw peak power; high level vswr, 1.2 maximum; life, 500 hr at rated power; overall length, 1.555 in.; maximum height from center line of waveguide to keep alive cap, 1½ in. maximum. Circle 53 on Reader Service Card.

### 10-Watt Amplifier with built-in preamp

PYE LIMITED, P. O. Box 49, Cambridge, England. A compact 10-w amplifier with built-in preamplifier, the Mozart is a completely printed circuit unit giving outstanding reliability combined with light weight (only 8½ lb). Features include Dialomatic pickup compensation for easy matching with any pickup, separate volume control and illuminated on/off switch, inputs for pickup, radio, tape-record and play-back, three record equalization positions, and 4, 8 and 15-ohm speaker connections. Circle 54 on Reader Service Card.

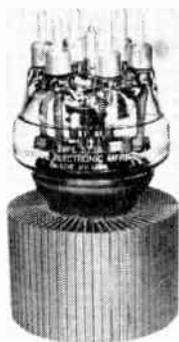


### Power Amplifier for lab or hi-fi

SUMMIT ELECTRONICS, INC., 7 Industrial Place, Summit, N. J. A new precision power amplifier has been announced for laboratory measurement application or to obtain the utmost in fidelity. It is said to feature exceptionally flat frequency response with unusually

low harmonic and intermodulation distortion. Noise and hum level are 70 db below full rated output of 30 w.

Several models are available for varying input impedance requirements, while output impedance is switch controlled from 4 to 600 ohms in all models. Circle 55 on Reader Service Card.



### Power Triode three-electrode tube

CENTRAL ELECTRONIC MANUFACTURERS, Inc., Denville, N. J. Type 5736 power triode is a three electrode tube with a plate dissipation of 3 kw, designed for use as a modulator, amplifier or oscillator in a-m, f-m and tv broadcasting, h-f communications systems and induction and dielectric heating equipment.

The new triode features precise and stable alignment of electrodes and brazed radiator construction. The tube is especially suited to cathode-drive operation due to its four-grid terminal construction which provides a low-inductance connection to the grid.

Maximum ratings of 5.0 kv d-c plate voltage and 7.0 kw plate input apply at frequencies up to 60 mc; operation at 100 mc is possible with plate voltage and input reduced to 80 percent of maximum ratings. Circle 56 on Reader Service Card.

### High-Power Radar features compactness

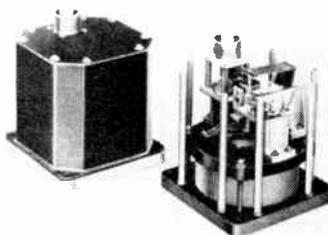
MARCONI'S WIRELESS TELEGRAPH Co., Ltd., Chelmsford, Essex, England, are producing a new high-power (3 megawatt) 10 cm radar transmitter/receiver. Type SR1000

provides in a single compact unit the answer to all modern long-range radar requirements in the fields of early warning, air traffic control, air and coastal defense systems and meteorology. Installed in the larger types of naval vessel, it can function with great efficiency in air-to-surface warning systems.

The equipment is housed in a cabinet only 87 in. by 73 in. by 40 in. and requires only connection to a three-phase a-c supply. Power supplies, cabling system and a comprehensive waveform and performance monitoring system are all contained in the cabinet.

Overload and phase failure protection circuits are incorporated in the equipment. These operate on a "three shot" basis, automatically taking the transmitter off the air and attempting to restore it three times. The SR1000 is designed for unattended operation with full remote control facilities.

Another feature is the comprehensive built-in monitoring system, which automatically and continuously monitors the more important parameters such as peak power, noise factor and swr. Key waveforms are selected for display by press buttons. Circle 57 on Reader Service Card.



### Accelerometer uses air-damping system

AMERICAN ELECTRONICS, Inc., 655 W. Washington Blvd., Los Angeles 15, Calif., has available a new model A101 linear accelerometer. Providing an electrical null output at some predetermined acceleration ambient, the A101 was designed specifically to measure forward acceleration of the ICBM.

The accelerometer, suspended between two NI-SPAN-C springs, utilizes a forcer capable of being

driven from the analog computer to produce 1 lb of force flat up to 20 cps, with linearity of  $\pm 3$  percent, to simulate acceleration of a missile.

Due to an air-damping system which provides a  $0.7 \pm 0.1$  damping ratio, the model A101, despite variation of viscosity, provides an acceleration response which is, in large degree, insensitive to the temperature changes that plague fluid-damped instruments in most accelerometers. Circle 58 on Reader Service Card.



### Power Supplies modular type mounting

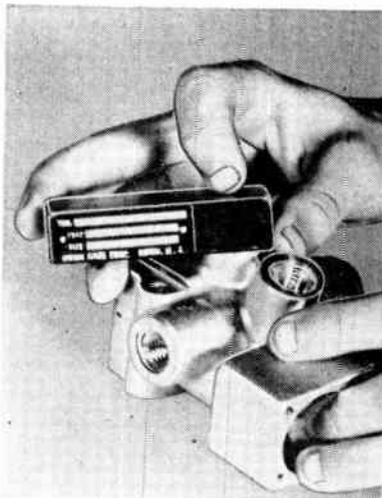
TRANS ELECTRONICS, Inc., 7349 Canoga Ave., Canoga Park, Calif., is now producing two versatile d-c power supplies of modular type mounting design for use in laboratory, test bench or original equipment. Models RS-217A and RS-317 are carefully engineered, rugged packages for chassis or sub-chassis use—for compound use—and can be ordered for rack mounting application.

The two models are similar except for output voltage ranges, designed with instant time-saving demountable construction for substitution and circuit salvage. Output for model RS-317 is 225-325 v d-c at 175 ma continuous duty; for RS-217A, 150-225 v d-c at 175 ma.

Input for both models is 105-125 v, 60 cps a-c; line regulation 0.1 percent; load regulation, 0.1 percent; ripple and noise less than 7 mv peak to peak; recovery time less than 25  $\mu$ sec.

Internal impedance is less than 1 ohm. Dimensions for both mod-

els is 7½ in. by 5½ in. by 6½ in. height overall. Chassis units can be purchased from stock at \$79.50; \$99.50 per unit rack mounted without meters; and \$134.50 per unit with meters. Circle 59 on Reader Service Card.

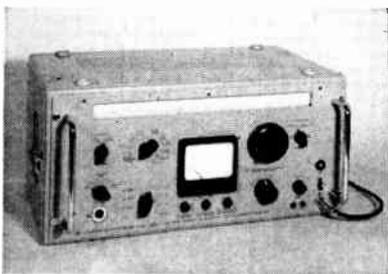


### Flush Pin Gage bar-type device

UNION GAGE CORP., 711 Lehigh Ave., Union, N. J. This gage has been especially designed to meet the problem of gaging in difficult-to-reach positions found in engine and electronic machine work.

This is one of a line of over 150 standard bar and indicator flush pin gages designed to meet 90 percent of depth gaging applications.

These gages are available from stock for immediate delivery and the cost is less than any specially designed gage of similar quality. Circle 60 on Reader Service Card.



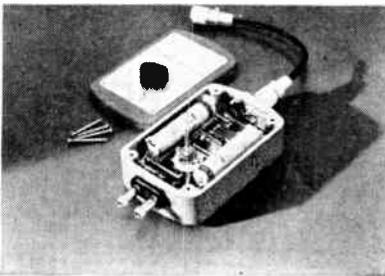
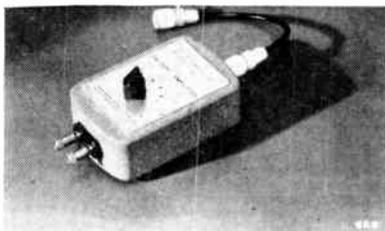
### Microvoltmeter highly selective

INTERNATIONAL TELEPHONE AND TELEGRAPH CORP., 100 Kingsland Road, Clifton, N. J. A highly

selective microvoltmeter with great sensitivity and a frequency range of 20 kc to 30 mc has been introduced. The instrument (type USV11) has a sensitivity of 1  $\mu$ v to 1 v, full scale, and a voltage level range of -120 to 0 db in sub ranges of 10 db, making it ideal for analyzing complex wave forms and taking voltage level readings.

Frequency range of the unit is available in six sub ranges: 20 to 100 kc, 100 to 300 kc, 300 kc to 1 mc, 1 to 3 mc, and 10 to 30 mc. The meter has two bandwidths, 500 cps and 5 kc, the latter usable between 0.1 and 30 mc.

Accuracy of voltage indication at 1 mc and 1 v is  $\pm 2$  percent. Frequency response referred to 1 mc is  $\pm 5$  percent. Suppression of image frequency is better than 60 db. Level is about 0.4  $\mu$ v for 5 kc bandwidth and 0.1  $\mu$ v for 500 cps bandwidth. Input impedance is greater than 500 kilohms with 200  $\mu$ mf in parallel. Circle 61 on Reader Service Card.



### Decade Amplifier a transistorized unit

TABER INSTRUMENT CORP., North Tonawanda, N. Y., has developed a high gain, broadband transistor a-c decade amplifier. It is primarily designed to magnify weak input signals and to extend the sensitivity of high impedance input devices such as oscilloscopes, oscillograph amplifiers, null balance recorders and vtvm's.

Model 194 G is an ideal amplifier

for use with a-c strain gage bridge circuits such as incorporated in the company's teledynes (fluid pressure transducers).

This general purpose laboratory amplifier has a low noise level, is hum-free, and nonmicrophonic. It operates from two self contained 5 v mercury batteries. These batteries have a useful life of 1,000 hours of continuous operation at normal room temperature. Exceptional stability is achieved through utilizing d-c coupled stages with 80 db of d-c feedback around the complete transistor amplifier. Circle 62 on Reader Service Card.

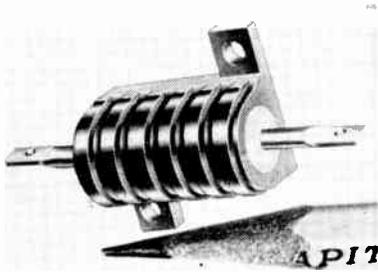


### Relay Eliminator has no moving parts

TREPAC CORP. OF AMERICA, One Engle St., Englewood, N. J. Model 530 Trepac (Teleprinter relay eliminator package) is the first of a series of transistorized kevable switching devices designed to replace conventional electromechanical relays. These units, packaged as small plug-in type devices equipped with standard octal plugs, consist principally of power transistor circuits with silicon diodes and built-in rectifiers which enable them to be powered directly from the 115 v, 60 cps line. Model 530 Trepac was designed to replace the W. E. type 255A polar relay that normally would be installed in the housing of teletypewriters. In this usage it not only replaces the line relay but it also eliminates the need for the separate power supply, current-limiting resistors and spark-suppressing filter and it simplifies the printer-table wiring.

Since the unit has no moving parts and consequently no sparking, arcing or bounce, or contacts or

armature wear, it is virtually maintenance-free and extremely reliable. **Circle 63 on Reader Service Card.**

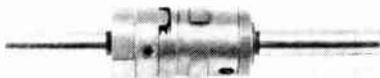


### Wirewound Resistor subminiature type

DALE PRODUCTS, INC., Columbus, Nebraska. The Dalohm subminiature 10-w powerhouse resistor provides precision resistance, high power capacity and excellent heat dissipation in the short space of  $\frac{3}{4}$  in. square, not including terminals. It is available in tolerances of  $\pm 0.05$  percent to  $\pm 3$  percent with a resistance range from 0.05 ohm to 30,000 ohms, depending on tolerance specified.

When panel mounted on aluminum, the RH-10 will dissipate 10 w, derating to 0 at 275 C. Conservative wattage rating in free air is 6 w.

The entire resistor element is ruggedly constructed with welded termination throughout. This precision wound element is suspended in a special shock absorbing compound, which also completely seals it from extreme environmental conditions. **Circle 64 on Reader Service Card.**



### Indexing Clutch for high speed use

DIGITRONICS CORP., Albertson Ave., Albertson, L. I., N. Y. The Dykor model S-100 clutch is the

basic component of the A-100 mechanical pulse amplifier indexing clutch and is now available as a separate low-cost unit. It uses the wrapping principle of a helical wound coil to give precise indexing and transmission of high torque relative to low energizing force, in short response time.

A triggering force of 0.05 in.-lb engages the clutch in 1 millisecc to transmit at least 10 in.-lb of torque. Angular increments of one revolution or  $\frac{1}{2}$  revolution are standard model.

High shaft speeds and fast triggering are possible because of the low inertia parts. In the one revolution index at least 40 cps are feasible.

The unit is specifically designed for high speed precision indexing in such applications as stepping devices for tape in electronic computers, one revolution positioning in instrument and automatic machinery, and photographic sequencing. **Circle 65 on Reader Service Card.**

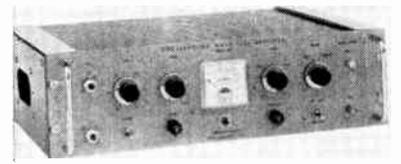


### High-Vacuum Station mobile unit

VEECO VACUUM CORP., 86 Denton Ave., New Hyde Park, L. I., N. Y. Model VS-9 high-vacuum pumping station combines mobility with versatility. It features very fast pump-down; extremely high vacuum with bakeout, better than  $10^{-7}$  mm Hg; high speed air-cooled diffusion pump with an 85 liter per sec capacity, with no water connection needed; specially designed low-loss cold trap which will operate from

8 to 10 hr on one filling; full valving, including roughing line; ultrastable RG-3 ion gage circuit, and the RG-75 non-burnout ion gage. The RG-3 circuit has a measured drift of less than 2 percent of full scale per day, and permits readings down to  $2 \times 10^{-8}$  mm Hg.

A leak detector can easily be connected to the auxiliary leak-test line, so that an object can be leak-tested while it is being evacuated. Special atmospheres can also be introduced into the evacuated object through this line. **Circle 66 on Reader Service Card.**



### TWT Amplifier provides high gain

ALFRED ELECTRONICS, 897 Commercial St., Palo Alto, Calif. Model 505 traveling wave tube amplifier provides high gain, flat response, and versatile modulation characteristics over a 2 to 1 bandwidth. A 10-mw power output is available from 1 to 2 kmc. Through front panel grid and helix connections, which permit f-m, a-m and phase modulation, a wide variety of operations may be performed. Model 505 may be used as amplifier for millimicrosecond rise time r-f pulses or for linear amplification of wide band, complex modulated r-f signals. Other applications include generation of extremely stable microwave oscillations using external resonant feedback circuits, Doppler radar simulation, and age amplifier operation.

A high gain regulator amplifier and a special heater supply assure extremely stable operation. Low spurious modulation characteristics are obtained through use of a double shielded solenoid.

Also available are twt amplifiers that provide 10 mw and 1 w output from 1 to 12.4 kmc. **Circle 67 on Reader Service Card.**

# Literature of the Week

## MATERIALS

**Natural Mica.** Ford Radio & Mica Corp., 536 63rd St., Brooklyn, 20, N. Y. To provide engineers with helpful information, the company has prepared special brochures giving up-to-date technical data on mica, the types of materials available and tips on how to design electronic insulation incorporating the natural material. Circle 68 on Reader Service Card.

## COMPONENTS

**Miniature Couplings.** Thomas Flexible Coupling Co., Warren, Pa. Bulletin MC-100 illustrates and describes a line of miniature couplings for use on servomechanisms, computers and other small devices. Prices are included. Circle 69 on Reader Service Card.

**Silicon Rectifiers.** Audio Devices, Inc., 620 E. Dyer Road, Santa Ana, Calif. Data sheets No. 1 through No. 4 describe silicon rectifiers designed for use in radio, tv and electronic devices where low cost is an important requirement. Circle 70 on Reader Service Card.

**Transistorized Time Delay.** Tempo Instrument Inc., 240 Old Country Road, Hicksville, N. Y. Tech Data No. 1357 is a 4-page illustrated brochure describing a line of electronic time delay relays. The relays discussed are of sub-miniature design and employ transistor circuits—all moving parts except relay contacts have been eliminated. Circle 71 on Reader Service Card.

## EQUIPMENT

**Accelerometers.** Donner Scientific Co., Concord, Calif. Data file #10 is a 4-page bulletin containing illustrations, photos, specifications and descriptive matter covering a line of vacuum-tube and transis-

torized accelerometers. Circle 72 on Reader Service Card.

**Automatic Controls.** General Controls Co., 801 Allen Ave., Glendale 1, Calif., has released a new catalog titled "Automatic Controls." It groups together a wide selection of automatic controls most commonly used in designing automatic systems. Circle 73 on Reader Service Card.

**Magnetic Storage Drums.** Bryant Chucking Grinder Co., P. O. Box 620, Springfield, Vt. A 4-page folder covers magnetic storage drums. Illustrated description, chief features and performance characteristics are given. Circle 74 on Reader Service Card.

**Pulse Code Generators.** Electro-Pulse, Inc., 11861 Teale St., Culver City, Calif. A 4-page, 2-color catalog describes the 5100A series programmed current pulse generators for use in design and test of memory components and digital logic. Circle 75 on Reader Service Card.

**Radome Testing.** Textron Inc., 1421 Old County Road, Belmont, Calif. Recording of the deflection angle of a radar beam caused by the plastic radome are made automatically by a system described in Form 150-257. Circle 76 on Reader Service Card.

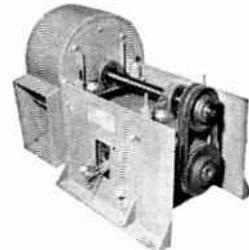
## FACILITIES

**Reliability Testing.** Networks Electronic Corp., 14806 Oxnard St., Van Nuys, Calif. A new environmental and qualification testing brochure is available which illustrates and describes facilities, equipments and instrumentations used for testing electronic and electrical components for missile, rocket and aircraft applications. These laboratories are available to general industry for component reliability tests. Circle 77 on Reader Service Card.

## American Blower suggests: EASY WAY TO END HEAT FAILURES IN ELECTRONIC UNITS

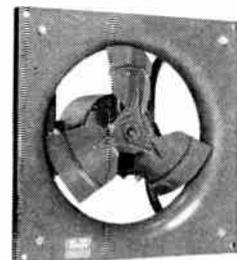
Problem: End malfunctions from self-generated heat in sensitive electronic equipment. Solution: Provide dependable cooling with an American Blower packaged air-moving unit. Numerous sizes and designs to choose from—many can be modified as needed. Or, if necessary, we can start from scratch and design a fan or blower to fit your exact needs. Individual specification bulletins are available; write, detailing your requirements. American-Standard\*, American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

### FOR COOLING TRANSMITTERS



Heavy-duty, V-belt-driven blower. Capacity: 517 cfm @ 0.25" sp @ 640 rpm and 1400 cfm @ 1.5" sp @ 1642 rpm. Bulletin 2712.

### FOR COOLING CABINETS



Propeller fan. Capacity: 1325 cfm @ 0" sp to 310 cfm @ 0.62" sp @ 1725 rpm. Write for Bulletin 4812.

\* AMERICAN - Standard and Standard are trademarks of American Radiator & Standard Sanitary Corporation.



CIRCLE 26 READERS SERVICE CARD

# FCC Reports Odd Cases

**Mother nature and human nature conspire to show FCC's monitoring bureau that anything can happen**

CLEANINGS from the latest FCC reports show pranks afflicting the spectrum from many causes. Examples:

**Washington**—MAYDAY and SOS distress signals coming from the same transmitter were investigated. A 15-year-old ham called for help when his step-father and mother quarreled. FCC warning: "International distress doesn't include domestic trouble."

**Georgia**—Location of a patrol car was broadcast in a feminine voice over the car's transmitter. Police found a teen-age girl had stolen the car and called for help to escape companions whose behavior she didn't approve.

**California**—Railroad officials complained of a strong interference signal gumming up their communications. Investigation traced the signal to a defective control relay in the transmitter of the railroad's own yard locomotive.

**New York**—A commercial station here and a government station in Florida called for help in finding mystery jamming. FCC found the source in Virginia. A defective electronic heater in a Martinsville plant was emitting excessive radiation.

**Georgia**—Five unlicensed transmitters were found

being operated by a small town police department. The chief thought he had authority from the county sheriff who, in turn, thought his "approval" came from the state highway patrol.

**Washington**—A tv viewer reported aviation radio messages giving competition to channel 29. Inquiry showed a certain make of tuning component in his and other sets, to be the villain. A filter solved the problem.

**Michigan**—Licensed radiomen complained of interference which was finally traced to four youths who had set up their own network to hear each other's phonograph records. The unlicensed disk jockeys were let off with a warning.

**California**—Induced voltage from an Oakland station affected the dockside loading cranes. Stevedores soon tired of carrying r-f voltage as part of their work, discontinued cargo handling until the 10-kw station closed down for the night.

**Puerto Rico**—Interference to tv reception here was traced to a poor connection at a nearby aeronautical beacon. About the same time, a stateside aviation station had its troubles traced to a faulty f-m transmitter nearby.

**California**—Service at a land radar station was disrupted by a Navy ship's radar. Sailors denied it, pointed to the motionless antenna. A check showed the transmitter was still turned on.

## FCC ACTIONS

- Amends Motor Carrier rules to simplify information filing by applicants. Effective March 3—a week from Monday—applicants need only identify authorization for operating, and need not submit letters from principal carriers they serve.

- Finalizes part of "split channel" rule making by reducing from 2.37 to 1.365 mc space allowed to Railroad Radio Service in 152-162-mc band. Space gained is slated for Maritime Mobile, Motor Carrier, and Auxiliary Broadcast services.

- Invites comment by April 1 on proposed ruling that technical standards adopted in Docket 11253

be mandatory in all new systems in the 25-50 and 152-162-mc band; and that space thus gained be made available to other applicants. Proposal will allow equipment now in use to stay in operation under certain conditions.

- Permits Western Union to establish rates for class M full-descriptive service on basketball games to be played at Kalamazoo's Western Michigan gym.

- Extends American Broadcasting/Paramount Theatres' permit to supply tv programs broadcast on U. S. stations to Canadian stations in Montreal, Quebec, Toronto, and Vancouver. Permission is extended to next February.

## STATION MOVES and PLANS

**WMUR-TV**, Manchester, N. H., gets initial decision looking towards grant of license to cover present operation.

**KYAT**, Yuma, Ariz., slated for hearing on request for extension of time to construct station.

**WSEL**, Chicago, receives c-p to change antenna-transmitter location.

**WLCK**, Scottsville, Ky., modifies c-p to change type transmitter, studio site, and remote control point.

**WLYN**, Lynn, Mass., receives waiver allowing sign-off at 6:30

# General Insurance of America tested ... and picked audiotape

p.m. from April 28 to Sept. 30.

**WJMJ**, Philadelphia, plans operating transmitter by remote control while using nondirectional antenna.

**WFST** (a-m, f-m), Caribou, Me., transfers license to Northern Broadcasting.

**KXLJ**, Helena, Mont., obtains license grant for tv station; antenna 370 ft.

**KDLA**, DeRidder, La., plans to install new transmitter.

**WRDB**, Reedsburg, Wis., plans increase in antenna height.

**KHOL-TV**, Kearney, Neb., gets license to make changes in station facilities.

**KUOM**, Minneapolis, Minn., gets license covering change of antenna-transmitter location, and use of a combined a-m/f-m tower.

**WFLW**, Monticello, Ky., installs new transmitter, changes frequency, power, and raises antenna height.

**WEAR-TV**, Pensacola, Fla., replaces expired c-p for changes in tv station.

**WFMB**, Nashville, Tenn., operates transmitter by remote control.

**WJEJ-FM**, Hagerstown, Md., receives authority for second remote control point.

**WXAL**, Demopolis, Ala., files for permission to determine operating power by direct measuring of antenna power.

**KIFI**, Idaho Falls, Idaho, seeks c-p change to go from 1400 to 1150 kc, up power from 250 watts to 5 kw.

**KVSO-TV**, Ardmore, Okla., files for extension of completion date.

**KCJB**, Minot, N. D., gets license covering changes in tv station.



*Chief Engineer cites type EP Audiotape for "dust-free coating, uniform signal output . . . high precision"*

WHEN General Insurance Company of America bought four Electrodata tape transports 18 months ago, they knew one thing: their computing system should have the finest magnetic recording tape available. It was decided that the best way to make the final decision was to test.

The tests started immediately. Every nationally known make of magnetic recording tape was used on the transports for at least a month. The result was clear; type EP Audiotape was chosen.

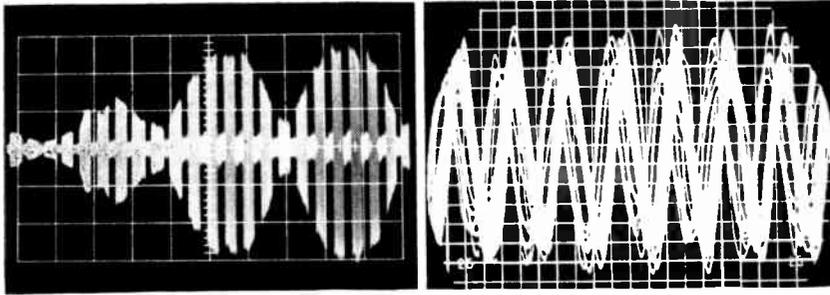
As D. G. Jessup, Chief Engineer of General's Computing Department, wrote in a letter to Audio Devices, "To obtain the optimum reliability and performance from our computing system we need the oxide dust-free coating, uniform signal output level correct in both directions of travel, and high precision reels which you supply. Keep up the good work!"

The extra precision Mr. Jessup found in type EP Audiotape is not a matter of chance. Rather it is the result of meticulous selection and inspections that start when the master rolls of base materials are examined for uniformity. The quality control is continued through the manufacturing process, ending only when the tape is checked by a defect counter, rejects discarded, and the defect-free tape packed in sealed containers. This high standard of control is backed up by our guarantee that every reel of type EP Audiotape is defect-free.

For more information on type EP AUDIOTAPE, write for Bulletin T112A. Write to Box TE, Audio Devices, 444 Madison Ave., New York 22, N. Y.

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**Beeps from Russia's Sputnik, left, contrast with signals telemetered from U. S. Army's Explorer I. Here is the story of how the data is gathered, what it means and the electronic circuits . . .**

# Inside Our Satellite

LOS ANGELES—"By Jupiter, we've done it."

This is the feeling these days among Cal-Tech's JPL electronics team members as Explorer I, U. S.'s first satellite, streaks overhead. The team was responsible for satellite's 11-lb payload.

Latter contains, among other devices, two transistorized, crystal-controlled transmitters.

A 0.01-watt transmitter, expected to last for two months, operates on 108 mc. It telemeters data on nose-cone temperatures, micrometeorite impact and heavy primary cosmic rays. This low-power transmitter feeds a dipole antenna, created by electrically splitting satellite shell.

The 0.06-watt transmitter, which lasted for 11 days, operated on 108.03 mc. It telemetered data on skin and internal temperatures, micrometeorites and cosmic rays. This high-power transmitter fed a turnstile antenna composed of four wires coming out of the center of the satellite.

The transmitters are composed

of 54-mc oscillators, frequency doubler and power-amplifier circuits. Bell Labs diffused-base transistors are used for r-f circuits. Elsewhere, TI silicon transistors are used. Mercury cells furnish power for individual transmitter power supplies.

Skin-temperature sensors are located at glass-fiber rings between the instrument section and the final-stage motor, and between the instrument section and the nose cone. The internal temperature is picked off just aft of the high-power transmitter.

Continuous cosmic-ray count is accomplished by a miniature Geiger-Mueller tube in the instrument section. Data was telemetered simultaneously by both transmitters, now by one. Average counting rate, scaled down by 32, causes a frequency change once each second. System can speed up and transmit at 40 times normal rate during intense solar or magnetic storms.

Micrometeorite action is sensed through two systems. First contains 12 grids of fine wires in par-

allel on the outside of the shell. When the wires are struck by particles, they break. This changes the total resistance of the grid system. The change in resistance is telemetered to earth. A second micrometeorite sensing system uses sensitive microphone reporting sounds of slightly larger micrometeorites striking the outer shell of the satellite.

One tough packaging problem was to maintain temperatures so that germanium transistors wouldn't get too hot and mercury batteries wouldn't freeze. Without precautions, temperatures could vary from 150 C to -100 C. Eight equally spaced one-fourth-inch zirconium oxide stripes on satellite nose help hold the total temperature range to 50 C.

Another problem was minimizing effects from 700 rpm spin and 100-G initial acceleration. The piezoelectric crystals that control transmitter frequencies are mounted on the spin axis, and in a plane so that the thrust loading during the launching phase would give least amount of trouble. Other electronic components are mounted as close to spin axis as possible. The supporting structure was cantilevered wherever possible to take punishing loads. Each transmitter's batteries, for example, normally weigh one pound. In launching accelerations they were equivalent to 100 lb. of dead weight.

Electronic tracking of the missile during launching was done by ABMA scientists. The missile contained an inertial-guidance autopilot. It was programmed to arch over to horizontal flight above a 200-mile altitude. No radio guidance was used.

## Satellites Compared

Satellite	Total Weight (lb)	Overall Size (in.)	Instrument Compartment	Transmitter Frequency (mc)	Apogee Height (mi)
Sputnik I..... (USSR)	184	22.8 diam (spherical)	.....	20.005 40.002	560
Sputnik II..... (USSR)	1,120	(conical)	.....	20.005 40.002	1,056
Explorer I..... (U. S.—Army)	30.8	79 (cylindrical)	20 by 6 (diam)	108.00 108.03	1,700
Vanguard I..... (U. S.—Navy)	21.5	20 (spherical)	7 by 5.5 (diam)	108.00	.....

# Plato Creates New Market

**Army's new project to provide anti-missile missile for field troops means three things to our industry. It's all here . . .**

DETAILS RELEASED last week of Project Plato, Army's "antimissile missile for field troops," had three main meanings for the electronics industry.

- Another "multi-million dollar" new market . . .
- Another technical triumph over what was considered four years ago to be an "impossible" assignment, and . . .
- Another serious tactical gap filled.

Under development for the past four years by Weapons Systems Manager Sylvania Electric, Plato's unique role in the general defense picture seems to assure it of even wider application than that suggested by the Army.

Designed to detect, track and kill in a matter of seconds anything from an IRBM to a short-range anti-tank missile, Plato will be needed by American and NATO troop installations overseas, SAC bases, for NATO civil defense, and on our own coasts as a defense against enemy missiles launched from submarines.

Besides flexibility, Plato has the additional advantage of mobility, despite its bulk. The entire system can be moved to strategic sites by air transport, trucks and trailers.

Although classified, specific components and their sophistication can be outlined by looking at Plato's almost simultaneous sequence of tasks.

An incoming missile must be detected at great enough range to provide time to track the intruder, compute its trajectory, and arm and launch the antimissile missile. The magnitude of this job can be appreciated after considering that the radar cross-section of an IRBM is less than 0.25 square meters and must be detected as far away as 1,000 mi. Short range missiles on the other hand involve different radar techniques.

Plato's detection equipment must be able to distinguish between an IRBM and a meteorite or perhaps a decoy missile which the IRBM might release as a defense counter-measure.

The trajectory and velocity of an intruding IRBM, once it has been detected and is being tracked, must be computed. Different programming is required for shorter range guided missiles.

When the antimissile missile is launched, it is picked up and tracked by a guidance radar. It is kept on an interception path by a computer which sends in periodic flight-path corrections.

The actual missile to be used by Plato is Army's Nike-Zeus, also slated to be the kill bird in the anti-ICBM system. Payloads will be interchangeable according to target. A nuclear warhead would naturally not be used against short-range anti-troop guided missiles, whereas

it might be against an enemy IRBM or ICBM.

Subcontractors working with Sylvania are Sanders Associates, General Electric and American Machine and Foundry. Redstone Arsenal is technical supervisor of the project; Boston Ordnance District has contract supervision.

Although the specific portion of the system each subcontractor is supplying is classified, Sanders Associates has adapted certain components of Panar (ELECTRONICS, Oct. 20, 1957) for use in Plato. Using a pulsed Doppler technique, Panoramic radar enables quick determination of both velocity and position of a detected object. Panar scans electronically, thereby avoiding the mechanical problems of a rotating antenna.

American Machine and Foundry has done design and development work on a major component of the r-f equipment in the Plato System.

## Transistors In New RAT

A COMPLETELY transistorized guidance system controls fin movement in the Navy's new rocket assisted torpedo, it was indicated this week.

RAT is 16 ft long, weighs 450 lbs. It is aimed automatically by an electronic computer linked with a standard sonar submarine detecting device.

Torpedo was developed at Naval Ordnance Test Station, Pasadena and China Lake, Calif. RAT's payload was made by Clevite Research Center, Cleveland. Librascope, Glendale, Calif., did systems development work, manufactured ship-board computer used. Rocket was made by Allegany Ballistics Lab, Cumberland, Md.

Still classified; torpedo's speed, length of search time, search plan, system's range, type of homing device used.

Sonar feeds range and bearing of prey into analog computer. The computer quickly programs the entire missile flight.

## Slashes Prices Of Transistors

DELCO RADIO division of General Motors cut prices on its line of power transistors by as much as 28 percent earlier this month. It also announced the addition of a new power transistor to the line.

Reductions ranged from 25 cents to \$2.25. Delco now offers 10 power transistor types, \$2.25 to \$18 in production quantities.

New transistor, type DT-80, is a *pnp* germanium high power transistor for general use with a 28 volt power supply and in uses where high voltage transients are met.

# Soviet Reports On Sunspots

**Crimean observatory instrument yields solar flare data. Australian scientists map high radio emission**

SOVIET AND AUSTRALIAN scientists, working independently, indicate that they are coming up with answers to some of the questions radio engineers ask about sunspots. The Soviet studies amplify results reported by the U. S. National Academy of Sciences in the year-end-1957 interim report (ELECTRONICS, Feb. 14, p 12).

From the Crimean astrophysical observatory of the USSR Academy of Sciences last month it was reported:

- A new instrument, a photoelectric solar magnetograph, has made possible a study of the magnetic profile of solar flares.

- Data obtained with this instrument indicates that solar flares are connected with transformation of magnetostatic energy into thermal energy.

The Soviet study, part of the International Geophysical Year, apparently confirms the fact that such flares resemble a thermonuclear explosion. Crimean

observatory director Severny says gases attain a speed of 500 km (about 310 mi) per second. Nuclear processes whose exact nature is unknown are believed to be the cause of the solar explosions.

The Soviet studies (connected with IGY programs investigating ionospheric physics and earth magnetism) confirm that X-rays affect D-layer ionization, and that other sunspot activity causes periodic displacement of the earth's geomagnetic fields.

Meanwhile, Australian scientists studying radio waves from the sun believe their research may lead eventually to improved short-wave communications. Work is being done at the radio physics division of the Commonwealth Scientific and Industrial Research Organization.

The Australians report successful operation of their new crossed-grating interferometer, designed for high resolution observations of the sun. This instrument has 64 parabolic antennas, each 19 ft in diameter, and produces beams less than one-twentieth of a degree wide.

With this instrument Australian scientists produce daily maps of the solar disk on which the position and brightness of the regions of high radio emission are displayed. The maps make it possible to follow the development of these active regions.

## DEVELOPMENTS ABROAD

- Montreal's Jean Talon Hospital has just put into use a new X-ray-tv system operated remotely by a radiologist. Operator is said to be completely protected from radiation and able to work in daylight in a room apart from the patient. Images on tv screen are claimed to be clearer than those produced by other methods. Smaller-than-usual radiation dose for patient is also cited. Apparatus reportedly lends itself to mass X-ray examinations and has special advantages in examinations of the stomach.

- In Australia a 225-ft diameter radio telescope designed by British firm Freeman, Cox and Co. will be constructed in Sydney, with the Carnegie and Rockefeller Foundations reportedly picking up 90 per cent of the tab. Telescope will be

used by Commonwealth Scientific and Industrial Research Organization.

- Yugoslavia expects this year to produce prototypes of automated machine tools. These include: electronically controlled copying-lathe; electroerosion metalworking machine with electronically controlled distance regulation and water supply; ultrasonic boring and grinding machine. Zagreb firm Radioindustrija is reportedly studying electronic controls for the food processing industry.

- Hungary's Orion Works in Budapest says it expects to turn out by 1960 several million transistors of a quality equal to transistors made in Britain in 1957. About 20 percent of Hungary's electronic products are exported.

## EXPORTS and IMPORTS

Japanese electronics firms have indicated interest to the Ministry of International Trade and Industry in getting technical aid from IBM in the manufacture of computer parts. Two plans are reportedly being discussed. One would set up a joint venture in which IBM of Japan would participate along with a group of Japanese firms, including Fuji Communications Apparatus, Oki Electric and Nippon Electric. Hitachi and Tokyo Shibaura Electric are also being consulted. Second plan would supply technical aid to the Japanese firms through IBM of Japan.

French developer of the Caravelle twin-jet commercial transport, Sud Aviation, has ordered \$1.5 million worth of Lear, Inc., L-102 all-transistorized autopilots. Decision by

French firm to specify the autopilot follows 25 months of flight testing in an Air France Caravelle.

Austria is considering a tight radar net over its territory to aid civil aviation and help prevent abuse of airspace. Equipment would be bought on the international market. However, question of who will manage the system—civilian or military authorities—must first be settled.

In West Germany Siemens is reorganizing. Siemens und Halske (low voltage gear) and Siemens und Schuckert (high voltage gear) have each given up part of their operations and turned these over to a new company, Siemens-Electrogeraete AG, Berlin and Munich, whose shares they hold jointly. New firm takes over the whole household appliance field, including radio and tv sets. Siemens reported \$600 million in sales in the year ending Sept. 30, 1957, with the field covered by the new company accounting for about one-sixth of the total.

Greece will soon accept bids for construction of a \$5-million tv station atop Mount Parnes near Athens. Station will have a 50-mile range, cover the Athens and Piraeus basin. Later, other stations will be built to serve both mainland and island areas.

Tokyo's Yokogawa Electric Works has set up a trading company in New York through which it expects soon to export industrial measuring equipment and other products to the U. S. Yokogawa aims to export products that can be produced cheaply in Japan and to import others from the U. S. Japanese firm will send technicians to the U. S. this year to survey automation equipment demands. Foxboro Co., Foxboro, Mass., which has a technical agreement with Yokogawa, will supply American products in the industrial control field.

Britain's Plessey Co. annual report shows that 20 two-way manufacturing agreements with American firms have helped the firm main-

tain its profits before taxation at last year's level of \$4.6 million despite rising costs. Its 1957 highlight was entry into the transistor field through an agreement with Philco.

Australian subsidiary of United-Carr Fastener plans a 30-month expansion program and will add radio and tv components to its manufactured line.

In Nurnberg, West Germany, N.S.P. GmbH has begun operations as the third non-U. S. licensee of G. H. Leland, Inc.

India's nationalized Air Indian International (AI) has ordered a \$1-million electronic flight simulator from Curtiss-Wright. Delivery is expected next January.

In England Elliott Brothers will manufacture instrument motors under an agreement with Holtzer-Cabot division of National Pneumatic Co. of Boston. The servomotors are used in strip recording instruments, timing devices and electronic control systems. Elliott will make the motors for equipment of its own manufacture as well as for instrument makers throughout Europe and the Commonwealth.

Export program of Wiancko Engineering Co. is getting underway this year, with Shallway International Corp. of Palo Alto, Calif., and Crawley, England, acting as Wiancko's export department. Wiancko will export pressure and force pickups, accelerometers, carrier systems, and both ground and airborne f-m telemetering systems for dynamic measurement in aircraft and missiles, and for experimental and production testing.

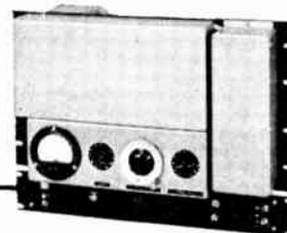
In Wetzlar, West Germany, optical firm Ernst Leitz will use a new \$120,000 Elliott 4201 computer for design of optical systems.

South Africa has ordered from Marconi a 10-kw h-f independent sideband radio transmitter for the station at Klipheuvell. It will be used for telephone and telegraph traffic.



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## Raytheon Expands in West

HAVING been housed temporarily in rented quarters, Raytheon's government equipment division now occupies its new 42,000 sq ft laboratory (picture) in Santa Barbara, Calif. The building is located on a 15-acre site adjacent to the Santa Barbara airport. Plans include provisions for expanding the building up to six times the original floor space.

The new laboratory was established in Santa Barbara to provide the same company talent and facilities on the west coast as have been available in the east. In addition to fulfilling directly needs of various government agencies, this facility has, as one of its primary missions, the servicing of the aircraft and missile industries. Presently employing over 150 people, the laboratory will perform advance engineering and development work in such areas as infrared, countermeasures, communications and radar.

Much of the division's work is of a commercial nature and includes several items for the CAA. Among these are airport surveillance radars used for traffic control and proximity warning indicators for operating in the infrared region. Other projects under way include highly classified devices for the armed services, such as advanced reconnaissance systems capable of detecting and analyzing enemy aircraft or satellite signals.

The Santa Barbara laboratory marks an expansion of Raytheon in California. During the past eight

years, the company has operated a laboratory at the Naval Air Missile Center, Point Mugu. It also maintains commercial sales or service offices in San Diego, Los Angeles and San Francisco, plus government service offices in the latter two cities.

Raytheon presently has a backlog of \$250 million in government contracts. Employing more than 27,000 people, the company operates a score of plants and laboratories in New England, Tennessee and California.

## Garrett Joins NBS Division

ELECTRONIC scientist Lewis F. Garrett has joined the National Bureau of Standards. As a member of the Data Processing Systems Division, he will develop computer techniques for handling real-time problems.

For the past seven years Garrett worked in USAF headquarters, most recently as chief of the Univac section.

## ASTIA Opens New Office

THE Armed Services Technical Information Agency has opened a San Francisco regional office, located at the Oakland Army Terminal.

James V. Ferguson has been as-

signed from Dayton headquarters to head the office. He is assisted by a small staff of Air Force civilian employees.

The new facility is designed to furnish technical report services and assistance to Department of Defense supported research and engineering activities in the San Francisco region, including northern California and bordering states.

## Cohu V-P's Take New Posts

APPOINTMENT of R. T. Silberman, vice-president of Cohu Electronics, Inc., to the presidency of the corporation's Kin Tel Division in San Diego, Calif., is announced.

At the same time, Thomas M. Hamilton is named administrative vice president of the corporation's Millivac Division in Schenectady, N. Y.

Both will retain their vice presidencies in the parent company, and Hamilton will continue to serve as administrative vice president of Kin Tel.



## Filtors Names R&D Chief

RELAY manufacturer, Filtors, Inc., Port Washington, N. Y., appoints Louis De Lallo (picture) as chief research and development engineer.

In this capacity he will assume responsibility for the design and

development of new and improved electromagnetic devices to be added to the line now manufactured by the firm.

Prior to this De Lallo was employed by Norden Ketaf Corp. where as chief potentiometer engineer, he developed high accuracy linear and function potentiometers and potentiometer components. In the magnetics field, while employed by the Sperry Gyroscope Co. as a project engineer, he designed and developed many types of magnetic amplifiers and related devices for use in auto-pilots, computers and control systems.

## Beckman Hires Sales Manager

APPOINTMENT of Austin F. Marx as sales manager for special products for the Berkeley Division of Beckman Instruments, Inc., is announced. He will be responsible for the modification of standard high-speed counting instruments to specific requirements and for the development of custom electronic test equipment.

Prior to joining the Beckman organization, Marx served as a government sales representative for the Stewart-Warner Electronics division of Stewart-Warner Corp., Chicago. Earlier, he was a senior technical editor for Motorola's Communications and Electronics Division.

## Midwest Firm Is Realigned

THE AMERICAN ELECTRONICS Co., Minneapolis, Minn., announces establishment of a new division, organization of a new corporation, and building of a new plant.

New division will be known as Monarch Electronics Co., which, together with the already established American Electronics Co., will become divisions of the newly organized American-Monarch Corp. This expansion was made for reasons of organization and involved no sale of stock, transfer or merger.

Also announced was the purchase

of a 5 acre tract in the twin city area, upon which the firm has already contracted for the building of a new and larger humidity-con-



## Form New Firm In California

FORMATION of Watkins-Johnson Co. in California, to deal in research, development and manufacture of electron devices, is announced. The firm, which expects to locate laboratory and manufacturing facilities in the immediate vicinity of Palo Alto, will specialize in microwave tubes. The company has been formed as a closed corporation with initial capitalization of \$1,100,000.

President is Dean A. Watkins (pictured left), professor of electrical engineering at Stanford University and director of the electron tube laboratory of Stanford's electronics laboratories. He will retain his present connections with Stanford.

Vice-president is H. Richard Johnson (at right), recently resigned as head of the microwave tube department of Hughes Research Laboratories, Culver City, Calif.

Among the members of the board of directors, in addition to Watkins and Johnson are Frederick E. Terman, provost and dean of engineering at Stanford U. and William R. Hewlett, executive vice-president of the Hewlett-Packard Co., Palo Alto. Both of the latter are past national presidents of the IRE.

In his public announcement of the formation of the company, Watkins indicated an employment of between 50 and 75 persons by

trolled plant. The new plant will house both divisions of the corporation and will be completed in mid-summer, 1958.



the end of 1958. He stated an aim of making significant contributions to the national defense effort in electronics. "We intend to bring to practical realization new devices with applications in radar, missile guidance and radio communications", he said.

Both Watkins and Johnson are nationally-recognized leaders in their field of electronics specialization—microwave tubes.

Last fall Watkins received the 1957 Electronic Achievement award of the Seventh Region, IRE. Recently named a Fellow of the Institute, he also received national attention last August with the announcement of his invention of the Helitron tube, which permits instantaneous radar tuning over a prodigious range of microwave frequencies.

Johnson, also a microwave specialist, joined the electron tube laboratory of Hughes R & D in 1951 and succeeded Watkins as head of the microwave tube department in 1953. A senior member of the IRE, he has six patents applied for.

## Westinghouse Ups Mechlin

APPOINTMENT of George F. Mechlin, Jr., as director of advanced systems engineering in the West-

inghouse Sunnydale, Calif., division is announced. He will direct scientists and engineers working on special studies related to the development of experimental handling and launching systems for the Navy's intermediate range ballistic missile, Polaris.

Meehlin joined Westinghouse in 1949 as senior scientist in experimental physics at the Bettis plant of the company's atomic power division in Pittsburgh, Pa. In 1954 he became supervisory scientist on the submarine fleet reactor project, progressing in 1956 to the managership of the project's physics subdivision.



## Heinz In New Post At Ampex

IN A MOVE calculated to strengthen its engineering organization, Ampex Corp., Redwood City, Calif., appoints Winfield Heinz (picture) to the new post of manager of engineering, instrumentation division. The new assignment will enable the growth of the division's engineering effort to parallel the anticipated growth in business volume.

Heinz, formerly Ampex Instrumentation Division coordinator, brings to the new position a professional experience of 30 years in instrumentation, automatic control and process engineering. In addition to holding key engineering positions with industrial firms, he has served as president of a consulting engineering firm bearing his name.



## R-W Gets V-P

FORMER Thompson Products manufacturing executive, Irwin A. Binder (picture), is named vice president for manufacturing of The Ramo-Woolridge Corp., Los Angeles, Calif. In his new position he will be responsible for coordinating all corporation manufacturing efforts involving both commercial and military products. They will include the Los Angeles and Denver manufacturing activities.

## Berkeley Names Sales Manager

NEW sales manager for special products for Berkeley Division of Beckman Instruments, Inc., Richmond, Calif., is Austin F. Marx. He will head sales of nonstandard counting and timing instruments made to special customer order.

Marx formerly served with Stewart-Warner Corp. as government sales representative for the electronics division and with Motorola as a senior technical editor for the communications and electronics division.

## Industro Ups McDougall

OPERATIONS manager of the Industro Transistor Corporation's Long Island City, N. Y., plant. Archie McDougall, has been elected vice president in charge of manufacturing. A production engineer with

25 years' experience in the electronics field, McDougall initiated and has directed production operations in this new semiconductor plant.

Volume production of germanium junction-alloy transistors has been underway at the plant since early December when equipping and production line facilities were completed.

McDougall was formerly superintendent of manufacturing for the Radio Corp. of America. He established and directed production in RCA's Harrison, N. J., and Somerville, N. J., semiconductor plants.



## Reeves Selects Vice President

JAMES A. NOTTINGHAM (picture) is appointed vice president for manufacturing of Reeves Instrument Corp., producer of electronic equipment for military aircraft-missile-satellite systems and for industrial uses. Formerly manufacturing manager at Sperry Gyroscope, Nassau, Long Island, he will direct all manufacturing for Reeves, which has its main production facilities at Roosevelt Field, L. I., N. Y.

## AAC Expands Plant Area

FURTHER expansion in ten years for the Airborne Accessories Corp., Hillside, N. J., is announced. The

latest expansion involves the addition of a one-story building located immediately adjacent to its present facilities. This building is being utilized fully as a tool and engineering model shop to meet the increased demand for experimentation and the development of new electromechanical and electronic equipment.

The other facilities comprise four separate buildings: one for the general, administrative and sales offices; one for the precision machine shop; one for the assembly operations; and one devoted exclusively to engineering and containing an extensive laboratory for testing product quality and performance.

## Plant Briefs

Through the addition of their 12,000 sq ft plant in Bristol, R. I., the Electronics Division of Waldorf Instrument Co., Huntington Station, L. I., N. Y., is offering its facilities for short range subcontracting for complex electronic sub-assembly and final assembly work.

Infrared Industries, Inc. has established a new engineering and production division, Infrared Standards Laboratory, in Riverside, Calif. The division will offer industry and government an infrared test and evaluation center, said to be the first service of its kind in private industry.

Rohm Mfg. Co., Peoria, Ill., manufacturer of tv, communication towers and accessories, acquires an additional 13,750 sq ft of floor space by utilizing two buildings near the present main plant-office building.

## Executive Moves

William C. McDonald moves up from works manager to vice president for engineering and manufacturing at Non-Linear Systems, Del Mar, Calif.

Daniel W. Ruple, formerly production control manager of Aeroquip

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## YOUR LAST OPPORTUNITY . . .

This is your last opportunity to place your "SEARCHLIGHT" advertisement in the March 21st Business Edition of ELECTRONICS . . . the second of the two Radio Engineering Show Issues. Don't miss this opportunity to sell your surplus new electronic equipment and components. "SEARCHLIGHT" advertising forms close on February 28th.

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A MCGRAW-HILL PUBLICATION  
330 WEST 42nd ST. NEW YORK 36, N. Y.

Corp., Jackson, Mich., is appointed assistant to the president of Titeflex, Inc., Springfield, Mass.

Donald M. Christie advances from assistant manager to manager of the equipment manufacturing division of Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

## News of Reps

MICROMATION line of the Electronic Division of Waldorf Instrument Co., Huntington Station, L. I., N. Y., will be handled by the following reps in their respective areas: Frank Bradley Associates, New York, N. Y.; Gerald B. Miller Co., Hollywood, Calif.; Mury E. Bettis Co., Kansas City, Mo.; and John P. Brogan Associates, Westbury, N. Y.

Boston's Epsco Components Division appoints two new field reps: C. B. Parsons & Co. of Seattle, Wash., covering the areas of Washington, Oregon, Idaho, Montana, British Columbia and Alaska; Samuel C. Hooker, Ltd. of Montreal, covering all of Canada except British Columbia.

THREE eastern sales reps will handle sensitive relay line of Baso Inc., Milwaukee, Wis. They are Michael H. Sullivan, Boston, Mass., for the New England area; Par Distributors, Syosset, N. Y., for New York City, New Jersey and Philadelphia; and the Alan E. De-Cew Agency, Sodus, N. Y., for upper New York State.

Sales coverage of Electro-Span digital supervisory control systems has been expanded through the appointment of Andrew L. Polich, Inc., as rep for Oregon, Washington, Montana and Idaho, according to Pacific Division of Bendix Aviation Corp., North Hollywood, Calif.

Gawler-Knoop Co. takes on the magnetostrictive delay lines, storage units and allied equipment of Deltime, Inc., Mamaroneck, N. Y. The Gawler-Knoop outfit provides engineering-sales services to buyers and suppliers alike.

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F. J. Eberle, Business Mgr.

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JAN. 31	FEB. 7	FEB. 14	FEB. 21
FEB. 28	MAR. 7	MAR. 14	MAR. 21
MAR. 28	APR. 4	APR. 11	APR. 18
APR. 25	MAY 2	MAY 9	MAY 16
MAY 23	MAY 30	JUNE 6	JUNE 13
JUNE 20	JUNE 27	JULY 4	JULY 11
JULY 18	JULY 25	AUG. 1	AUG. 8
AUG. 15	AUG. 22	AUG. 29	SEPT. 5
SEPT. 12	SEPT. 19	SEPT. 26	OCT. 3
OCT. 10	OCT. 17	OCT. 24	OCT. 31
NOV. 7	NOV. 14	NOV. 21	NOV. 28
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BUYERS' GUIDE ISSUE—JUNE 15

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**THE DAY  
SOME-  
BODY  
GOOFED**



On April 7, 45 B.C., during the reign of Cleopatra, Memamadun Ptolemy (pronounced me-mama-done-toll-me), radar operator, fell asleep at just the time chosen by some unfriendly neighbors to make a border raid.

Memamadun (he was the only survivor) was brought before Cleopatra.

"Can you give me any reason why I shouldn't throw you to my pet crocodile Julius for letting such a terrible thing happen?" she asked.

Memamadun stifled a yawn.

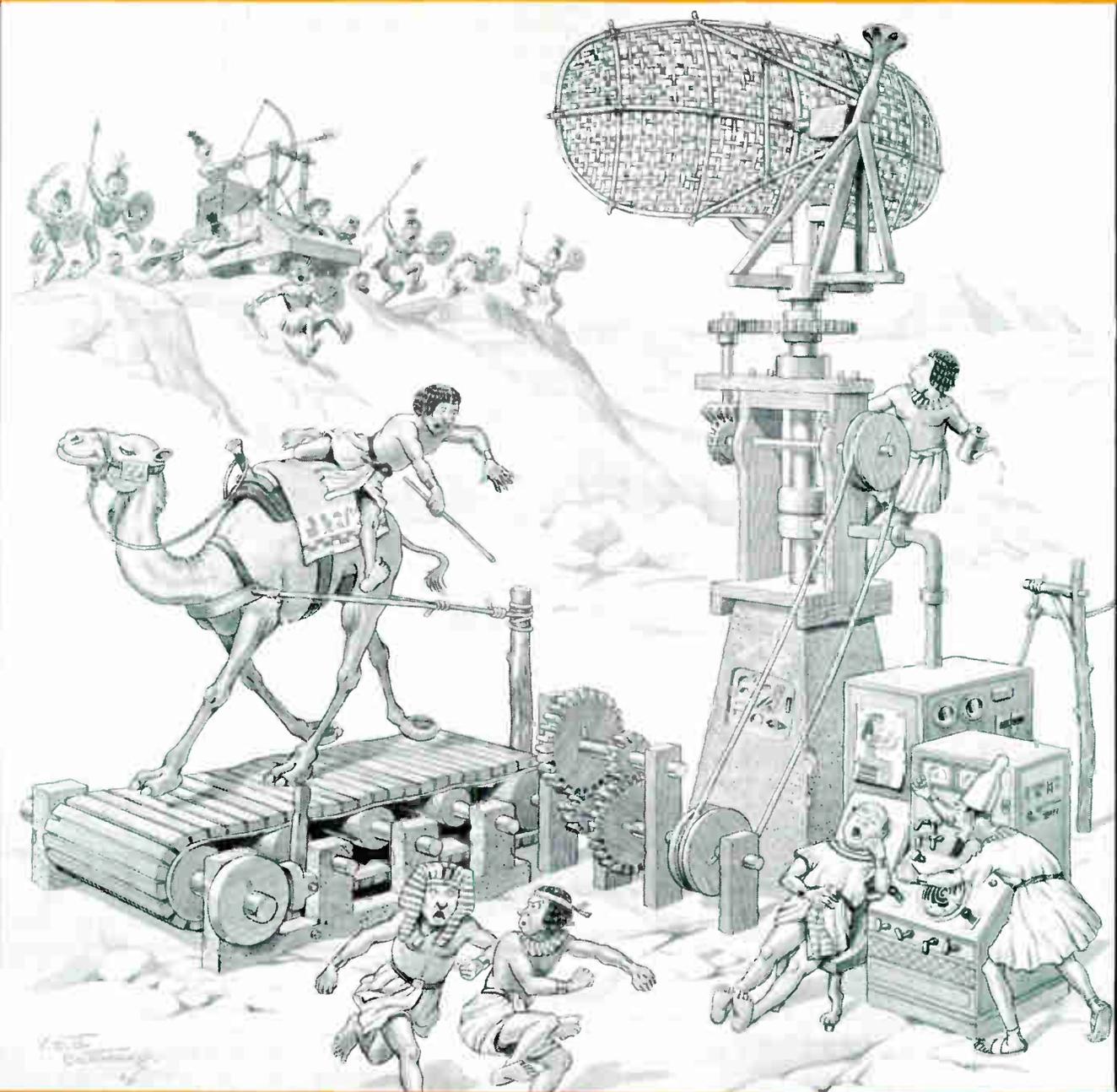
"Even if I'd been awake, our radar wouldn't have prevented the attack," he said. "Our radar won't work."

"Why not?" the queen asked, stroking Julius' head.

"It can't," Ptolemy told her. "For one thing, Bomac\* tubes haven't been invented yet."

"That's right, too!" Cleopatra said. "Case dismissed."

No. 2 of a series . . . BOMAC LOOKS AT RADAR THROUGH THE AGES



\* Bomac makes the finest microwave tubes and components this side of the Nile



**Bomac LABORATORIES, INC.,**  
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A CASE HISTORY

...RCA-6AF4-A

# Demonstrates How RCA's Preferred Tube Types Program Improves Tube Quality

The development of the RCA-6AF4-A...outstanding for superior quality...is just one example of the effectiveness of RCA's continuing program to provide manufacturers with tubes of uniformly high quality at moderate cost.

**Troublesome days**—The "cage" structure originally used in the 6AF4 was the only one readily available that would satisfy the oscillator-service requirements of UHF television receivers. In spite of certain shortcomings of the 6AF4 structure, the tube has been popular with manufacturers needing a UHF-oscillator triode. To eliminate the shortcomings of the 6AF4, RCA undertook an extensive redesign of its structure.

**Now, an outstanding tube**—Today, the RCA-6AF4-A is considered by manufacturers to be outstanding in all respects. Critical evaluations show clearly that the improved RCA-6AF4-A offers such distinct advantages as minimized slump, product uniformity, and long life.

**Dynamic life-tests prove RCA's quality**—Projected average life for this tube type is 4,000 hours or more, based on life tests under dynamic conditions at 1,000 Mc. The new RCA-6AF4-A, a Preferred Tube Type, is certainly the right choice for manufacturers designing new UHF-TV tuners and receivers.

RCA's Preferred Tube Types Program currently offers a list of 62 tube types for TV and radio receiver applications. Tube types on this "list" have qualified as Preferred Tube Types by meeting these 4 important requirements: *Quality*...it performs adequately in each function for which it is chosen; *Versatility*...the tube's characteristics are suitable for a wide variety of applications; *Popularity*...it is among the popular currently used types; *Economy*...the tube is adaptable to low-cost manufacturing techniques.

You, too, can gain for your own designs and products, the benefits

offered by RCA's Preferred Tube Types Program. Contact your RCA Field Representative for the up-to-date list of RCA Preferred Tube Types. Or, write RCA Commercial Engineering, Section B-19-Q-3, Harrison, N. J.

#### RCA Field Offices

**EAST:** 744 Broad Street  
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**MIDWEST:** Suite 1181  
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WHitehall 4-2900

**WEST:** 6355 E. Washington Blvd.  
Los Angeles 22, Calif.  
RAYmond 3-8361



**NICKEL-ALLOY CATHODE**... especially well balanced for 6AF4-A application...reduces interface resistance, and grid loading. Contributes substantially to longer useful life for this tube type.

**PALLADIUM-PLATED GRID**... performs more uniformly throughout life of the tube. Contact potential is more constant. Interelectrode leakage is minimized.

**SILVER-PLATED PINS**...reduce skin effect at UHF.



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Electron Tube Division

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