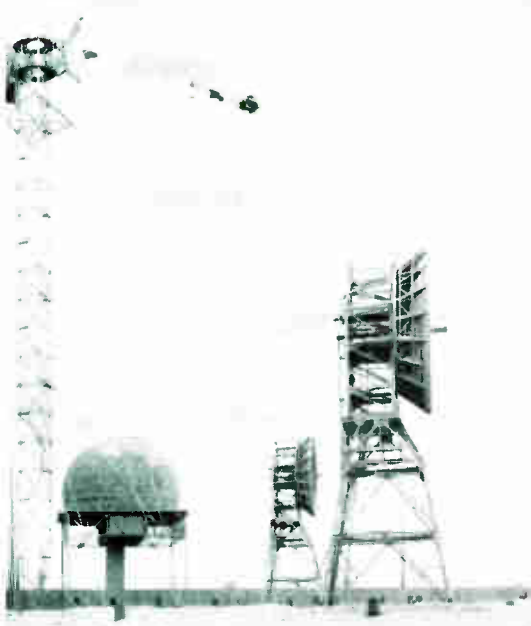


APRIL 4, 1958

electronics

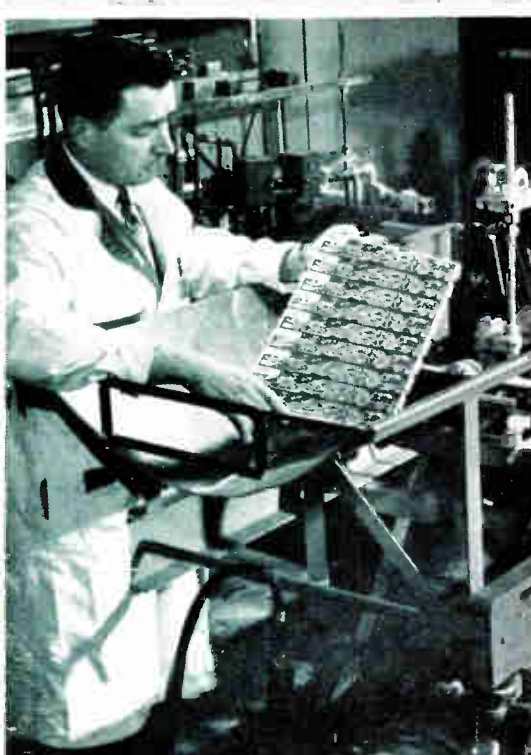
business edition

A MCGRAW-HILL PUBLICATION • VOL. 31, NO. 14 • PRICE FIFTY CENTS



Radar Answers Space Challenge

More power plus multifrequency operation
may quadruple DEW-Line range . . . p 15



Machines Speed Set Production

Automatic offset equipment prints up to
50,000 circuits a week p 22

Raytheon — World's Largest Manufacturer of Magnetrons and Klystrons



Focal point for the requirements of a growing industry

Today great companies in an ever-widening circle depend on Raytheon to supply magnetrons and klystrons for their microwave equipments.

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Shoptalk . . .

THERE IS NO ULTIMATE WEAPON, and there is no absolute defense. But America's radar defenses give the best currently practicable protection against today's operational weapons in potentially hostile hands. And new equipment and techniques coming along in industry and government laboratories should be able to handle the challenge of future intercontinental ballistic missiles, manned satellites and rocket planes.

To get the true picture of our radar industry, Associate Editor Leary spot checked manufacturers of long-range radar, visited government laboratories and installations not before opened to the press. Here are a few of the things he found out about:

✓ *Multifrequency radar—how a radar system can increase its range without decreasing its repetition frequency*

✓ *New high-powered klystrons and special waveguide techniques that make possible peak pulse power undreamed of a few years ago*

✓ *Electronic scanning techniques that enable radar to pinpoint a hostile missile in three-dimensional space*

✓ *Monte Carlo methods applied to radar that literally teach the gear to recognize a hostile missile 3,000 miles or more away*

These are just a few of the techniques emerging from the laboratory. They will not only go a long way towards insuring our national security but will also mean more business in coming months as Uncle Sam updates his radar fences. Leary's story, "Radar Answers Space Challenge" begins on p 14.

A QUIET REVOLUTION is taking shape in several parts of our industry. It involves moving still farther from hand assembly methods to mechanical assembly and processing. Last week, Midwestern Editor Harris went through previously guarded portions of Motorola's giant manufacturing complex near Chicago, where radio sets are now made almost wholly by machine.

Techniques include punching circuit boards, coating them with adhesive, then automatically and simultaneously plating them on both sides; mechanized printing and etching of circuit patterns; inserting components on giant turntables and automatically soldering connections.

Harris' story takes you on a guided tour of the factory to see how new production equipment helps one manufacturer compete successfully in an era of rising costs. See p 22.

MEET THE NEW COMMISSIONER. Senatorial confirmation of John Storrs Cross' nomination to the Federal Communications Commission is expected. An E. E. graduate from Alabama Polytech, former Navy and State Department telecommunications expert Cross would join the Commission at a time when overcrowding of the electromagnetic spectrum has greatly multiplied the technical problems facing our communications industries. Associate Editor O'Brien introduces you to the new commissioner in his *Plants and People* section beginning on p 53.

Coming in Our April 11 Issue . . .

Coming in Our April 11 Issue . . .

● **Archimedean Lung.** Interest in cardiac surgery has led to the development of an extra-corporeal device capable of temporarily maintaining the entire circulation of the body. Operation of the rotating oxygenator which simulates the human lung can be likened to an Archimedean screw. The stream of blood which passes through the cylinder is raised and lowered and spread in a thin film over a large surface. The red cells are directly exposed to a mixture of oxygen and carbon dioxide. The cylinder is rotated by a friction wheel that is driven by a variable speed motor.

Heart action, according to author Schild of New Electronic Products in London, is simulated by servo-controlled pumps. An error signal from a capacitance transducer in the oxygenator activates servo motors to maintain constant volume within the circulatory system as variable reluctance pickups monitor pressure. System responds to capacitance changes as small as 0.1 micromicrofarad.

● **Electronic Picture Timer.** An electronic timer with four thyratrons switches on cathode-ray-tube picture for 1/30-second interval needed to exactly complete two interlaced tv fields. Vertical drive pulses from tv sync generator provide time-reference triggering. Clean, single-frame photographs of the presentation are made with an open-shuttered still camera. A stabilized high-voltage supply minimizes defocusing. The timer was developed by A. A. Tarnowski and K. G. Lisk of Eastman Kodak.

● **Stopping Vibration Failures.** Efficient vibration-resistant designs that bypass costly trial-and-error prototypes are described by F. B. Safford and W. S. Inouye of Nortronics Division of Northrop. A simulated vibration environment is assumed and its transmission through isolators is plotted and adjusted for practical considerations. A fragility curve is developed for each component type and a composite characteristic derived by superposition. Performance comparisons between beefed-up and resonance-damped chassis are presented.

● **Improving Scatter Receivers.** A quadruple-diversity f-m receiver which uses baseband combining achieves a noise-figure improvement of 0.5 to 1.5 db with silicon diodes in place of an r-f amplifier stage. Paul Gruber of Radio Engineering Labs suggests a well-designed single-ended coaxial mixer, followed by a low noise-figure i-f amplifier to further improve performance.

● **Transistor Audio Amplifier.** High-power transistor audio amplifiers designed at RCA operate over an ambient temperature range of -10 to +50 C. Author Marvin Herscher says that neither series-type nor quasicomplementary symmetry-type circuit uses a driver or an output transformer.

ISSUE AT A GLANCE

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electronics

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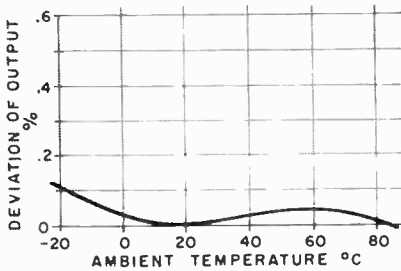
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NEW KEARFOTT TACHOMETERS:



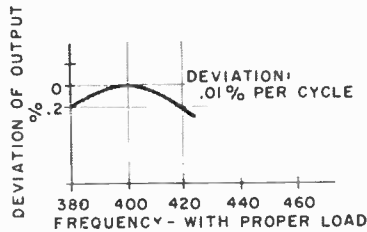
KEARFOTT SIZE 11 AND SIZE 15
INTEGRATING TACHOMETERS
ACTUAL SIZE

... provide precise integration under all conditions



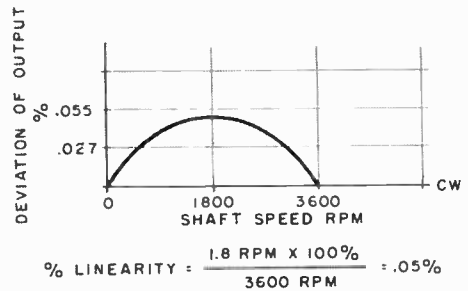
TEMPERATURE

Variations of output, due to temperature changes, are minimized by Kearfott's precise unit temperatures control and/or compensation.



FREQUENCY

Variations due to frequency changes are held to .01% per cycle with appropriate loading.



SPEED

Minimum deviation of output from mean value due to speed is characteristic of these precision tachometers.

Kearfott Tachometers are ideally suited for applications in aircraft, missiles, and other equipment requiring precise integration. They are compact and light in weight. They offer excellent environmental resistance due to all stainless steel construction. Kearfott's unique design eliminates the need for thermostatic temperature control. Units available to operate under high temperature (200°C.), high vibration (500 cps) and shock (10 G's).

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GENERATOR CHARACTERISTICS			
MODEL	VOLTS OUTPUT PER 1000 RFM	LINEARITY TO 3600 RPM	EXCITATION AT 400 CPS
Size 11 R860-25	2.75	0.1%	115V
Size 11 R862-22	2.75	0.1%	115V
Size 15 T816-25	2.9	0.05%	115V

SERVO MOTOR CHARACTERISTICS		
MODEL	NO LOAD SPEED	STALL TORQUE
Size 11 R860-25	5500 RPM	0.55 in. oz.
*Size 11 R862-22	4500 RPM	0.5 in. oz.
Size 15 T816-25	4500 RPM	0.4 in. oz.

*Drag Cup Motor—Maximum starting voltage, 1 volt.

Send for data sheet on Kearfott Tachometers and other Kearfott Components and Systems.

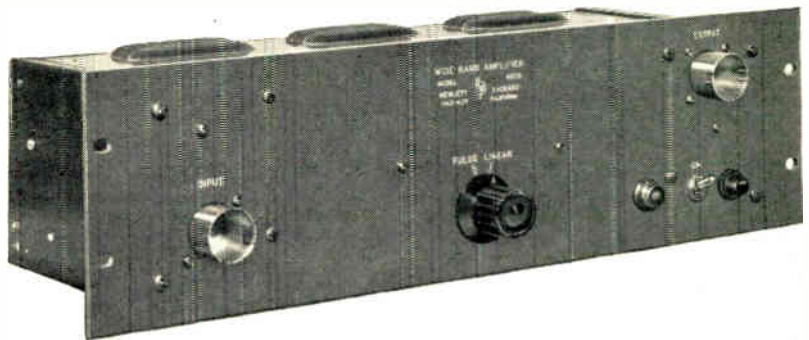


AMPLIFIERS

**Wide band, fast pulse amplifiers — 90 db in cascade —
distortion-free amplification of pulses shorter than 0.01 μ sec!**

At moderate cost, -hp- 460A and 460B Amplifiers offer true amplification of millimicrosecond pulses at power levels sufficient to operate scalars, counting meters and cathode ray tubes.

Model 460A provides voltage gain of approximately 20 db while Model 460B is a 15 db terminal amplifier insuring maximum output. Since rise time is 0.0026 μ sec, and overshoot and ringing are negligible, distortion-free amplification of pulses faster than 0.01 μ sec is assured. The high gain, no distortion feature means the instruments, in cascade, serve as a 100 MC pre-amplifier

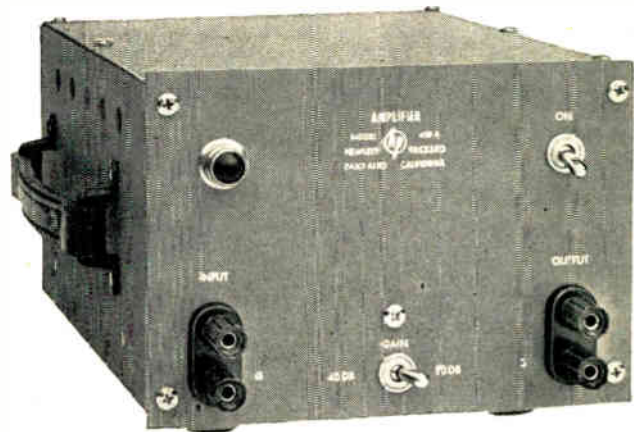


for standard oscilloscopes, and a $\times 10$ sensitivity multiplier for voltmeters. Rack mount model only. -hp- 460AR, \$185.00. -hp- 460BR, \$225.00.

**General purpose amplifier — 20 or 40 db gain — high
stability 10 cps to 1 MC — low priced at \$140.00**

-hp- 450A is an ideal, general duty amplifier for use wherever wide frequency coverage and stable gain are desired. Gain is $40 \pm \frac{1}{8}$ db or $20 \pm \frac{1}{8}$ db at 1,000 cps as selected at front panel switch. Frequency response is flat, stability is $\pm 2\%$ on ± 10 volt changes in line power, input impedance is 1 megohm with approximately 15 μ mf shunt, distortion is less than 1%, output 10 volts maximum into 3,000 ohms. The instrument is resistance-coupled and has no peaking or compensating networks. Phase shift is negligible and there are no spurious resonances or oscillations. Hum is minimized by a dc filament supply to the two amplifier tubes. \$140.00.

*Data subject to change without notice.
Prices f.o.b. factory*



**-hp- also offers 4 Traveling-Wave Tube Amplifiers
covering frequencies 2 to 12.4 KMC! See your -hp-
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FIELD ENGINEERS IN ALL PRINCIPAL AREAS

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has six new oscilloscopes. Tested them?

Time for Debentures?

Convertible debentures offer way to sell stock today at tomorrow's price with gains up to 20 percent

SYLVANIA RECENTLY completed a \$20-million 4½-per-cent convertible debenture issue with stock conversion price 14 percent above current price of its common stock.

This underlines two points many Wall Street firms have made to ELECTRONICS in recent days:

(1.) There is growing investor interest in convertible debentures. (2.) This interest offers an advantage to electronic firms.

Many electronics firms are natural candidates for successful convertible debenture issues because of their excellent prospects for growth. Good growth prospects which indicate stock will climb above conversion price are a basic requirement of a successful convertible debenture issue.

Convertible debentures are a hybrid security, offering investors relative safety of income payments and principal plus opportunities for capital gain. Like a bond, they guarantee payment of interest and principal. Through stock conversion privilege, they offer a share in growth.

Firms issuing convertible debentures can sell "today's stock" at "tomorrow's prices" as the stock conversion price is set at 10 to 20 percent above current price of the firm's common stock.

Right now the large and well-established firms in

the electronics industry are in the best position to take advantage of the market for convertible debentures, says Alfred Averell, partner in the New York brokerage firm of Bache & Co.

Because of the greater interest protection provided by their greater stability of operations and larger earnings, they can sell debentures with a favorable conversion advantage, he explains.

However, once the market starts rising, attractiveness of convertible debenture issues of moderate-size electronics firms will increase, he thinks. Then, these firms can expect to sell debentures with conversion prices up to 20 percent over current price.

He feels more and more moderate-sized companies in electronics and other growth industries will be issuing convertible debentures in the future. Reason: increasing investment interest in both interest and principal protection along with inflation protection. Long term trend toward lower interest rates is also a factor.

A moderate-sized company is, roughly, one with average earnings of about a million a year, according to Wall Street investment firms.

On the other hand, not all agree that only the giants of the industry can take advantage of today's market. American Electronics, which earned about \$600,000 last year, has a \$3½ million convertible debenture issue in registration with the SEC.

The following are among firms which share in our industry and have issued convertible debentures: American Machine & Foundry, Daystrom, Burroughs, RCA, Collins Radio, Smith-Corona, Lockheed Aircraft, Thompson Products, Northrop Aircraft, General Dynamics, ITE Circuit Breaker, Royal McBee and U. S. Industries.

SHARES and PRICES

APPLIED SCIENCE FIRMS have roots in advanced and specialized scientific research and aim for the military and civilian markets for unique products of advanced design.

A recent study of applied science

firms by the New York brokerage firm of Carl M. Loeb, Rhoades & Co. advises investors in this type of firm to watch closely for both gain and loss possibilities.

On one hand, the status of small technical companies has improved because of the speed-up in the mis-

sile program, growing emphasis on research and development and more liberal governmental financial policies. On the other hand, the shift of the Pentagon toward weapons systems methods of procurement tends to favor large financially strong companies.

Typical Applied Science Firms	Recent Price ¹	Indicated Dividend Rate	Percent Yield	Earned Per Common Share			1957 Price Range
				1957	Period	1956	
Airborne Instruments	42	....	....	2.00 est.	(year)	1.54	OTC 28-50
High Voltage	30½	0.10	2.9	0.89	(year)	0.45	OTC 18-29
Magnetic Amplifiers	3½	....	....	0.22	(year)	0.31	OTC 2¾-4
Midwestern Instruments	6¾	....	....	0.50	(6 mos) ²	0.16	OTC ¾-4
Microwave Associates	10¾	....	....	0.13	(year) ³	0.47	OTC
Sanders Associates	14¾	0.08	0.5	0.99	(year) ⁴	0.59	OTC
Taylor Instrument	30	1.20	3.3	3.47	(year) ⁵	5.45	OTC 27-43½
Technical Operations	5¾	....	....	0.29	(year) ³	0.17	OTC

¹bid prices ²ended July 21 ³ended Sept. 30 ⁴ended July 31 ⁵ended June 20

MERGERS, ACQUISITIONS and FINANCE

• **Norden-Ketay** of Stamford, Conn., and **United Aircraft** announce merger plans. The plans call for exchange of one share of United for 20 shares of Norden-Ketay. Stock of United Aircraft recently closed at 56½ while Norden-Ketay closed at 34.

Previously announced merger plans of Norden-Ketay and Solar Aircraft have been abandoned because of inability to agree on terms.

• **Sola Electric**, Chicago manufacturer of electrical and electronic components, will become a division of the diversified **Basic Products Corp.** of Milwaukee. All Sola stock is to be exchanged for 175,000 shares of Basic common and 37,200 shares of its preferred stock. Through subsidiaries and affiliates, Basic makes malt and electrical equipment and operates oil producing property.

• **National Industrial Conference Board's** survey on the business de-

cline finds 75 percent of 176 manufacturers reporting that new orders in January ran below those of last year. Dollar volume of new orders was also down.

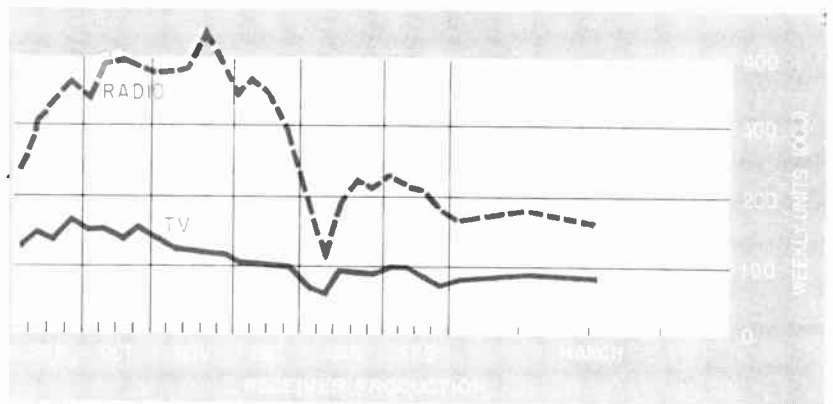
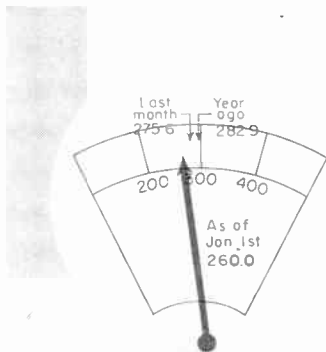
However, about 40 percent of sixty-three firms replying to another question indicated dollar volume of new orders would increase considerably in the third quarter of this year.

• **National Electric Products**, Pittsburgh, Pa., acquires **Frequency Standards** of Asbury Park, N. J., manufacturer of electronic apparatus and instruments. National is a leading producer of electrical distribution systems. Acquisition is a move by National to expand and diversify product lines and operations. Frequency will operate as a division of the acquiring firm, under the direction of J. Kelsey Burr, founder of P. S.

• **Dynalysis Development Labs**, electronic design and manufactur-

ing firm of Los Angeles, has been acquired by **Yuba Consolidated Industries** of San Francisco in a cash transaction. The LA firm will be operated as Yuba Systems Division. Although it has done some manufacturing in the past, scope of its projects has been limited by small manufacturing space. It now plans to develop and produce autopilots, guidance systems, electronic countermeasures systems, launching and ground-handling equipment.

• **Perkin-Elmer**, Norwalk, Conn., reports that sales rose 43 percent in the six months ended Jan. 31, 1958, over the same period last year, from \$4.9 to \$7.0 million. Net profits over the two periods increased from \$265,475 to \$290,465. Firm also reports that it is not planning any additional financing in the near future. Last year it raised \$2 million through privately placed notes and \$1.5 million through public sale of common stock.



FIGURES OF THE WEEK

RECEIVER PRODUCTION

(Source: EIA)	Mar. 14, '58	Mar. 7, '58	Mar. 15, '57
Television sets, total	88,598	87,508	129,754
Radio sets, total	170,434	180,165	328,540
Auto sets	41,942	52,069	126,352

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Mar. 19, '58	Mar. 12, '58	Mar. 20, '57
Radio-tv & electronics	45.82	46.40	47.52
Radio broadcasters	59.51	56.79	63.71

FIGURES OF THE YEAR

	Totals for first month		
	1958	1957	Percent Change
Receiving tube sales	26,805,000	37,571,000	- 28.6
Transistor production	2,955,247	1,436,000	+105.8
Cathode-ray tube sales	621,910	760,860	- 18.3
Television set production	433,983	450,190	- 3.6
Radio set production	1,026,527	1,085,529	- 5.4

LATEST MONTHLY FIGURES

EMPLOYMENT AND PAYROLLS

(Source: Bur. Labor Statistics)	Dec. '57	Nov. '57	Dec. '56
Prod. workers, comm. equip.	380,400	398,000	407,800
Av. wkly. earnings, comm.	\$78.40	\$77.22	\$79.15
Av. wkly. earnings, radio	\$76.64	\$75.08	\$75.95
Av. wkly. hours, comm.	39.2	39.0	40.8
Av. wkly. hours, radio	39.1	38.9	40.4

TRANSISTOR SALES

(Source: EIA)	Jan. '58	Dec. '57	Jan. '57
Unit sales	2,955,247	2,773,000	1,436,000
Value	\$6,704,383	\$6,619,000	\$4,119,000

TUBE SALES

(Source: EIA)	Jan. '58	Dec. '57	Jan. '57
Receiving tubes, units	26,805,000	27,736,000	37,571,000
Receiving tubes, value	\$23,264,000	\$24,881,000	\$31,170,000
Picture tubes, units	621,910	644,026	760,860
Picture tubes, value	\$12,341,927	\$12,971,489	\$13,594,525

Another Clevite Break-through!

HIGH FREQUENCY POWER TRANSISTORS



This history-making addition to Clevite's line of PNP germanium power transistors offers long-sought advantages to designers of high frequency audio amplifiers as well as high-speed switching and core driver circuitry in digital computers.

For high frequency audio amplifiers:

(TYPE CTP 1133)

POWER DISSIPATION = 10 WATTS

at 70°C base temperature

POWER GAIN = 27 to 33 db

when $I_c = 420$ ma and power output = 2.0 w

POWER GAIN CUTOFF FREQUENCY = 20 kc minimum

... compared with 5 to 7 kc for conventional transistors

DISTORTION = 5% maximum

at 1.2 w output

For high-speed switching:

(TYPE CTP 1135)

POWER DISSIPATION = 10 WATTS

at 70°C base temperature

DC CURRENT GAIN = 40 minimum

at 0.5 amp

COMMON EMITTER GAIN BANDWIDTH PRODUCT = 1 megacycle

For complete information
write or phone:

CLEVITE TRANSISTOR PRODUCTS

241 Crescent St., Waltham 54, Mass.
TWinbrook 4-9330

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Clevite Harris Products, Inc. Clevite Electronic Components Clevite Research Center Internmetall G. m. b. H.



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for your new plant

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I'm Charlie Fife . . . of course every plant must have 100% financing of some kind; but, I'm sure you'll agree that this unique plan can solve a lot of problems, providing others, equally important, can be worked out as well.

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Area Development Department*



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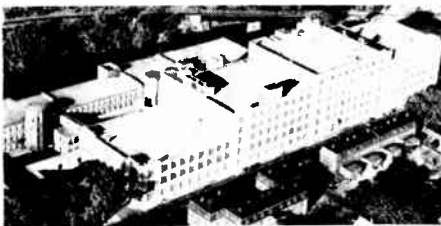
Defense blindspot removed by

DARE

New missile guidance system tracks targets unseen by other airborne systems.



SANDERS' "DARE" TEAM was headed by William Morgan, Coherent Ground System; Kenneth Dollinger, System Project Engineer; Alfred Cann, Missile Seeker; Robert Stetson, High Voltage and Microwave Circuits.



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Design and production of key missile components has enhanced and assured success of the DARE project. Sanders Associates is a well-known creator and producer of *hydraulic servos* for steering and controlling missiles and antennas . . . *rate gyros* for stabilization and control . . . *microwave components* for antenna and RF circuitry . . . *flexible printed circuitry* for decreasing size and weight and increasing system reliability.

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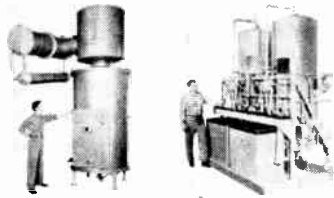
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10

WASHINGTON OUTLOOK

CAPE CANAVERAL's launching pads are going to be hot with both military missiles and space research vehicles for the foreseeable future. The two weeks following the successful Vanguard firing called for shots of the following: Army's Explorer III, Army's Jupiter IRBM, Air Force Atlas ICBM, Air Force Thor IRBM, two Bomarc anti-aircraft interceptors and two each of the pilotless bombers Snark and Matador.

The stepped-up activity is generating some expansion of Canaveral's facilities—four Titan launching pads are being constructed, for instance, and additional radar picket ships are being placed downrange.

The news of the firing of the Bull Goose—Fairchild Aircraft and Engine's missile that is designed to appear to the enemy as a bomb-carrying bomber—doesn't give much of a tip-off to the state of the weapon's development, since the vehicle is propelled by a jet engine. The electronics of the bird is being kept under the tightest security wraps.

- The staging of a conducted tour of the Canaveral base doesn't indicate new Pentagon policy of open house. On the contrary, the press party was staged for a particular purpose, and once the reporters, editors, and tv men departed, the doors slammed shut again.

Range officials had three things they wanted the newsmen to take away with them to counteract public impressions that they feel have grown up with the publicity surrounding firings from their base.

They wanted to demonstrate that increased firing doesn't mean that there's increased danger—either to the area around the Cape or to ships or islands downrange. Officials stressed their "impact predict"—a computer that feeds them constantly an accurate indication of the point at which the missile will come back to the earth or ocean. Safety officer is thus able to push the destruct button if the missile shows any sign of getting off the prescribed track.

They wanted also to stress that the Cape is a research facility, that it is designed and equipped to learn from both firing failures and firing successes.

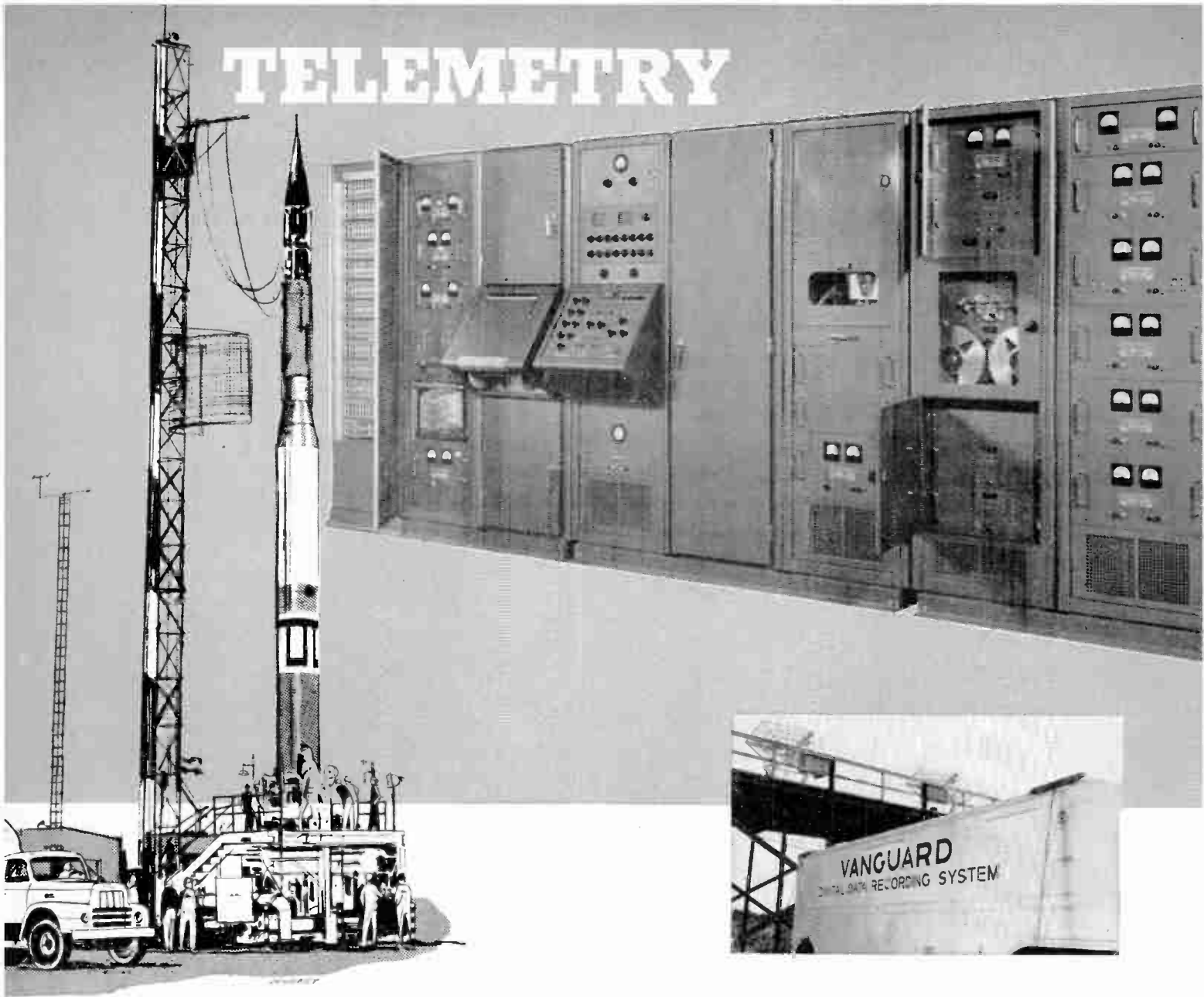
And they wanted to emphasize that the long countdowns and delays won't be characteristic of the missiles when they become operational.

- Government backed shipbuilding programs are creating a big market for electronics manufacturers. In the merchant-ship field, shipyards already are building or have orders for 116 ships that will require an estimated \$60 million in electronic parts. Coming up is a giant cargo ship replacement program that is expected to produce close to 250 additional ships over the next 10 to 15 years at a total cost of close to \$3 billion. The government will pay around 45 percent of the cost of building the ships through construction subsidies. Around 5 percent of the cost of building the ships will go for electronic equipment—such things as navigational equipment, radar, radios and electrical circuitry.

The Navy's nuclear powered submarine building program will add several million more to the electronics market, too. Three of the atom powered submarines are already in service, another 19 building or ordered. The estimated cost of electronic equipment going into the subs is pegged at around \$175 million.

April 4, 1958 — ELECTRONICS business edition

TELEMETRY



The Vital Link in Missile Progress

PERSONNEL INQUIRIES INVITED.

Missiles are test fired for only one purpose: to obtain data that will help build better missiles. If the test does not yield this information it must be considered unsuccessful — regardless of how well the "bird" performed.

Reliable telemetry equipment consequently assumes a vital role in the development of the missiles so necessary to our defense program. There is no other way to collect and preserve the all-important data from unmanned and unrecoverable test vehicles.

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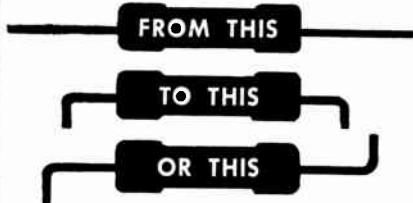
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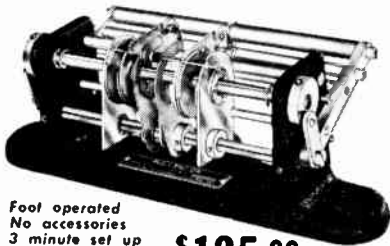
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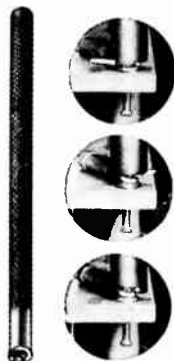
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EXECUTIVES IN THE NEWS



Burgess: human dynamo

New professional manager on the electronics scene is Carter L. Burgess, 42, Virginia-bred executive who is American Machine & Foundry's first "outside" president. He takes over half of the double job held until recently by chairman Morehead Patterson, who picked Burgess for his "organizational and administrative ability."

Burgess' specialty is handling people. Men in the AMF organization, admittedly "just getting to know" their new boss, speak of him as warm, informal, outgoing. He has a great love for order and efficiency, a knack for grasping complex ideas and boiling them down—and he can transmit his enthusiasms to people around him.

Manager Burgess went to school in hometown Roanoke, Va., put himself through Virginia Military Institute (B.A. '39) by working as an express handler. He was an insurance adjuster before going into the Army as a Military Police lieutenant in 1941. Walter Bedell Smith noticed him, advanced him carefully but rapidly until Burgess was a colonel, secretary to the SHAEF general staff.

After the war he worked for the State Department for a time, then became assistant to TWA president Jack Frye. In 1953 he went south to help reorganize the University of South Carolina. Charles E. Wilson (at right in the picture) picked the husky, blue-eyed Eisenhower Democrat as assistant Defense Secretary for manpower in the fall of 1954. Two years later he was back at TWA as president.

Burgess is a human dynamo, drives himself hard, seems to keep going on an occasional Coke and a perpetual cigar. He doesn't say much about \$262-million AMF (about one fourth is atomics and defense work); he admits he's too new, wants to give the job a "concentrated go" to find out about the company and its people.

He and his wife Mae (they were married 29 days before Pearl Harbor) live in Pelham Manor, N. Y. His favorite hobby is being with his children—five of 'em, all girls.

COMMENT

Calibration—and Comment

"Exact Calibration From a Standard" (Sept. 1 '57, p 194) shows a fairly complicated means of comparing two radio frequencies

which involves a certain amount of interpretation, as an additional oscillator is used.

I would point out that calibrations of the type described can be carried out very simply using a single receiver which has a "magic

eye" type of tuning indicator.

If the signals to be compared are adjusted so that each is capable of about half closing the "eye," then as the frequencies pass in and out of phase the eye will open and close. Our local BBC "light programme" station is on 200 kc to better than one part in a million, and I have had no difficulty in setting crystal standards to within this accuracy.

Incidentally, I had not realized that Comment was a letters-to-the-editor section. This is perhaps a criticism of American technical journalism. In our journals we usually have a page or two devoted to correspondence, whereas in American journals this appears to be a single column which straggles on for several pages.

H. O. BRADSHAW
NORTHFIELD, BIRMINGHAM
ENGLAND

We keep our letters more or less in the same place, but of course do not fill a solid page or two. This is really a reflection of something else: American engineers seem not to have the penchant for commenting in the public forum on all sorts of subjects, as their English cousins do.

Angels

I have read with interest the very enlightening article by Vernon Plank, "Atmospheric Angels Mimic Radar Echoes" (Mar. 14, p 140). We were particularly interested in view of our recent field experiences both in this country and Spain with higher powered search equipment.

D. C. FABER

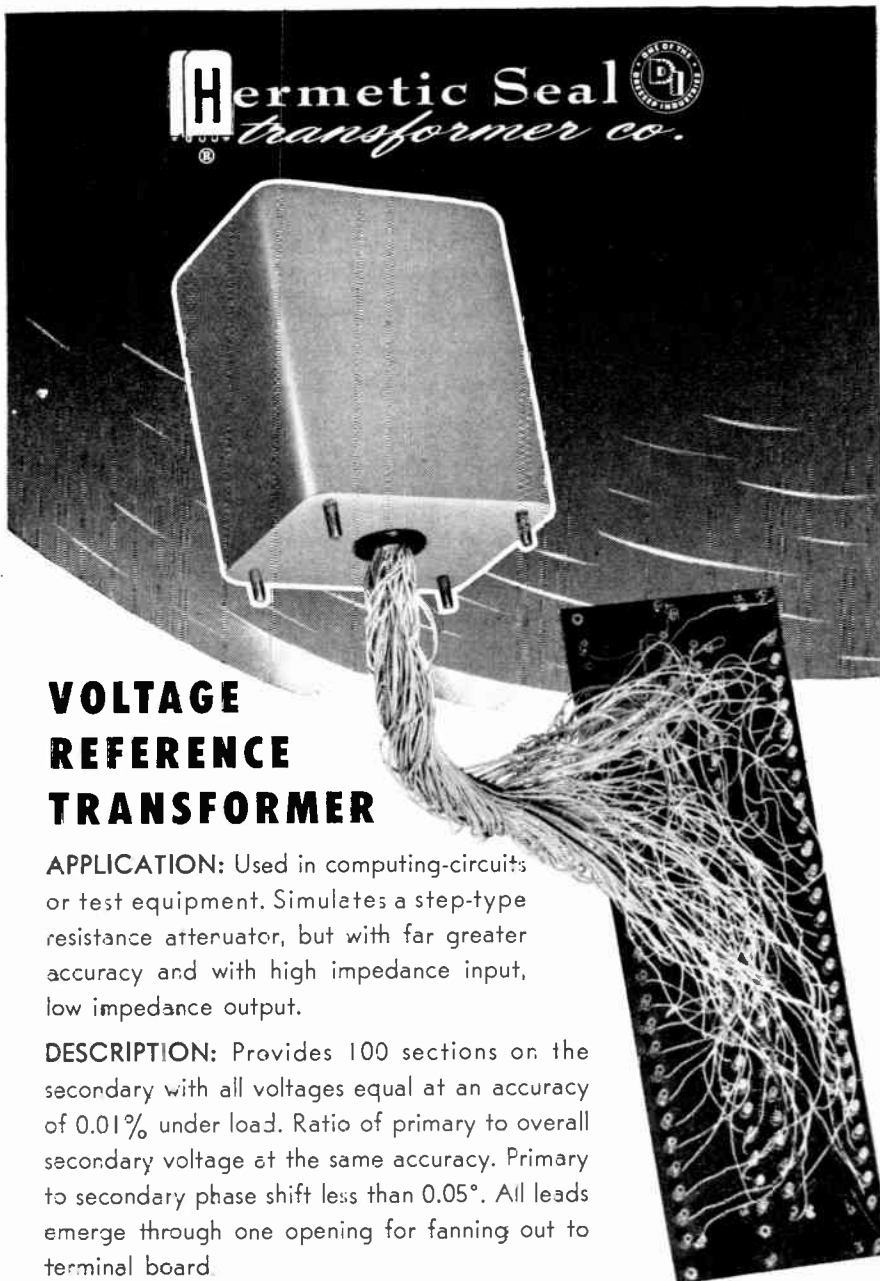
BENDIX RADIO
BALTIMORE, MD.

Reliability Error

A reader just pointed out to me that the reliability cited in my article "Tropo Scatter System Design Charts" (Jan. 17, p 91) is in error. It should be 98 percent instead of 99.5 percent as originally given for both ssb and f-m systems.

I am sorry that I did not discover this error when the original manuscript was sent to you.

LEANG P. YEH
WESTINGHOUSE ELECTRIC
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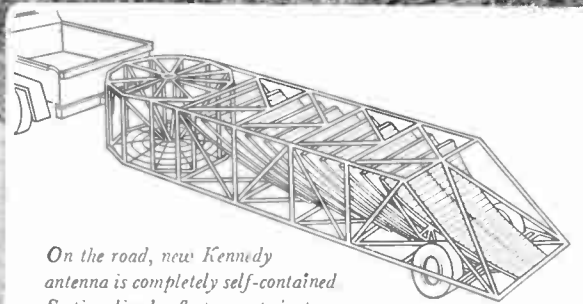
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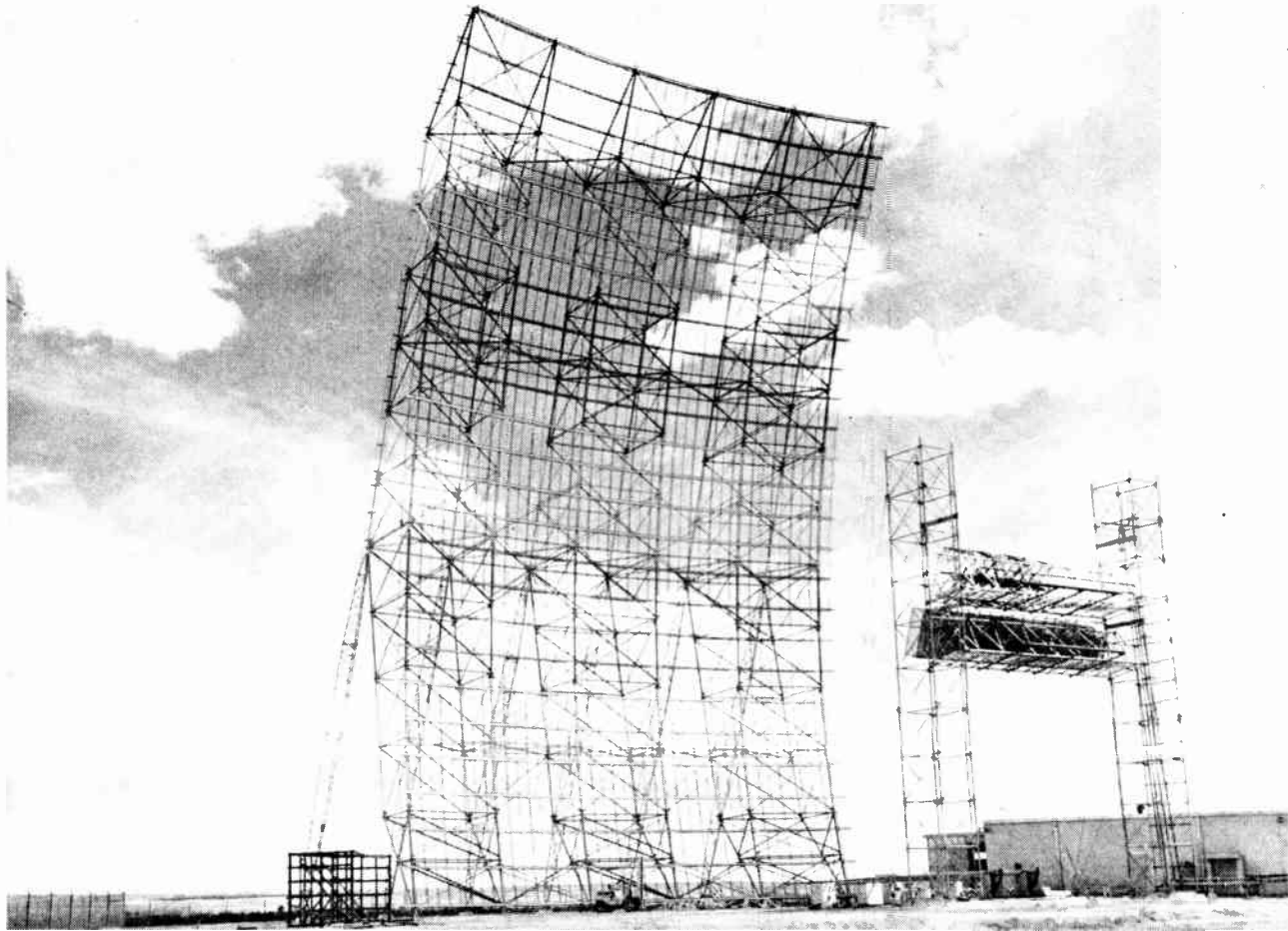
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Antenna of FPS-17 radar watches missiles launched some 500 miles away. Radar antennas for Ballistic Missile Early Warning System will be twice as big as this 110 by 165-ft monster. This is just one way that . . .

Radar Meets Space Challenge

PROBLEM—How to get a hostile ICBM before it gets us

SOLUTION—Extend the range of our warning radar, shorten its response time, increase its discrimination

METHODS—Use some brute force and all the tricks of electronics, physics and statistics

A TOP RESEARCHER for the U.S. Air Force is talking.

"A lot of people," he says, "seem to be angry with the Air Force and radar research because the earth is round and radio energy travels more or less in straight lines. The important thing to remember is that we're not—and haven't been—sitting back

fat, dumb and happy, waiting. For us, the immutable law is still: every weapon has a counterweapon."

He was telling *ELECTRONICS* about the problem of detecting ballistic missiles by radar in time to do something constructive—or rather, destructive—about them. This particular pot has been boiling

since early last fall when the Soviet Union announced it had an intercontinental missile.

When the DFW-line radars (cover) began peering across the pole at probable sources of air penetration, everybody felt good. These sets are over 1,000 miles from the U.S. border, with better than 200-mile range. They give our Strategic Air Command something like two hours to scramble.

Now the USAF is moving against enemy missiles. Early last month RCA was given a management contract for a ballistic-missile early-warning system (BMEWS). General Electric will build the radars and Sylvania will build the computation-presentation system.

The radar is a sophistication of a monster installation that was installed some four years ago down on the Rio Grande. This prototype looks almost 500 miles to the northwest, watching the missiles come and go at Holloman AFB and White Sands. It was built and installed by GE, has given the Air Force valuable information on how to design an early-warning system against ballistic missiles.

BMEWS will not replace the DFW-line. USAF officers tell *ELECTRONICS* "the detection and location of aircraft and missiles present two different sets of problems." DFW-line will continue to guard against aircraft; BMEWS will watch for missiles rising as much as 3,000 miles away. Both will work into the SAGE system.

"For ballistic missile work," a radar researcher comments, "we're not interested in seeing much beyond 3,000 miles." The reason: at this distance a radar pointed horizontally is looking at a point 1,000 miles or more above the surface.

BMEWS will be installed within two years. Design work is finished; it remains only to do the final engineering and tool up to make the sets.

Brute Force

The system will use some brute force and a lot of sophistication to reach out and grab targets 3,000 miles away. It will have a peak power of 7-10 megawatts, work into an antenna system with a toroid-section reflector more than 300 ft high.

Frequency diversity will find some use in ultra-long range radars like BMEWS. This technique sends simultaneous pulses out on different frequencies. Since the straightness or curvature of a radio wave's path through the atmosphere is a function of frequency, the pulses go and return on slightly different routes and are combined when they return. If atmospheric conditions garble or fade one signal, the other usually gets through.

Multifrequency transmissions may also be used to increase average power while still keeping maxi-

mum range. The set will divide the maximum-range waiting time into several parts; a single scan will be made up of several pulses. One pulse will go out on one frequency and a receiver preamplifier tuned to that frequency will wait the full maximum-range waiting time. Meanwhile, other pulses on other frequencies will go out at fixed intervals, with other preamps waiting the full time. A synchronized combiner will mix the signals before sending them to the presentation system.

Besides increasing average power without cutting down range, this multifrequency technique will sharply reduce the chance that a fast-flying object can cut across a tight radar beam between pulses and so escape notice.

. . . and Sophistication

Early radars relied on human operators to capture, locate, track and take data on targets. Gradually the radar itself has taken over all these functions but one: the initial location and recognition of a blip as a target. BMEWS will do even this.

First, moving-target indicator techniques will cancel out ground return and fixed clutter. "MTI's are pretty good now," comments a USAF radar expert. "They can still be improved, but coherent MTI's are quite reliable and adequate."

The computation-presentation system will be "taught" the echo pattern of a rising ballistic missile. It will compare information returning from each scan against its recorded pattern. The first time an unpredicted echo returns, the computer will use its learned rise pattern to figure out where the next echo should be by the Monte Carlo method. This statistical technique is used to predict where a moving particle will next appear on the basis of little or no information about its previous behavior.

Each new echo will confirm or correct the prediction. On the basis of very few returns—half a dozen or so, amounting to about a second of time—the computer will be able to begin predicting point of probable impact. Each subsequent echo will correct the prediction.

Within the next few seconds, course will be extrapolated to point of impact and the warning will go out. BMEWS will then plot an intercept course and provide data to direct countermissiles.

Besides BMEWS, there are a lot of new moves in the radar game.

- Coherent systems permit radar operators to figure out velocity of the target by measuring the Doppler shift between pulse and echo. Part of the transmitted pulse is used to stabilize the local oscillator to a fixed difference from transmitter frequency.
- Solid-state supercooled masers will increase re-

ceiver sensitivity by perhaps as much as 10 db. This will enable radarmakers to cut down on power while still reaching far out.

- New klystrons provide higher power outputs and far greater frequency stability than magnetrons. More stable power supplies are among other evolutionary developments.

- Lower frequencies will accomplish two things. First, longer waves bend in the atmosphere, may give radarmen a little better view over the horizon. Secondly, they're more likely to encounter "wave-length-size" objects, which return strong echoes. In Bath, Me., a 200-mc set with a 120-ft scanning reflector has been picking up beautiful echoes from objects 1½ yd long for a couple of years.

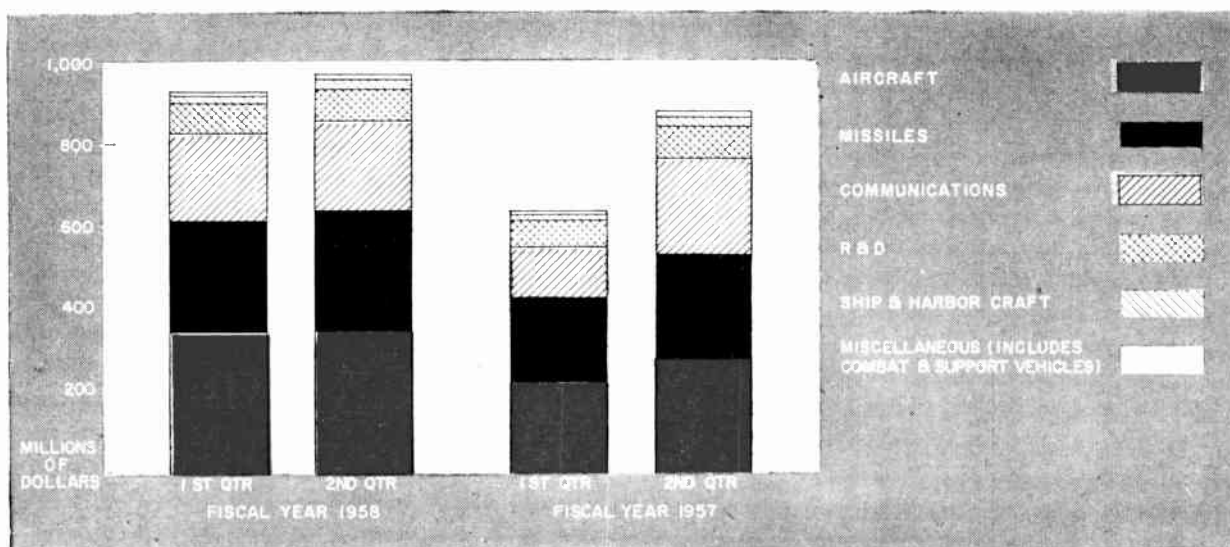
- Transmission lines are being improved. When

Cornell Aeronautical Laboratory succeeded in getting 21 megawatts on the air last month, the trick was in the transmission lines. CAL's system uses a magnetron driving a Stanford linear-accelerator-type klystron; this arrangement has produced peak power levels as high as 21 megawatts before. CAL managed to get 2-microsecond pulses of this peak power from the klystron to an 8-ft reflector at a pulse rep rate of 60 per second without arcing or burning up the line.

"We built the thing with parts that you might call off-the-shelf," a CAL spokesman told ELECTRONICS. "We could put them together into a working radar set tomorrow if anyone wanted us to."

With the Defense Department looking seriously at the space beyond the moon, someone may want to—soon.

PRODUCTION and SALES



Military Spending Continues To Climb

MILITARY SPENDING for electronic equipment in the second quarter of fiscal year 1958 (last quarter of calendar year) increased about 4½ percent from the preceding quarter.

Total military electronic spending, according to estimates by Electronics Industries Association, amounted to \$967.5 million for the second quarter in fiscal 1958, compared with \$926 million in the first fiscal quarter.

Spending for electronics in these two quarters was divided among the following budget categories:

Fiscal 1958,	1st Qtr.	2nd Qtr.
	(in millions)	
Aircraft	\$340	\$346
Missiles	273	299
Communications	204	214
R&D	73	74
Ship & Harbor Craft	23	25
Combat & Support Vehicles	2	0.5
Miscellaneous	11	9

First quarter spending for fiscal 1958 was up nearly 45 percent from the \$637 million spent in 1957. Second quarter spending was up 11

percent from the \$876 million spent in 1957.

Division of 1957 spending in first and second quarters by budget categories was:

Fiscal 1957,	1st Qtr.	2nd Qtr.
	(in millions)	
Aircraft	\$213	\$270
Missiles	205	259
Communications	130	236
R&D	65	76
Ship & Harbor Craft	17	19
Combat & Support Vehicles	2	3
Miscellaneous	5	13

Profits In 1957: 'Fair'

Year-end statements of electronics industry report fair profits record for the year, but considerably weaker earnings in the fourth quarter. With most companies not looking for a pickup in business before the second half of '58, only so-so first quarter earnings loom

A FAIR YEAR and a weak fourth quarter summarizes a 40 company check of the industry's 1957 year-end earning statements.

For the year, net profits were up over last year

for 24 of the 40 companies. Sales increased for 34 firms.

A profit downturn for many firms became more noticeable in the fourth quarter. Out of 37 com-

Manufacturers of Electronic Equipment (E), Components (C) and Materials (M)	Percent Change from 1956				Actual 1957 Sales (000 omitted)	Actual 1957 Profits
	Fourth Quarter 1957		Full Year of 1957			
	Sales ¹	Profits ¹	Sales	Profits		
Aerovox.....	- 27.4	+ . . . ³	- 17.3	+ . . . ³	20,900	276
American Bosch Arma.....	- 6.5	- 36.1	+ 9.9	+ 9.8	134,000	5,080
Amer. Mach. & Foundry.....	+ 27.1	+ 33.0	+ 32.3	+ 32.3	262,000	11,782
Applied Science.....	+ 26.7	- 10.9	+ 72.2	- 91.7	6,200	18
Arvin Industries.....	- 20.5	- 76.4	+ 7.9	+ 25.7	69,700	3,690
Bell.....	- 1.7	- 26.8	- 2.8	- 30.0	210,000 ⁵	4,033
Boeing.....	+ 58.5	+ 53.7	+ 58.7	+ 18.7	1,597,000	38,160
Burroughs.....	- 6.0	- 35.4	+ 3.7	- 29.1	282,800	10,074
Clevite.....	- 25.2	- 64.6	- 3.1	+ 2.1	71,400	3,989
Douglas ²	- 27.6	- 52.8	+ 1.6	- 7.7	1,091,000	30,666
Fairchild Camera.....	- 35.9	+ . . . ³	- 13.9	- 12.2	37,000	799
Fansteel Metallurgical.....	- 7.1	- 37.5	+ 2.6	- 8.0	32,900	3,042
Foot Mineral.....	- 7.9	- 16.6	+ 0.8	+ 2.6	24,900	2,302
General Electric.....	+ 3.5	+ 22.5	+ 6.0	+ 16.0	4,336,000	247,852
General Precision.....	+ 7.0	+ 3.2	+ 20.9	+ 78.0	185,000	4,264
General Tire & Rubber ²	- 1.8	- 42.4	+ 7.8	+ 4.1	421,000	11,300
General Transistor.....	+225.0	+122.7	+188.1	+ 88.0	3,300	346
Giannini (G.M.).....	+ 4.1 ⁶	- 32.1 ⁶	+ 11.0	- 8.5	10,600	311
High Voltage.....	+ 86.6 ⁶	+103.2 ⁶	+ 75.0	+ 96.4	4,900	330
Hooker Electromechanical ²	+ 1.1	+ 8.6	- 1.8	- 33.0	108,000	8,848
IBM.....	+ 38.0	+ 37.6	+ 36.2	+ 29.8	1,000,000	89,292
Indiana Steel.....	- 6.5	+ 24.0	+ 10.6	+ 5.6	12,500	350 ⁵
I-T-E Circuit Breaker.....	+ 10.5	+ 3.2	+ 16.8	+ 20.9	125,000	6,343
Lockheed.....	+ 10.9	- 1.0	+ 21.1	+ 6.2	900,000 ⁵	16,000 ⁵
Mallory.....	- 8.2	- 62.9	+ 13.3	+ 2.2	78,100	3,133
Marchant.....	- 10.3	-114.6	- 3.7	- 71.0	26,000	563
McGraw-Edison.....	+156.5	- 9.3	+ 21.8	- 3.7	257,000	14,650
Minneapolis-Honeywell.....	- 3.2	- 12.7	+ 12.8	- 5.0	325,000	21,350
Minnesota Mining.....	+ 1.1	- 12.2	+ 11.8	+ 2.6	370,000	39,727
Nat'l Cash Register.....	+ 1.0	+ 3.6	+ 12.2	- 1.2	383,000	18,190
Philco.....	Same	+ . . . ³	+ 4.5	+669.5	373,000	4,363
RCA.....	+ 2.2	- 15.7	+ 4.3	- 3.7	1,176,000	38,549
Servomechanisms.....	+ 29.3	- 17.6	+ 26.8	- 41.8	23,000 ⁵	807 ⁵
Stavid.....	+ 3.4	+ 10.8	+ 27.4	+ 18.3	10,100	239
Sylvania.....	+ 5.8	+ 22.0	+ 3.3	- 14.7	343,000	12,655
Thompson.....	- 7.6	- 75.8	+ 20.2	- 9.2	369,000	11,942
Tung-Sol.....	+ 22.0	+ 7.1	+ 20.2	+ 7.6	64,100	3,130
Western Electric.....	- 9.1	N.A.	+ 4.6	+ 4.4	2,481,000	84,608
Westinghouse Air Brake.....	+ 2.0	- 21.5	+ 10.2	+ 1.4	237,000	12,088
Zenith.....	+ 20.0	+ 43.4	+ 12.7	+ 32.2	160,000	8,166

¹ Approximate ² Fiscal year, ends Nov. 30 ³ Nonmeasurable, deficit previous period ⁴ Deficit, but less than previous period
⁵ Estimated ⁶ Percent change in last six months

panies for which it was possible to estimate fourth quarter earnings, 20 were down from last year and 17 were up.

Fourth-quarter sales increases in some cases were also less satisfactory than sales increases for the year 1957 as a whole. Fourth-quarter sales were up for 20 firms, down for 17 and one reported no change. Last half sales were up for the two firms reporting semi-annually.

Chief reasons given for yearly and quarterly earnings being below expectations were the cutback in military spending and a general softening of the economy. Lower prices, rising material and labor costs, higher research and development investment plus change-over costs of putting new products into production were also frequently mentioned.

Nevertheless, a number of firms reported enviable earnings records:

In the radio-tv-electronics group, Zenith's annual earnings were up 32.2 percent; quarterly earnings were up 43.4 percent. Philco's profits last year were six to seven times higher than 1956.

Among the research-and-development firms High Voltage reported a 96.4-percent increase in annual profits and indicated a 103.2-percent profit for the final six months.

In the group of aircraft manufacturing firms, Boeing's 18.7-percent annual earnings increase and

53.7-percent quarterly earnings increase stood out.

Among office equipment manufacturers, IBM made an impressive showing with fourth-quarter earnings up 37.6 percent and annual earnings up 29.8 percent.

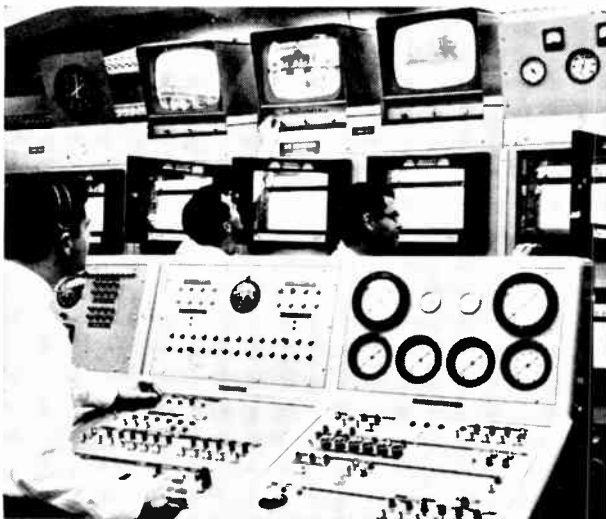
Several industry leaders indicate that first-quarter 1958 earnings may be disappointing. Five out of fifteen firms said their first-quarter earnings for 1958 would be less than for first quarter 1957. Firms were more optimistic about possibilities of a pickup in the second half of the year, maybe by the second quarter.

Higher planned military spending is the chief hope for an immediate pickup in electronics business.

However, the firms which have been feeling the effects of increased military spending report that the first quarter of 1958 is still too early for the new military business to be reflected in higher sales and profits.

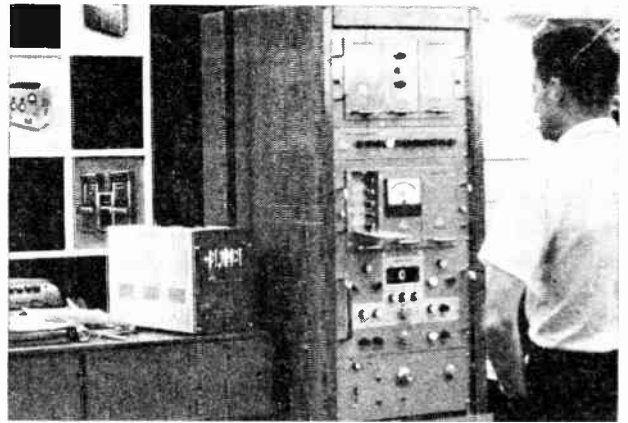
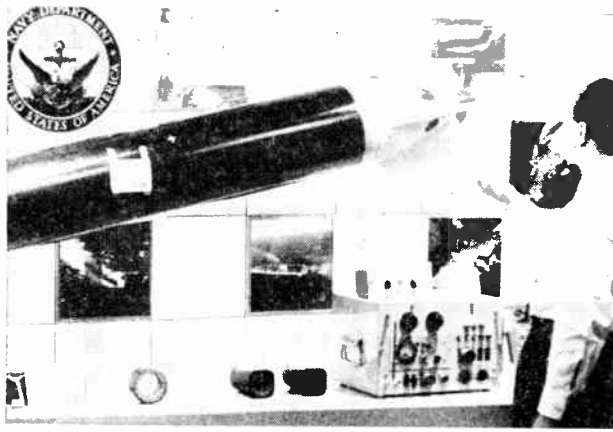
On the other hand, some firms report they have seen little evidence of increased military spending. They report contract-negotiation activity is increasing, but that procurement authorities are slow to sign on the last dotted line.

Component manufacturers and sub-contractors have felt the lack of new defense business most keenly.



Eyes and Ears of Rocket Range Blockhouses

A \$300,000 tv network monitors hazardous static firings of liquid and solid rockets at Aerojet-General's huge test facility in Sacramento, Calif. System installed by Hallanore Electronics division of The Siegler Corp. consists of 36 camera-receiver chains with two-way sound. Transistorized cameras are electrically controlled



Military displays were highlighted among many exhibits at last week's IRE Show. On display were acoustical torpedo (left) and data handling equipment for missile testing

The Year of the Hard Sell

This year's Radio Engineering Show stressed components, hardware, materials, instruments and production equipment for the industry. Few displays held anything startlingly new but nearly all contained ideas to help the engineer design better parts and products

THE ELECTRONICS INDUSTRY appeared last week at the 46th annual IRE Convention as a lusty young giant, sleeves rolled up, ready to tackle bigger jobs in research, development, design and production.

Uncle Sam, the industry's top customer was much in evidence. Many displays featured components, materials and equipment designed especially for missiles, satellites as well as for conventional weapons.

Although the military theme was apparent, the exhibitors weren't telling much. Pictures and models set the scene, not actual equipment. Two probable reasons: tighter budgets and tighter security.

Most of the computers shown were of the analog type. The digital models seemed this year to have departed for the many office-equipment shows.

Microwave gear was accorded much space. In microwave the push in design is on two fronts: higher in frequency, higher in power—to communicate with our missiles in flight, to detect the enemy's.

Making things smaller is still the principal business of many engineers. Show-goers saw a 4-lb television set, radio transmitter in a sardine can.

In components, the microwave-amplifying maser made its commercial debut.

Transistors of both silicon and germanium were widely used in equipment on display. And new intermetallic compounds, only recently considered exotic, were offered for sale by several suppliers. Their main asset: resistance to extremely high temperatures.

On the other end of the scale, engineers saw batteries designed to deliver full output under Arctic cold.

Visitors to the fourth floor of New York's Coliseum sensed a trend to more automatic production. Coil winders were out in force. One firm showed an automatic assembly machine.

Environmental test equipment gained prominence. One random noise generator shown had an output amplifier built on a scale heretofore usually reserved for powerful radio transmitters.

Engineers went away from the Coliseum saying things like—"More evolutionary than revolutionary." But one man had it summed up in a nutshell—"This year they came to sell, not to impress."

SILICON

(ACTUAL SIZE)



POWER

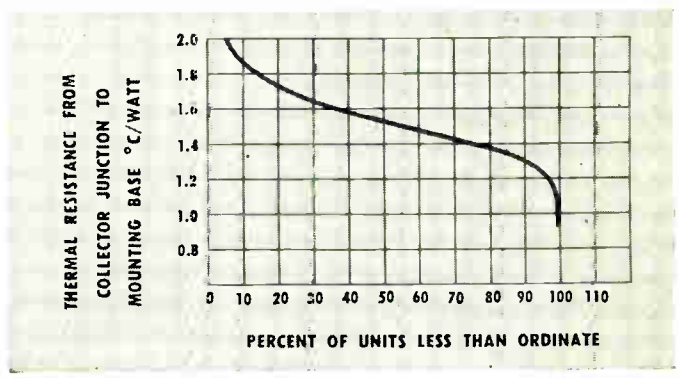
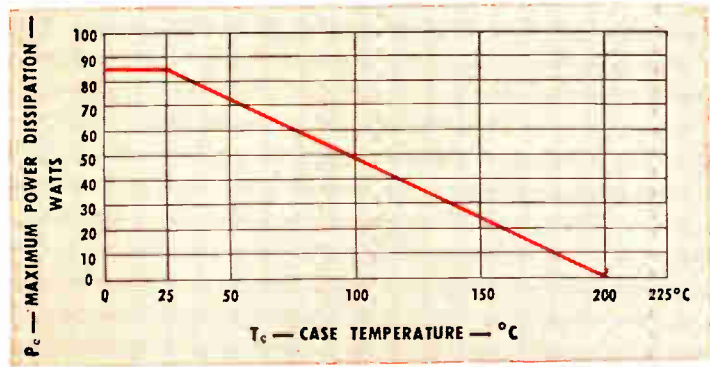
IMMEDIATELY AVAILABLE IN PRODUCTION QUANTITIES FROM T/I!



(ACTUAL SIZE)

TRANSISTORS

45 WATTS at 100°C . . . OPERATION TO 200°C



For your audio servo applications... for your circuits that demand *high* power at *high* temperatures, specify TI 2N389 and 2N424 high power silicon transistors. Obtain optimum performance from -65°C to +200°C.

Both units are derated from 85 watts at 25°C to 200°C and combine the additional advantages of low distortion... stability... high reliability.

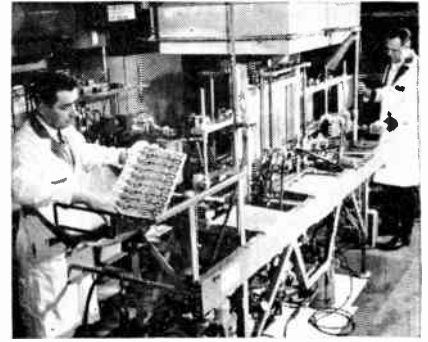
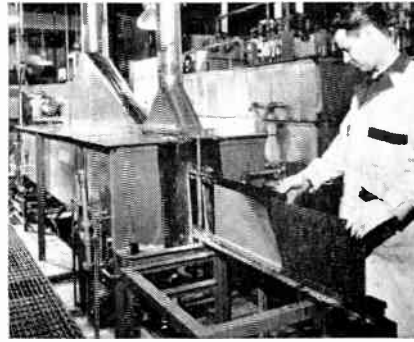
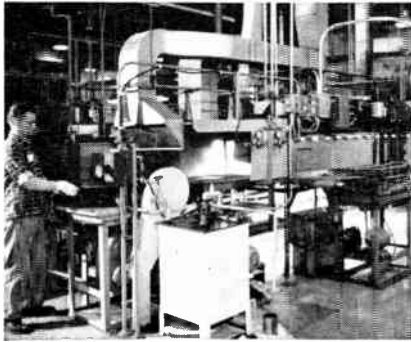
Test Conditions	2N389		2N424		units
	min	max	min	max	
BV_{CEX}	60	—	80	—	volts
BV_{EBO}	-10	—	-10	—	volts
R_{CS}	—	5	—	10	ohms
V_{BE}	—	8	—	—	volts
V_{FE}	10	60	—	—	volts
h_{FE}	—	—	10	60	—
PC	—	85	—	85	watts
PC	—	45	—	45	watts
Storage Temperature	-65°C to +200°C				

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Prepunched circuit board is coated on both sides with adhesive (left), then sprayed to give a thin conductive film (center). Automatic offset printer (upper right) then masks areas not to be plated. After plating, boards are cycled on lazy-susan (lower right) from one assembler to next and automatically soldered as . . .

Machines Speed Set Output

CHICAGO—NEW MACHINES for plated circuits and lazy-susan soldering and assembly contribute to economy, speed and quality in one firm's portable radio and auto radio manufacturing facilities. Automatic offset equipment prints up to 50,000 circuits a week.

Here are the steps followed at Motorola in making radio sets automatically:

Die punch the XXXP laminate board. One board will furnish chassis for several radio sets.

Wash and brush board to get rid of foreign material.

Coat both sides of circuit board with special thermosetting adhesive which establishes a good base for the circuitry.

Metalize the board by spraying a coating of metal only 1/10,000,000 in. thick on both sides of the board. A chemical reduction process facilitates spraying on the metal coating successfully.

Print both sides of the board with enamel ink, using an offset process. The ink pattern covers the nonconducting portions of the circuits.

Electroplate a 1/1,000 in. thick coating of copper on the unprinted portions of the board.

Wash and brush the board to remove any foreign material.

Dip the circuit board in ink stripper which dissolves away the enamel-ink mask.

Bright dip the board. This removes any unwanted

metal film and lusterizes the desired 1/1,000 in. thick electroplated circuitry.

Mask with an overcoat the portions of the circuitry that will not receive solder in subsequent operations. This helps confine solder to required areas, reduces waste, gives uniform application.

Cure the circuit board in an oven.

Die separate the large circuit board into several individual radio chassis.

Dip the plated chassis in a fluxing bath, dry the chassis and inspect.

Assemble radio sets on lazy-susan turntable and automatically solder parts in place.

Hans Schiff, works manager at Motorola, explains that plated circuits give economy of circuit layout per sq in., economy in material usage for a given circuit pattern and compactness in the final package.

"We place no jumpers manually onto the board," he says. "They are part of the plated circuit pattern. We have continuity of plating through the holes. This prevents shorts and open circuits.

"When we deliver a circuit board to the assembly line," he continues, "no additional processes are required for the board. The method also gives us ease of soldering. More important, we do not have a critical temperature range in our soldering applications."

A big economy factor is freedom from the require-

ment of double handling to obtain double-sided circuitry. All equipment and initial die layouts emphasize registration. Good capping on both sides around the holes gives a solid feedthrough of solder and serves as additional insurance to prevent wiring from lifting.

The company designed and made the adhesive coating machine and its other featured equipment. Units shown in pictures are for a portable radio chassis approximately 2.16 by 10 sq in. or a total of 21.6 sq in.

A group of eight banks of infrared lamps totaling 64 lamps are used to dry. Travel time for a strip is 10 ft per min.

The firm's lazy-susan device does 150 soldered connections at one stroke. Timing of the rotary unit to reach working positions and one soldering position is synchronized with the labor content

of particular unit being handled at the time.

Process starts by the operator placing the printed circuit board in a holding fixture. The operator inserts sockets, resistors, capacitors, transformers and other units into the board in a vertical position.

The machine is indexed on the time cycle and other operators around the table put in parts that will demand equal time. This factor is determined from time standards. The unit cycles to the last position where solder bath rises and solders components.

The unit is removed from its holding fixture on the lazy-susan and put on the assembly line where tubes are inserted and speakers hand wired. The chassis is moved to phasing and test positions, assembled in its case, and then moved to final test and visual inspection before packaging and shipment.

'Flying Saucer' Radar Sweeps Skies

SOUTH WEYMOUTH, MASS.—One of the most potent airborne radar systems ever constructed was in the first stages of a six-month evaluation program this week at the Naval Air Station here.

Its mission—prevent end runs around the DEW Line.

Navy's Lockheed-built experimental "flying saucer," a Super Constellation (see photo) with a flap-jack-shaped rotating radome 37 feet wide, will sweep surface-to-sky spaces off the eastern and western flanks of the North American Air Defense Command's perimeter.

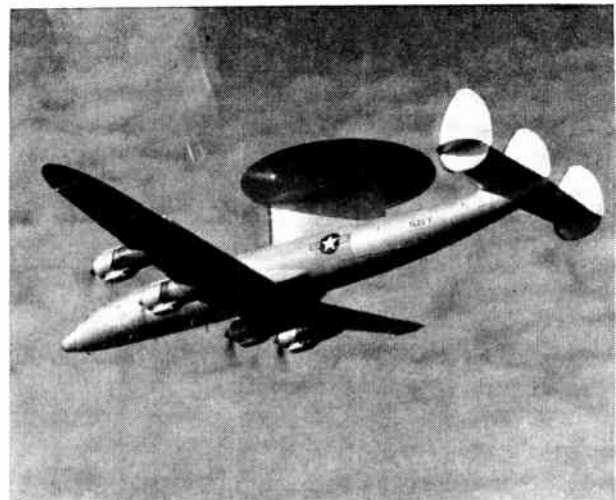
The WV-2E joins Navy's WV-2's and Air Force's RC-121's on Airborne Early Warning duty, patrolling from the mid-Atlantic north to Newfoundland and from the mid-Pacific up to Alaska.

Function of the aircraft is to detect and identify manned bombers, track them in three dimensions, control intercepter planes, and report to surface command. Radar system, designated APS-70, includes automatic data processing equipment and it can track scores of targets for simultaneous interception.

"Nuclear-armed bombers constitute the most immediate threat to American cities and bases—and will remain a threat . . . for years to come," warned Maj. Gen. Harvey T. Aless, NORAD deputy chief of staff.

The radar was developed by MIT's Lincoln Laboratory, with Lockheed as airframe design and electronics system manager, and GE and Hughes as major suppliers.

Details of the radar are classified, but William



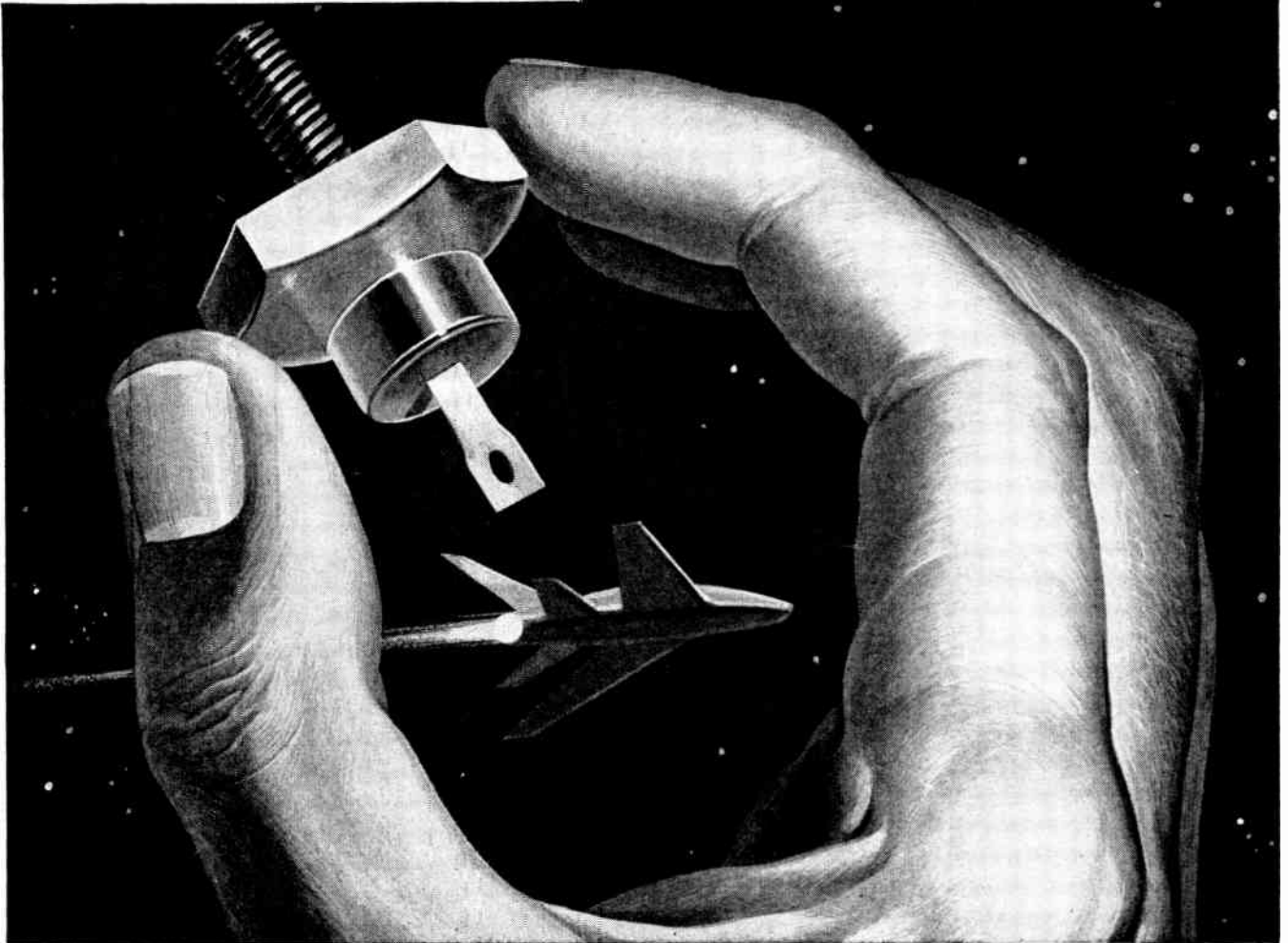
W. Ward of Lincoln Lab says the antenna increases range 70 percent over the earlier WV-2. The new radar has high peak and average transmitted power and sensitive receiving circuits. It can report on objects in the skies from sea level to 100,000-ft without shifting the antenna upward or downward. "There are no hidden altitudes," says Ward.

Moving target indication and other selective features allow operators to observe airplanes and ignore ships. Interfering radar signals reflected from clouds, precipitation and "sea clutter" are minimized.

"The innovations are straightforward ways to improve radar performance—brute force solutions to the problem," according to Ward.

Many of the components and circuits developed for the airborne radar have already found applications in new ground-based and shipboard systems.

NEWS ABOUT SILICON DEVICES



SILICON RECTIFIERS are finding increasing use at elevated temperatures in aircraft and missile applications by providing more power per pound.

Now...design improvements made possible with components of Du Pont Hyperpure Silicon

Today silicon rectifiers make possible a vast improvement in jet-age aircraft generators—the use of engine oil as a coolant instead of less-efficient ram air. Silicon rectifiers take the place of oil-sensitive brushes, commutator and slip rings . . . are completely unaffected by 150°C. engine oil. Result: a *brushless* generator of less weight and size than ordinary generators.

Silicon devices can similarly help you miniaturize—improve design and performance. Silicon rectifiers have excellent stability . . . can operate continuously at -65 to 200°C. They're up to 99% efficient—reverse leakages are only a fraction of those of other semiconductors. Both transistors and rectifiers of silicon can pack *more* capacity into *less* of your equipment space.

Note to device manufacturers:

You can produce high-quality silicon transistors and rectifiers with Du Pont Hyperpure Silicon now available in three grades for maximum efficiency and ease of use . . . purity range of 3 to 11 atoms of boron per billion . . . available in 3 forms, needles, densified, cut-rod. Technical information is available on crystal growing from Du Pont . . . pioneer producer of semiconductor-grade silicon.



◀ NEW BOOKLET ON DU PONT HYPERPURE SILICON

You'll find our new, illustrated booklet about Hyperpure Silicon helpful and interesting—it describes the manufacture, properties and uses of Du Pont Hyperpure Silicon. Just drop us a card for your copy. E. I. du Pont de Nemours & Co. (Inc.), Silicon N-2496-E-4, Wilmington 98, Delaware.

PIGMENTS DEPARTMENT



REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

Giant Brain to Undergo Speedup

COMPLETE REDESIGN of one of the largest electronic computers will soon be formally announced. Drum-type memory system will be replaced by magnetic cores. Result is that machine, said to have been "loafing" heretofore, will handle much more data much faster.

STEREO PHONO DISK race is apparently all but won by the 45-45 system. Proponents of competing systems are far from throwing in towel, however. Nevertheless, many of the major record companies have 45-45 equipment installed and undergoing test. Informed observers feel that stereo disks of this type will be generally available by fall of this year.

GERMAN ANNOUNCEMENT of huge new dirigible, larger even than the Hindenburg or Graf Zeppelin II, cues considerable speculation concerning electronic equipment to be carried aboard the largest craft ever to roam the skies. Almost certainly doomed is the traditional system of dual helmsmen, one manning the elevators and facing forward while a rudder man stood with his feet planted fore-and-aft. They will be supplanted by electronic gyro and automatic pilot equipment, devices unknown to rigid airships when Hitler

ordered the dismantling of the two Grafts early in World War II. Other strong possibilities are radio-telephones for passenger use, and radio, tv and facsimile receivers in the lounges.

STEREO BROADCASTING activity is keeping pace with that in disk and tape. In addition to present systems using two separate carriers or multiplex f-m with subcarrier, still another system is on the horizon. This one uses sum-and-difference information theory, generally similar in principle to the Minter stereo disk (*ELECTRONICS*, Feb. 28), and thus is completely compatible for monaural reception on existing receivers. For this reason it is now being seriously considered for one of New York City's good-music stations.

MAGNETIC TAPE recording speeds have slid downward rapidly from the 30 ips of the original Magnetophone to the $\frac{1}{4}$ ips in experimental use today. Now the 7.5-ips speed used in hi-fi home machines for several years appears about to give way. One of the largest manufacturers has perfected a 3.75-ips machine of comparable quality which is about ready for market. As an inducement there will also be offered a rather extensive library of recorded tape at the slower speed.

TECHNICAL DIGEST

- Space-frequency correlation permits replacing unwieldy single large radar antenna on aircraft with two smaller antennas tucked into conveniently available locations. Technique described by Bendix engineers involves trading antenna size for system complexity; new system transmits two different frequencies rather than one. Technique can also be applied to underwater sound systems.

- Elongation of steel strip during each pass through cold-rolling mill is measured electronically without stopping mill, by comparing speeds of traction and braking rolls in electronic control system made by Siemens Schuckert of Erlangen, Germany. Perforated disk on shaft, rotating between photoelectric diode and small lamp, converts speed into signal frequency for each shaft. Circuit using bridge rectifier, amplifiers and square-wave generators

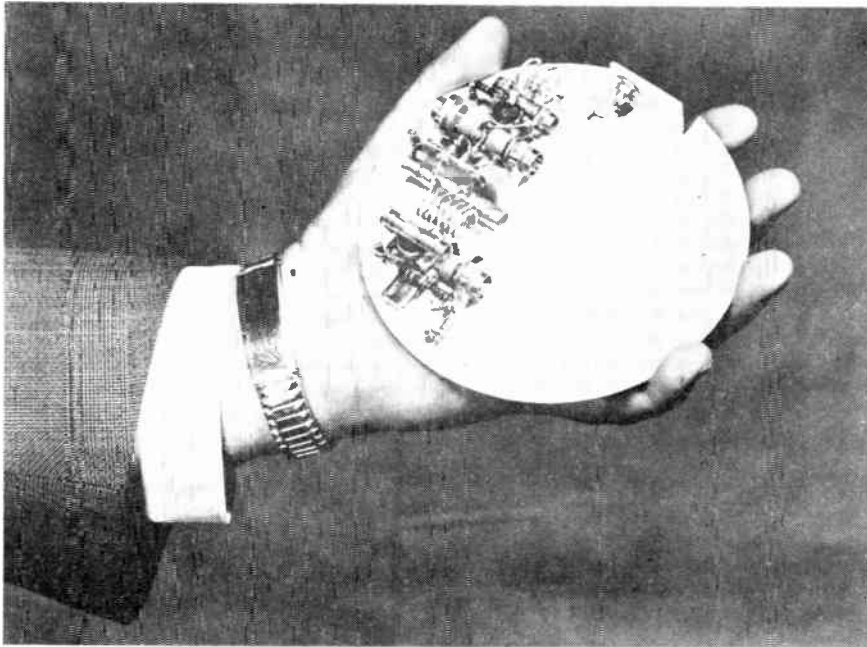
converts difference frequency to d-c signal driving recorder calibrated in strip thickness.

- Sorting of ferrous parts according to composition, hardness, strength or ductility can be achieved automatically at speeds up to 200 parts per minute with new Magnatest Q unit by Solut-Schall Ltd., London. When part slides through test coil surrounding chute, induced voltage is zero only if part is exactly like standard specimen in comparison coil. If part differs in magnetic and electric characteristics, resulting alternating voltage actuates sorting gate, gives pattern on scope screen and can also drive recorder.

- Magnetic fields are made visible by suspension of Magnaflex paste in oil, encased in three-piece laminated Plexiglas enclosure, eliminating nuisance of iron dust

pattern technique. Locations of poles in magnetized objects are quickly determined by giving device a snap of wrist to remove former pattern, then holding it against magnet. Technique is used in dust-free gyro room of Westinghouse Electric's North Carolina Works to determine number of poles in circular magnets for gyros.

- Brushless alternator, developed by Aerojet-General as high-frequency power source for missiles and aircraft, is explosion-proof and can withstand 430 C. Frequency range is 60 to 7,000 cps, corresponding to speeds of 1,800 to 70,000 rpm. Rotor is solid, with metal pole body embedded in non-magnetic metal cylinder. Stationary field coils surrounding rotor shaft at each end induce flux into rotor shaft, from where it travels to rotor pole faces and across air gap to stator laminations.



Transistors that operate on 108 mc are used in 6-cu in. satellite transmitter

Satellite Transmitter Uses Transistors

TRANSISTORS that operate as oscillators and amplifiers on 108 mc may increase satellite transmitter life 1½ to 4 times. The transistors have been incorporated in a 500-mw version of the Naval Research Laboratory's 100-mw satellite transmitter.

DuKane Corp., developer of the transmitter claims higher efficiency as well as the desired power level. A tube transmitter developed by DuKane for the same purpose require five times the battery voltage and five times the power.

In satellite programs, this means a highly significant saving in weight, since fewer batteries can do the same work. Similarly, using the same batteries, the satellite transmitter can broadcast for a much longer time.

Electronics Aids in Metal Studies

DIRECT-READING spectrometer with automatic glow-tube readout has been developed by Baird-Atomic for the National Bureau of Standards. The system presents information capable of being fed directly into electronic computers.

A highly repetitive workload of metal and alloy studies is handled by the Bureau for use in the cali-

The tiny transmitter weighs less than 3 ounces and occupies less than 6 cubic inches of space. The efficiency of the transmitter could aid in getting a rocket to the moon by substantially reducing payload.

An additional advantage of the transmitter is that it operates on a single 20 to 24 volt battery. A tube type transmitter requires a low-voltage filament battery and a high-voltage battery for plate supply.

The combination of light weight and low battery drain suggest other uses. Police and fire departments and civil defense applications are foreseen. For defense uses, the new circuits make a radio transmitter possible that is small enough to fit in a shirt pocket or an infantryman's helmet.

bration of emission spectrometers and other laboratory equipment. As many as 10,000 determinations are required to establish a single standard.

The reader provides simultaneous measurement of 18 of the 36 elements that the instrument is capable of measuring. The spectral intensities of these elements are

measured by photomultiplier tubes positioned behind exit slits at selected wavelengths.

The output voltage of each tube is proportional to the amount of the element contained in the sample being analyzed. The voltage is interpolated by an electronic glow tube counting system into digital values that can be handled by the punching mechanism of the IBM system and automatically processed.

Instruments Find Crash Causes

ELABORATE instrumentation is providing information about the behavior of experimental and other airplanes in the moments before crashes. Transducers, electronic amplifiers and recorders are monitoring stresses, pressures, temperatures to provide clues to defects.

In the tragic cases in which the pilot is killed, no other information may be available. Even if the pilot and crew can be questioned, they can't provide the quantitative information of recordings of large numbers of variables.

An F-100 Super Saber, for ex-

Japanese Computer Stores 2,400 Bits



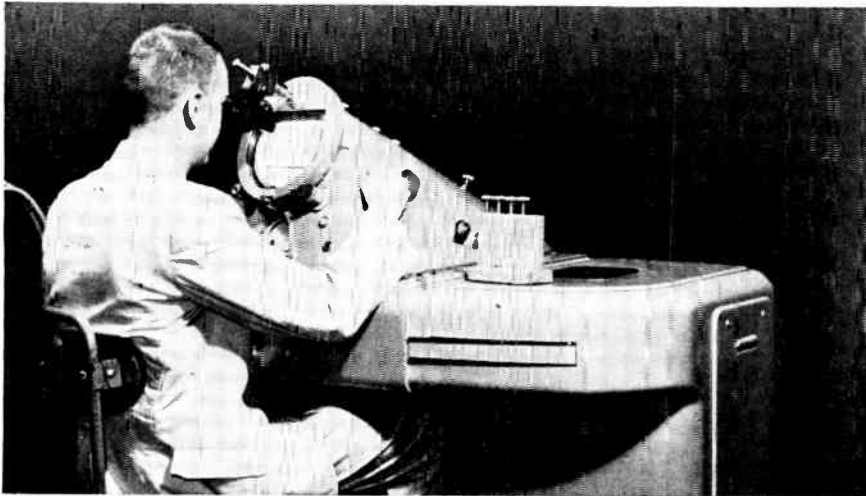
Shigeru Takahashi points to recording drum of Japanese transistorized computer (see p 50). Drum rotates at 18,000 rpm, and computer consumes only about 300 watts

ample, disintegrated during a flight test. The photo-sensitive paper record from a Consolidated Electro-

dynamics' recording oscillograph was recovered from the wreckage. The record showed that as the

pilot began a dive, the nose of the plane shot upward and to the right. Before the pilot could get the plane under control, it went into a high, nose-right yaw.

Microscope Magnifies 100,000X



Research on ferroelectric materials, plastics and molecular crystal structures will be speeded with this Norelco electron microscope in the physics lab of Hughes Aircraft. It will magnify the size of a specimen as much as 100,000 times on a viewing screen and up to 1 million times photographically

The opposing forces resulting from the sudden change of direction made at supersonic speed ripped the plane apart.

Recovery of oscillograms from a crashed SeaMaster provided similar information. The plane was returning from a routine test flight. While flying level at 21,000 feet and 600 mph, it suddenly went into a tight inside loop.

The pilot could not regain control, so the crew ejected. The plane went in a downward spiral and broke up at about 8,000 feet.

Examination of recovered oscillograms showed that a tail modification caused aerodynamic forces to build up at high speeds, eventually forcing a sudden nose-down movement of the horizontal stabilizer.

MEETINGS AHEAD

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

Apr. 8-10: Sixth National Conf. on Electromagnetic Relays, Oklahoma State Univ., Stillwater, Okla.

Apr. 8-10: Symposium on Electronic Waveguides, Microwave Research Institute of Brooklyn Polytechnic Inst., held at Engineering Societies Bldg., N. Y. C.

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

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

Apr. 14-16: Conf. for Protective Relay Engineers, Dept. of Electrical Engineering, A and M College of Texas, College Station, Texas.

Apr. 15: Closing date for registration, Intensive course in Automatic Control, scheduled for June 16-25 at Univ. of Mich., Coll. of Engineering.

Apr. 17-May 29: Lecture series on Principle and practices of Tape and Disk Recording, Every Thursday at 7:15 pm, Audio Engineering Society, RCA Institutes, N. Y. C.

Apr. 17-18: Second Annual Tech. Meeting, Institute of Environmental Engineering 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, 49th Annual Meeting, El Mirador Hotel, Palm Springs, California.

Apr. 21-26: Society of Motion Picture and Television Engineers, 83rd Convention, Ambassador Hotel, Los Angeles.

Apr. 22-24: 1958 Electronic Components Conf., IRE, AIEE, Theme: "Reliable Application of Component Parts," Ambassador Hotel, Los Angeles.

Apr. 24-26: National Academy of Sciences, U. S. National Comm., International Scientific Radio Union, Spring Meeting, Willard Hotel, Wash., D. C.

Apr. 27-May 1: National Assoc. of Broadcasters, 36th Annual Convention, Biltmore and Statler Hotels, Banquet in Hollywood Palladium, Los Angeles.

Apr. 28-30: Middle Eastern District Meeting, AIEE, Sheraton Park

Hotel, Washington, D. C.

Apr. 28-May 1: Sixth Annual Semiconductor Symposium of the Electrochemical Society, Statler Hotel, N. Y. C.

Apr. 29-30: Symposium on Electronic Scanning of Antennas, AFRCRC and Rome Air Devel. Command, L. G. Hanscom Field, Bedford, Mass.

Apr. 30-May 2: Seventh Regional Conf. and Trade Show, IRE, State Fair Grounds, Sacramento, Calif.

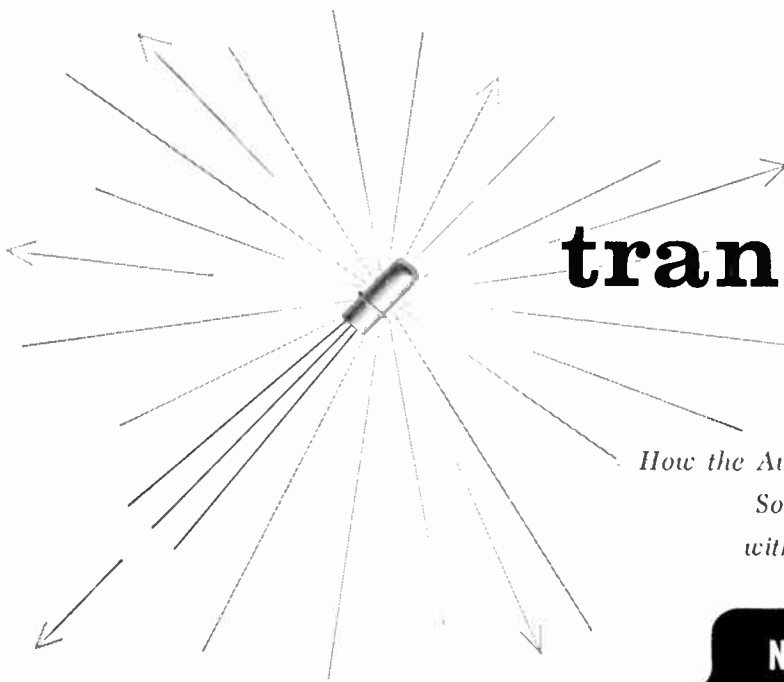
May 4-7: Fourth National Flight Test Instrumentation Symposium, ISA Park Sheraton Hotel, N. Y. C.

May 5-7: Professional Group on Microwave Theory and Techniques, PGMTT, Stanford Univ., Stanford, Calif.

May 6-8: Western Joint Computer Conf., First National Symposium on Modern Computer Design, Ambassador Hotel, Los Angeles.

May 12-14: National Aero. & Nav. Elec. Conf., PGANE, Biltmore Hotel, Dayton, Ohio.

May 12-14: Eighth Annual Research Equip. Exhibit and Instrumentation Symposium, National Institute of Health, Bethesda, Md.



transistor failure?

How the Autonetics Division of North American Aviation Solved This Costly Reliability Problem with RADIFLO Non-Destructive Testing

NORTH AMERICAN AVIATION

Hundreds of transistors were tested for leakage with the RADIFLO Leak Detection System by Autonetics. Environmental tests of these transistors conclusively showed: (1) a high percentage of transistor failures-in-circuit are due to leakage, and (2) such failures are virtually eliminated when transistors pass a RADIFLO test of 10^{-11} cc/sec.

Autonetics' Computer Department now tests all of its thousands of transistors with RADIFLO.

THIS IS HOW RADIFLO DETECTS LEAKAGE IN ANY HERMETICALLY SEALED COMPONENT

Parts are sealed in a tank... inert, non-toxic, radioactive gas is pumped into the tank under pressure... gas is removed and parts are air-washed... then, radioactive material that has leaked into the parts precisely measured, and the leakage rate immediately flashed to the instrument panel.

The RADIFLO Leak Detection non-destructively measures leakage to 10^{-13} cc/sec.—after units are completely sealed. It permits Go-No-Go parts-grading by leak rate... without electrical or mechanical harm to the component. Sensitivity is 1,000 times greater than any other method. The system can be completely automated.



Costly? Production quantities tested in your plant average less than 1¢ each!

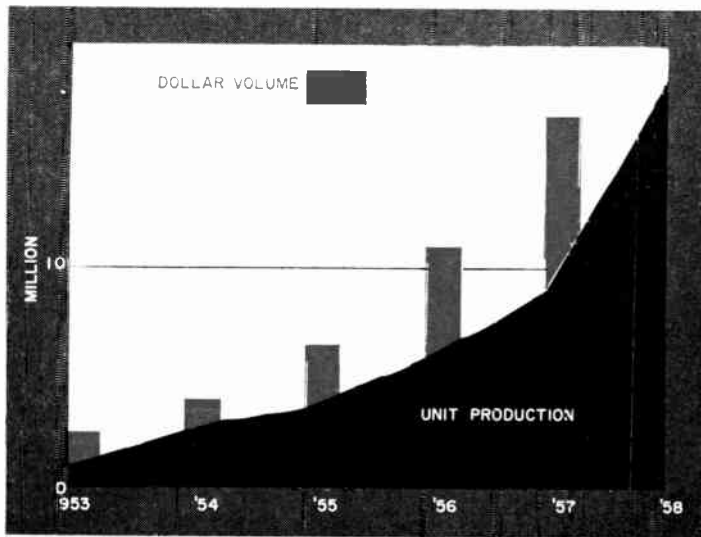
WRITE FOR BULLETIN 7071.1

Hundreds of Companies are using our Radiflo leak test service. Try it by contacting American Electronics, Inc., 108 West 15th St., New York, N. Y., phone CHelsea 3-0804 or



AMERICAN ELECTRONICS, INC.

REED-CURTIS NUCLEAR DIVISION
655 West Washington Boulevard, Los Angeles 15, California



Tantalum capacitors show steady production increase in past five years. Output will leap in 1958 as . . .

Tantalum Bind Ends

Product value may reach \$30 million this year. It was only about \$2.5 million in 1953

TANTALUM CAPACITORS will make a real showing this year. Previously tight supplies of high purity tantalum metal have been increased. Tantalum capacitors can be readily supplied by makers.

In the last few years, trade sources say, production dragged along at about half of demand because of inadequate supplies of metal. The supplies are now so good that refiners can fill orders within a few weeks.

Figures on tantalum refining are guarded, but refinery output has probably more than doubled in the last six months. The major supplier has upped his capacity by 50 percent. Another refiner reportedly is able to produce as much as the total supply of a year ago. And, it is learned, there are four new sources.

During 1958 an estimated 15 to 20 million tantalum capacitors will be made, roughly double 1957 output and 20 times 1953 output. A sizable part of the increase will represent orders unfilled in 1957 and stockpiling by manufacturers.

Product value will probably run around \$25 million to \$30 million this year, compared with about \$2.5 million in 1953. Average price is declining because of improved design and manufacturing techniques.

Military equipment still gets the lion's share of tantalum capacitors and is expected to continue as the major market as long as missiles and miniaturization remain dominant trends.

Production of solid-electrolyte tantalum capacitors has been doubling each year since 1956 and is now estimated at 2 million a year, virtually all in military gear. Various kinds of commercial uses are foreseen.

While continuing availability of tantalum metal is reasonably assured, columbium is being eyed as an alternative. The two metals are similar and columbium is only half as dense. The same refiners make both, but seem more interested at this time in columbium's nuclear and high temperature alloy prospects.

NOW...ANY MICROWAVE COMPONENT CAN BE BUILT AND ENGINEERED TO YOUR PARTICULAR APPLICATION

Regardless of complexity, design or tolerance problems—you can get UHF or microwave components that are job-engineered to your application. All units are delivered, *electrically tested and proven*, ready for immediate operation.

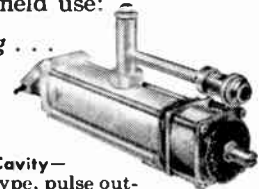
Components can be built from your prints or can be designed and built to integrate with the application. Close and confidential coordination is maintained from drawing board stage to installation.

Range of assemblies is practically unlimited—from dc. to over 40,000 mc., military or industrial. Typical examples are these components, delivered ready for field use:

Telemetering . . .

Tuneable S-Band

Transmitter Cavity—re-entrant type, pulse output 150 w., operates at extreme altitudes and under extreme conditions of temperature, humidity and salt spray.



Improving signal-to-noise ratio . . . selectivity . . .

Tuneable UHF

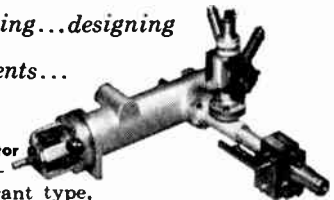
Pre-Selector—relatively low frequency coaxial resonator with very low insertion loss, extreme selectivity and very high signal-to-noise ratio. Especially adapted to use in aircraft or in crowded communication bands.



Calibrating . . . designing S-Band components . . .

S-Band Signal Generator Cavity—

re-entrant type, complete with thermistor mount and calibrated variable attenuator. Frequency range 2700 to 3400 mc.



Get the facts on our complete design, engineering and mechanical fabrication facilities. Have us quote on your needs—cavities, mixers, duplexers, multipliers, rotary joints, twists, bends and other components or assemblies.

Contact us today. Request catalog.

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MICROWAVE
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CIRCLE 23 READERS SERVICE CARD

B-58 Control System Unveiled

Half of Bendix' \$50 million in contracts has gone to subs. "Enormous" military and civil future seen

TETERBORO, N. J.—Recent unveiling of the control system that enables man to fly the B-58 Hustler at speeds and altitudes "too alien" to rely on feel and judgment has revealed a virtually automatic plane.

M. P. Ferguson, president of Bendix Aviation, prime contractor for the system, calls it "a completely new way to fly." Ferguson also sees "an enormous future for the system in both military and commercial markets."

To date, R&D and limited production contracts (22 complete systems have been delivered to weapons system manager Convair) have amounted to approximately \$50 million. Expected soon is a new production contract that will amount to at least \$25 million more.

Although all major elements of the control system are produced by Bendix (600 Bendix employees have been engaged for 3½ years on the project), about 50 percent of the contract money so far has gone for hardware to 400 subcontractors and vendors. All transistors and resistors, for example, are bought on the outside.

Eventual price, when tooled production facilities are available, might drop as low as \$150,000 per unit.

The 730-lb, completely transistorized control system consists essentially of three operations: sensing, computing and actuation.

Sensing data come from the pilot's controls and switches, the airplane attitude reference system,

heading and navigation data, radio guidance for range and approach, altitude and speed from the air data system, body rates and accelerations, actuator positions and velocities and similar information.

This input information is translated into mechanical motion and hence to control of the plane via three interconnected systems:

- **Amplifier computer:** Brain of the system, this 2.2 cu ft package contains 140 transistors, more than 2,000 resistors and capacitors, three miles of wire and 10 electromechanical units containing 14 motors, 60 potentiometers, 15 synchros and gearing with ratios varying from 900:1 to 1,235,000:1.

Here the commands that control the airplane are computed and distributed to other parts of the overall control system.

Also in the computer is a g-limiting feature that automatically prevents either the automatic pilot or the human pilot from commanding a maneuver that exceeds the structural limitations of the Hustler. A violent maneuver could disintegrate the plane.

The system constantly computes the gross weight of the plane (including fuel present and any equipment being carried), modifies this value in terms of acceleration, and maintains Mach and altitude through automatic trim signals as part of the overall control function.

- **Power Control Linkage Assembly:** Combined in a single rigid framework, the assembly contains mechanical parts of the control system that translate input signals from the amplifier computer into linear action. In all, it contains more than 17,000 parts. Electronic equipment in the PCLA include relays, servos, potentiometers and switches.

- **Surface actuation:** Hydraulically controlled.

MILITARY ELECTRONICS

- Navy's next big missile project will be SUBROC, a submarine launched missile that will attack both sea and land targets.

It will be more sophisticated than ASROC (ELECTRONICS Dec. 1, '57). SUBROC system proposals have been submitted by more than 60 firms. Final weapon system manager will be selected by negotiation. Subcontractor business will be big.

- **Production of Arma's tail de-**

fense system using closed circuit tv for the B-52C is scheduled to begin by mid-1958. Designated the AN/ASG-15, the system consists of five elements: track and search radar sets (GE), turret control mechanism, computer (Arma), optical sights and a tv camera (RCA).

The first four components are modified versions of the MB-9 fire control system. Adding a tv camera takes the tail gunner out of the tail and puts him up front with the rest of the crew.

CONTRACTS AWARDED

Western Electric gets a \$129,592,706 contract boost by the Army for production of Nike Hercules missiles and their related ground equipment.

American Electronics wins a \$1 million contract from Convair for ground support generators for the F-106A.

Crosley div. of Avco gets a \$1 million contract with USAF for a serv-

ice test quantity of closed circuit tv sighting link adaptations for aircraft weapon systems. Dage Television div. of Thompson Products will be a major subcontractor.

Beckman Instruments is awarded a contract by Ford Instruments for a series of precision potentiometers, motor generators and magnetic clutches. The components will be incorporated into a Navy shipboard fire control system.

Telecomputing Corp. will supply Army Ordnance with nuclear warhead test equipment under a \$1,845,000 contract. This contract is in addition to a \$1,000,753 agreement made several weeks ago.

Laboratory for Electronics will engineer and manufacture 64 AN/TPN-12's, portable landing control central systems, for Rome Air Force Depot under a \$3.6 million contract. The AN/TPN-12 is a portable airport traffic control radar as well as a GCA system for locating and talking down planes in bad weather. Range is over 20 miles. Accuracy is said to bring a plane to within plus or minus 20 ft of the exact touchdown point.

Melpar will provide Army Signal Supply Agency with ten transponder sets, AN/DPN-48, with C-band head under a \$161,639 contract.

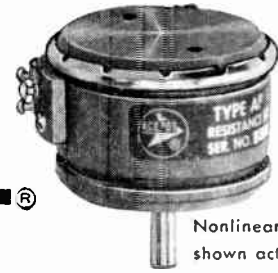
Radioplane will produce target drones for Los Angeles Ordnance District under a \$165,694 contract.

North American sells a digital computer to Los Angeles Ordnance District for \$256,703.

Preshaw & Thompson will supply the Los Angeles Ordnance District with warhead testing equipment amounting to \$496,358.

I-T-E Circuit Breaker will sell 178 Tacan antennas to BuShips under a \$1,711,350 contract.

Lockheed will manage instrumentation and flight test programs for the F-104B and the T-33A under \$2,519,240 and \$400,000 contracts respectively with AMC.



Nonlinear ACEPOT shown actual size.

ACEPOT®

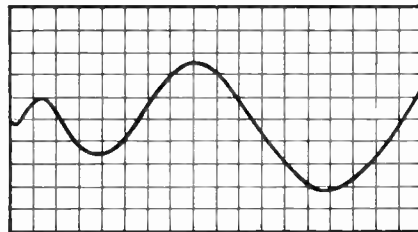
PRECISION, WIRE-WOUND

NONLINEAR POTENTIOMETERS

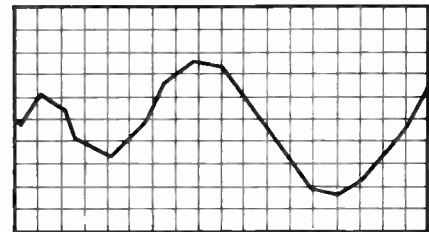
0.25% terminal conformity without padding resistors

A potentiometer without padding resistors produces a smooth output function curve as opposed to a stepped function curve when padding resistors are used. With the addition of padding resistors there is also a corresponding decrease in reliability and accuracy since each padding adds a pair of critical tap-offs to the delicate wire windings.

ACEPOT nonlinear potentiometers have terminal conformity to 0.25% without padding resistors. Desired output function is achieved by use of unique winding equipment of microscopic accuracy plus newly developed manufacturing techniques for precision, miniaturized parts. Dependability is guaranteed with ACE quality control. A tabulation of check points showing voltage ratio versus rotation is supplied for each unit.



ACEPOT WITHOUT PADDING RESISTORS achieves output function within 0.25% with smooth curve that follows application requirements exactly.



SAME FUNCTION WITH PADDING RESISTORS follows stepped curve which impairs accuracy and introduces "tap-offs" that decrease reliability.

To meet the exact requirements for your particular applications, ACEPOTS can be custom designed and mass produced with short lead time. ACEPOTS in AIA sizes are immediately available in sine, cosine, square law and logarithmic functions that meet applicable sections of MIL specs. Call, wire or teletype Dept. F at ACE ELECTRONICS ASSOCIATES, INC., 99 Dover Street, Somerville, Mass. SOMerset 6-5130. TWX SMVL 181.

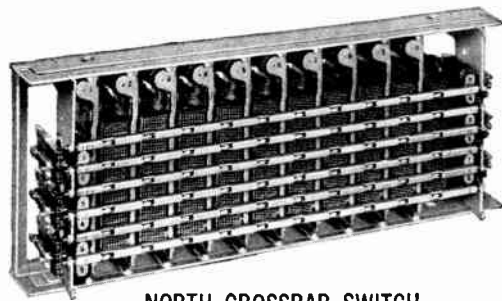
ACEPOT®
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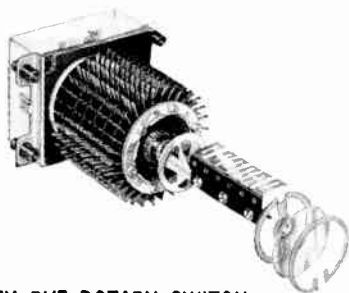
NORTH FLAT SPRING RELAYS

Time tested and proven telephone dependability for universal application.



NORTH CROSSBAR SWITCH

The most economical means of providing maximum switching capacity (inputs to outputs) with relay reliability.



NORTH RVF ROTARY SWITCH

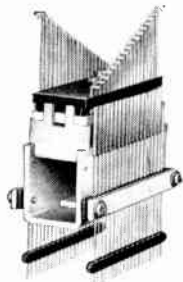
Advanced bank and wiper design affords new flexibility in rotary switch application.



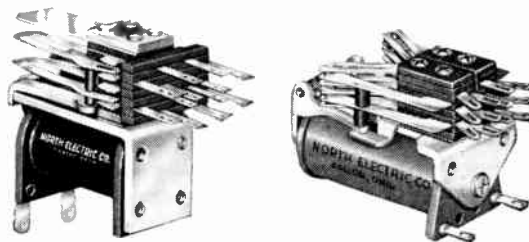
NORTH IR 207 & IR 226

Hermetically sealed general purpose and sensitive relays - high shock and vibration resistance meeting Mil. specs.

NORTH REED ARMATURE RELAY



Exceeds critical requirements in data switching systems where high speed, low level signals must be handled with minimum interference between channels.



NORTH "M" AND "E" TYPE RELAYS

Telephone type dependability in miniature size where space requirements are critical.

In system design...
**THERE IS A
 NORTH COMPONENT
 THAT IS RIGHT
 FOR EVERY
 APPLICATION**

North engineers, specialists for over 75 years in the design, production and application of relays and switch gear, can take over your control system design problems and solve them beyond your specifications. The accumulated know-how of three quarters of a century in this specialized field can be applied to help you - in design, in component specification, and in complete system manufacture.

INDUSTRIAL DIVISION
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Available in Canada through
 Ericsson Telephone Sales of Canada, Ltd., Montreal 8, P. Q.

April 4, 1958 — ELECTRONICS business edition

Announce New Test Instruments



Useful In Lab And Factory

MAXIMUM reliability of components and end products is assured by the constant use of testing equipment—first in the laboratory, and later on the production line. On display are some of the more recent test instruments now being marketed.

A transistor test set, designed for use by engineers engaged in the design and development of equipment employing transistors, is announced by Owen Laboratories, Inc., 55 Beacon Place, Pasadena, Calif., (50). Model 210-A, extremely simple to operate, can accurately ascertain the basic characteristics of all types of small transistors.

American Measurement & Control, Inc., 240 Calvary St., Waltham 54, Mass., (51), has developed the model 500 precision current bridge. It will supply either single-ended or differential current output up to a maximum of 100 ma. A few suggested applications are: testing moving-coil type galvanometers; testing relays for drop-out and pull-in characteristics; testing and calibrating d-c micropositioners.

Now available from Wayne Kerr Instruments, P.O. Box 801, Philadelphia 5, Pa., (52), are two vhf admittance bridges designed primarily for the measurement of antennas, cables, feeders and transmission lines in the 1 to 250-mc frequency range. Transistor characteristics can be easily determined under working conditions.

Teletronics Laboratory Inc., 54 Kinkel St., Westbury, L. I., N. Y., (53). Speed and convenience in production testing are combined with laboratory precision in the model DT-257 tester designed to measure characteristics of medium and low-power semiconductor diodes.

Manufactured by Armour Electronics, Inc., 15002 Oxnard Blvd., Van Nuys, Calif., (54), a compact tester measures I_{cbo} figure of merit of transistors. The test set accurately measures factors of both *pnp* and *npn* type transistors at any desired operating level, assuring the flexibility required for circuit design.



P-C Connectors one-piece body

H. H. BUGGIE, Inc., Box 817, Toledo 1, Ohio. A new series of printed circuit connectors and new additions to standard designs are announced.

Printed circuit board receptacles are now one-piece body construction available in either type GR and MFE mineral filled phenolic, MDG diallyl phthalate or CFC general purpose phenolic. The board receptacle series have a new contact design to prevent board-to-contact damage. Contact material is beryllium copper, standard plating is gold over silver. Nylon polarizing keys permit quick interchangeable polarizations.

Standard terminations are solder eye, taper tab (AMP), solder dip and wire wrap, for either single- or double-sided board circuits. Mini-

For more information use READER SERVICE CARD

imum creep is $\frac{3}{16}$ -in.; working volts are 550 a-c, 770 d-c; and test voltage is 1,650 rms.

The firm has also added new standard designs to its series of printed circuit terminal strips, ter-

minial connector strips and contact strips. **Circle 55 on Reader Service Card.**

Connectors

with dip-solder terminals

GORN ELECTRIC CO., INC., 845 Main St., Stamford, Conn. Printed circuit boards may now be joined at right angles economically using GPCW connectors with dip-solder terminals.

The connector's contact efficiency is such that desired circuit characteristics can be easily maintained. The contacts are made of heat-treated beryllium copper and



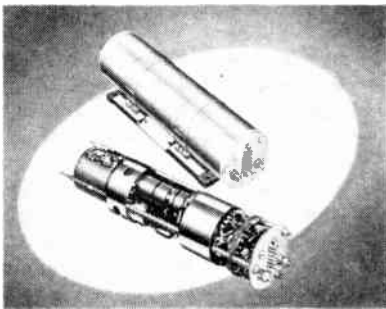
so retain their contact force after repeated insertions and with-

drawals. These same contacts are so designed that they may be also used for wire wrap techniques.

GPCW connectors are available in melamine, plaskon alkyl, or dyall-phthalate. Presently the GPCW with 15 and 22 contacts, spaced $\frac{3}{16}$ apart for $\frac{1}{16}$ in. thick boards, are available from stock, molded in high strength fiber glass filled plaskon alkyl. **Circle 56 on Reader Service Card.**

Voltage Monitor

reduces system error



G. M. GIANNINI & CO., INC., 918 East Green St., Pasadena 1, Calif. The company's precision voltage monitors are reducing normal tele-

metering and recording system errors from 4 or 5 percent to 0.04 percent or less. Basically, these small, lightweight servo-mechanisms increase the accuracy of recorded data to an accuracy comparable with the raw data picked up by the sensing devices.

The voltage monitor is a servo-mechanism which accepts analog signals from sensing devices such as temperature probes, pressure transducers, potentiometers, or synchros. Output is provided by potentiometers, synchros or coded disks.

These are shaft driven through a precision gear train at a ratio of 100:10:1 with respect to one another. Thus, one output will be a function of a 100-percent change in input signal, the second output a function of a 10-percent change, and the other a function of a 1-percent change.

These instruments are tiny, a typical configuration measuring only 2 $\frac{1}{2}$ in. diameter by 6 in. in length. With input impedances as high as 100 or 200 K, system error is no more than 0.04 percent. Instrument accuracy can be improved in larger units. **Circle 57 on Reader Service Card.**

Power Oscillators

20 and 50 w units

ELECTRONICS INTERNATIONAL Co., 145 W. Magnolia Blvd., Burbank, Calif. The new Elin precision power units meet the highest precision power source requirements demanded in preflight missile system checkouts, precision 400 cycle gyro testing, meter calibration and as special power sources for critical requirements. The 20 and 50 w 115 v units are ideal for final checkout of a greater variety of aircraft "black boxes". Ultra-low dis-

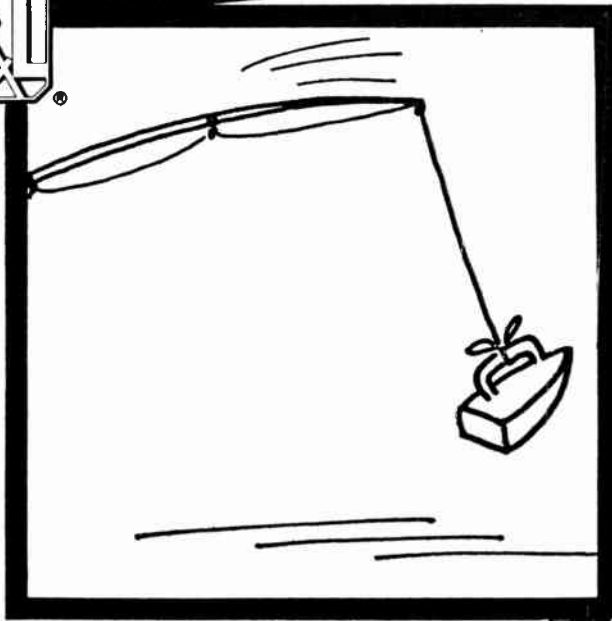
tortion and voltage stability make them the cleanest power source for outgoing and incoming inspection procedures.

Units may be obtained in the cabinet models (DK115, DK150) or rack models (DK115R, DK150R). Precision stability is derived from an exclusive high-Q LC tuned circuit and special voltage-sensitive bridge combined in a circuit employing a large amount of negative feedback. Ability to accommodate



DROODLES

BY ROGER PRICE

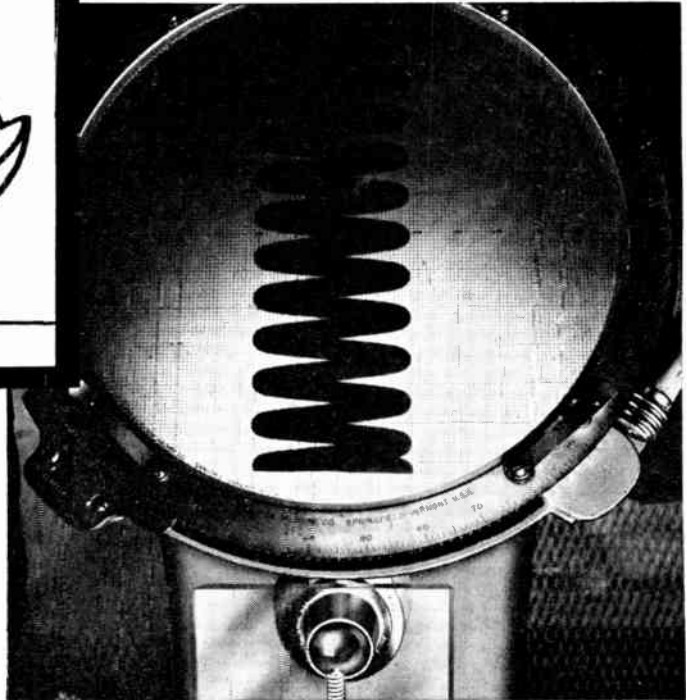


"CAST IRON"

This ice-fishing tackle, invented by me, shows how far the mind of man can soar if it's able to. For the technical-minded: I use a Lazy Daisy 2B flat iron, with 400-lb. test clothesline and a 7-foot section of old vaulting pole. When I let fly with plenty of wrist whip, a hole magically appears in the ice, and the fish lurking below get brained. That's when I move in fast with my net. What could be simpler and more ingenious?

About the only thing I can think of is the J & L Optical Comparator. It's very simple to operate and ingenious than practically anything. This marvelous instrument measures and inspects all sorts of parts and objects, laterally, vertically and angularly—it also inspects by reflection, by tracing and from overhead—and it's accurate, too (to .0001").

Don't take my word for it; here's an example of the Optical Comparator on the job at Wallace Barnes Company Division of Associated Spring Corporation,



Bristol, Connecticut. Spring dimensions are checked to .010" by means of the J & L Model PC-14 Comparator, using a grid chart at 10 magnifications. Accurate positioning of the springs is maintained by means of a focal plane glass on the staging fixture.

The special tools used in manufacturing various types of springs are also inspected on the J & L Comparator.

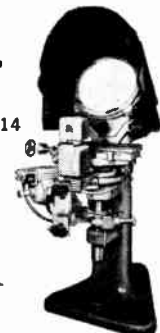
There are eleven models available—from a 7" Bench type to a 30" floor model. For complete details, send this coupon *today*.

----- "The originator of machine tool standards in optical inspection" -----

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 539 Clinton Street, Springfield, Vt., U. S. A.
Please send me Comparator Catalog 5700, which describes the complete line of J & L Optical Comparators.

Floor Model PC-14



name _____ title _____ street _____
 company _____ city _____ zone _____ state _____

384

line voltage variations makes the equipment an ideal source of a-c reference voltage or power supply

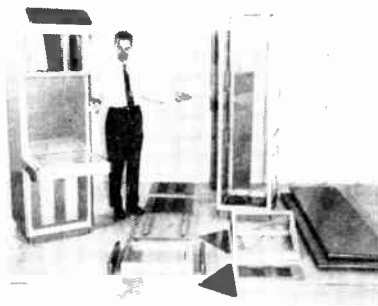
for critical applications.

The DK-115 and DK-150 have virtually zero source impedance.

Audio frequencies are between 250 and 15,000 cps. **Circle 58 on Reader Service Card.**

Modular Enclosures

a complete system



ELGIN METALFORMERS CORP., 630 Congdon Ave., Elgin, Ill., has engineered a complete system of modular equipment and instrument cabinets for use in automotive, communications, automation, electronic, missiles and nuclear research industries.

In using Emcor units, engineers can tailor-make to their own specifications almost any combination of interconnected, expandable en-

closures, housings, cabinet banks, or even complete control rooms.

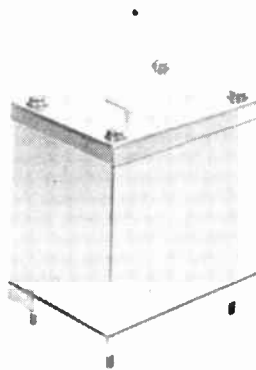
The expanded selection of basic frame designs now includes shelf-height, counter-height, and desk-height units in a complete variety of sizes.

Mass production of modular frames and "skius" reduces design, development, and machine set-up time costs. Merely by drawing parts out of stock, finished cabinets and consoles can be quickly assembled, expanded, or interconnected. **Circle 59 on Reader Service Card.**

Static Inverter

transistorized unit

PERKINS ENGINEERING CORP., 345 Kansas St., El Segundo, Calif., announces a newly designed completely transistorized static inverter to supply d-c and a-c power in target drones. Model M-977 contains no moving parts, and operates from a 28-29 v d-c input to provide, simultaneously, outputs of 150 v d-c ± 5 percent at 140 ma, 6.5 v a-c ± 0.5 percent at 2.1 amperes, 400 cps, ± 5 percent (100 μ sec rise time), and -22.5 v d-c ± 10 percent at 50 μ a.



The inverter has a load regulation of ± 3 percent and a ripple of 0.1 percent rms. Efficiency at full load is 85 percent and the temperature range over which it operates within specifications is -54 C to $+71$ C. Dimensions are 3 in. wide by 4 in. long by 4 in. deep, and it weighs 2 $\frac{1}{2}$ lb maximum. Built to meet environmental requirements of specification MIL-E-5272, the unit is ruggedly constructed and is mounted by means of four No. 8 mounting studs. Operating altitude is up to 50,000 ft. For further details write on your company letterhead.

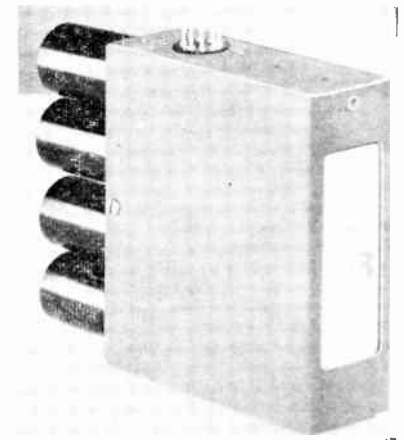
Decade Counter

completely transistorized

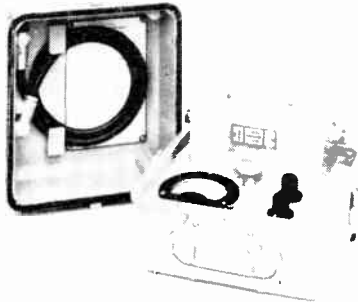
EPSCO COMPONENTS, 108 Cummington St., Boston, Mass., announces a completely transistorized decade counter capable of counting at rates as high as 150 kc. In compact size, the unit has an easy-to-read visual display featuring large $\frac{3}{8}$ in. numerals back-lighted on a translucent plastic panel. Because only the desired digit may be seen on the plastic panel, nonambiguous readout is assured, regardless of am-

bient light conditions.

The counter, designated model CT-101, incorporates rugged, plug-in, encapsulated flip-flop circuits for highest reliability. A 9-pin socket provides decimal or binary coded decimal electrical output for remote indication purposes. Because of the solid state circuitry employed, power consumption is extremely low (120 mw) and only two supply voltages of -3 and -10 v are re-



quired to operate the counter. Power and input signals are fed to the counter through a 9-pin miniature plug which facilitates chassis mounting. Circle 60 on Reader Service Card.



Vswr Indicator priced at about \$195

ALTO SCIENTIFIC CO., 855 Commercial St., Palo Alto, Calif. Model T-32 standing wave ratio indicator is a portable, self-contained unit, built to MIL-E-16400A. It is used to measure vswr in 50 ohm RG S, U transmission lines. Power between 10 and 1,000 w can be handled over the frequency range of operation of 250 to 550 kc. The unit withstands voltages developed with vswr up to 20 to 1. Accuracy for vswr between 1:1 and 10:1 is ± 10 percent. Circle 61 on Reader Service Card.



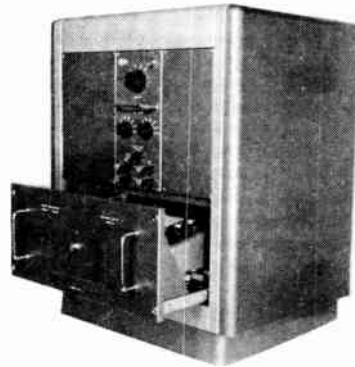
Vhf Transceiver for standby use

TOPP INDUSTRIES, INC., 5255 West 102nd St., Los Angeles, Calif., has introduced a vhf transceiver for use as a standby communication unit. It is the first unit of a new Topp-Flyte line of commercial aircraft communication, navigational and flight control equipment.

The transceiver is crystal-con-

trolled and covers any two-mc band from 118 to 152 mc. The entire unit fits a standard $3\frac{1}{4}$ in. panel opening and extends behind the instrument panel. Complete with its own built-in power supply, it operates from either 14 or 28-v sources. Weight of the unit is less than 5 lb.

The transmitter has an output of $2\frac{1}{2}$ w, conservatively. The unit operates at headphone or speaker levels. Back-lighted dial, ruggedized tubes and built-in antenna relay are also included on the transceiver. The unit is also designed for communication use in airport and industrial vehicles. Circle 62 on Reader Service Card.



Transducer Test Set for the aircraft industry

DORSETT LABORATORIES, INC., 401 E. Boyd St., Norman, Oklahoma. Designed for the aircraft and missile industries, the model 25 transducer test set graphically plots the performance of electromechanical transducers such as syncros, differential transformers and resolvers. Either direct comparison of the output of two transducers, or the difference between a standard unit and a test transducer may be plotted.

Both a-c and d-c transducers may be tested and functions of either X vs Y or X-Y vs X are automatically plotted. The a-c input impedance is 80 K and the d-c input impedance is 200 K minimum. Maximum d-c input voltage is 500 v and maximum a-c input is 150 v rms. Both X and Y a-c coordinate inputs are independently variable over 8 ranges from 1 v to 150 v and the frequency response of

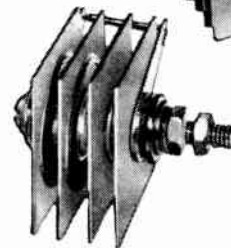
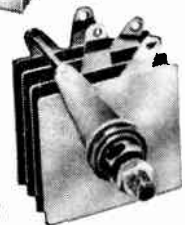
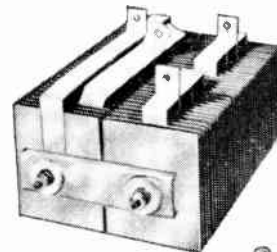
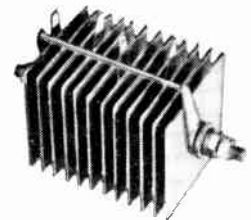
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Unexcelled in Performance**

These exclusively Chatham features are the result of years of pioneering achievement in the design, development and production of custom-made selenium rectifiers to specific applications.

Whatever your rectifier requirement—low voltage and high current, high voltage and low current or any other combination—Chatham's unapproached experience in this highly specialized field is readily yours. Please contact Engineering Department, Chatham Electronics, Livingston, N. J.



CHATHAM ELECTRONICS

division of

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General Offices and Plant: Livingston, N. J.

Sales Offices: CHICAGO, DALLAS, LIVINGSTON, LOS ANGELES

CIRCLE 27 READERS SERVICE CARD

**A Message to Executives
Seeking a New Plant Site**



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PENNSYLVANIA

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Complete financing on lease-purchase plan—low interest rate—deferred amortization. Plant "shells" now being readied for completion. Inspection welcomed.

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No capital stock and franchise taxes—no machinery and equipment taxes—no stock transfer tax—no state personal income tax—reduced manufacturer's sales tax.

Plant location services

Staff specialists available to serve industry, engineering firms, management consultants, industrial realtors and others with fully detailed plant location data.

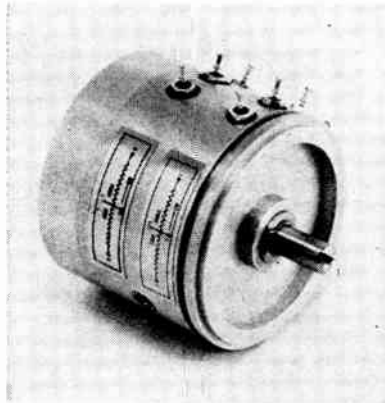


For free copy of pamphlets on these Pennsylvania Plant Location Advantages, write or call:

PENNSYLVANIA DEPARTMENT OF COMMERCE

Main Capitol Building
1107 State Street, Harrisburg, Pa.
Phone: CEdar 4-2912

the transducer test set is linear from 60 to 5,000 cycles. Optional auxiliary equipment includes audio oscillator and d-c power supply. **Circle 63 on Reader Service Card.**



Circular Pot all-metal, pressure sealed

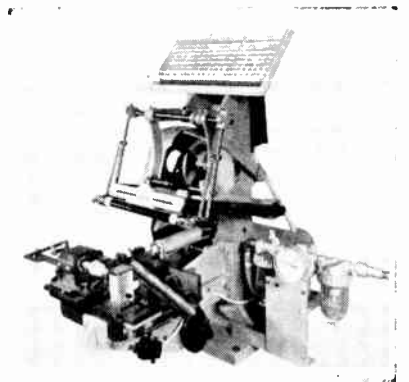
HUMPHREY, INC., 2805 Canon St., San Diego 6, Calif. A new all-metal pressure sealed potentiometer is now in production. It is available in single or dual units.

It already has qualified for severe environmental requirements, including humidity, salt spray, sand and dust. Temperature range is from -65 F to 257 F, or higher on special order, vibration to 10 g, shock to 30 g. It is linear to 1/2 percent.

The instrument can be provided with taps and a variety of resistance elements. **Circle 64 on Reader Service Card.**

1,000 v. Three proposed military types, the 1N538, 1N540 and 1N547 are available along with a wide variety for industrial and commercial use. They offer high forward conductance and low inverse current at high operating temperatures, making them particularly suited to power supply, magnetic amplifier and low frequency switching applications. The small hermetically sealed axial lead package can be easily mounted without insulation.

These junction silicon rectifiers are available in high temperature types (150 C) and general purpose types (100 C) described in bulletin TE-1351. **Circle 65 on Reader Service Card.**



Marking Machine for cylindrical parts

MARKEM MACHINE CO., 157 Congress St., Keene, N. H. Manufacturers of potentiometers or other cylindrical components can now imprint trademark, code detail and terminal designation in registration around the periphery using a model 45AG machine.

Potentiometers are fed to a chuck and by means of an air operated unit they are automatically offset printed and ejected at a rate of 30 per minute. Adjustments are easily made for a range of diameter and shaft lengths.

Markem masterplate and type inserts provide fast and easy change of any or all of the legend. Specialty air-dry inks are available for a wide range of component materials.

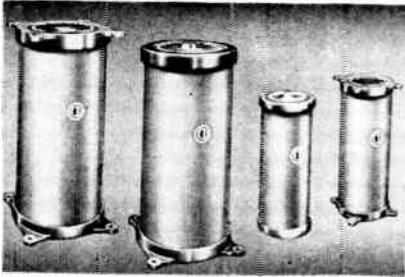
This bench mounted machine

Silicon Rectifiers axial lead

TRANSITRON ELECTRONIC CORP., Wakefield, Mass. New axial lead silicon rectifiers have current ratings to 750 ma, and voltage to

CIRCLE 28 READERS SERVICE CARD

has a maximum imprint area of 2 7/8 in. by 6 1/8 in. and is powered by a 1/4 h-p motor. Circle 66 on Reader Service Card.



Tubular Capacitors uhv type

CORNELL-DUBLER ELECTRIC CORP., South Plainfield, N. J. Designed expressly for uhv d-c filtering, pulse network, voltage doubler and hv- dc energy-storage applications, the new tubulars are available in voltage ratings from 25 kv to 200 kv.

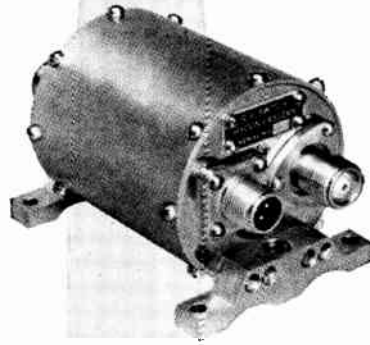
Employing the double-end design, with cast aluminum end caps serving both as mounting means and electrical terminals, these capacitors permit easy, economical installation in compact banks. This type of construction provides a long creepage path, and eliminates terminal flashover. Seven end-cap style combinations are offered to meet various requirements.

These heavy-duty tubulars are widely used in military, industrial and scientific research equipment employing h-v circuits. Applications include betatrons, energy storage, nuclear accelerators, impulse-test apparatus, also as capacitors for pulse network application with external coil, and in x-ray and other voltage doubler circuits. Circle 67 on Reader Service Card.

Transformers built to order

L&M ELECTRONICS, 476 So. San Jacinto Ave., San Jacinto, Calif., has introduced a new transformer, the IIT series, designed specifically to meet the exacting requirements of transistor inverters and power supplies. Extreme care is used in their design, with respect to d-c

TELEMETERING COMPONENTS for Severe Environment



HIGH POWER RF SWITCH, TYPE 1696 will switch a transmitter from one antenna to another at high power levels without mismatching the transmitter for *safe switching under power*. This unit is also applicable for ground use. **FREQUENCY RANGE:** 215 to 250 Mc/s (other ranges on special order); **ATTENUATION:** 0.25 db, maximum; **POWER RATING:** 100 watts R.F. C.W.; **VSWR:** 1.2 maximum; **SWITCHING TIME:** .15 sec. average; **SIZE:** approximately 2 1/2 inch diameter by 4 1/2 inch long; **WEIGHT:** 2 lbs.; **ACTUATING POWER:** 6 watts D.C.; **CROSS TALK:** 27 db down into unused channel; **SEQUENCE:** Make-before-break.

ANTENNAS, tailored to specific missile requirements.

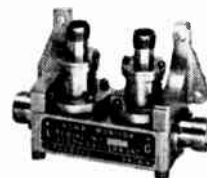
ENVIRONMENTAL SPECIFICATIONS FOR HIGH POWER RF SWITCH, ANTENNAS, DIPLEXER AND VSWR MONITOR

- **SHOCK:** up to 100 G
- **VIBRATION:** up to 20 G at frequency of 2000 cps.
- **TEMPERATURE:** Type 1696: -40°F to +250°F.
Antennas and Type 1231: Up to 350°F. (Type 1231 made of Invar may be provided at extra cost for use up to 500°F.)
Type 1273: Calibration shift of less than 3% between 70°F. and 310°F. Satisfactory operation as low as -40°F.
- **ALTITUDE:** Unlimited. All units are hermetically sealed.



DIPLEXER CAVITY, TYPE 1231

Two Diplexer Cavities and circuitry comprise DIPLEXER which feeds signals from 2 - 100 watt transmitters into a single missile antenna system. **Frequency Ranges:** 215 to 250 Mc/s, other ranges on request; **Frequency Spacing:** 3 Mc min.; **Size and Wt.:** each cavity approx. 3" diam. x 4" long. **TRIPLEXER** with characteristics similar to Type 1231 can be supplied.



VSWR MONITOR, TYPE 1273

This unit monitors RF Power, VSWR and Side-Tone amplitude and furnishes 2 d-c voltages representing incident and reflected power so that antenna power measurements may be made. **Power Handling Capacity:** up to 500 watts output to Indicator; one volt (nominal) from 500 ohms. **Frequency Range:** 100 to 400 Mc/s. Factory calibrated at desired frequency.



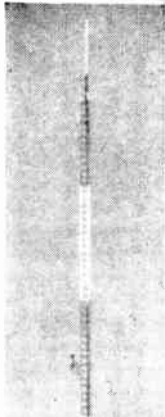
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—by getting a tower *specifically for your job*. These towers are suitable for use up to 300 feet guyed—or self supporting to 50-60 ft.! ROHN towers are in daily use for micro-wave, radio and dozens of all type communications requirements throughout the U. S.—at big savings—yet more than do the job! Can be used for a multitude of jobs.

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—get full engineering data to prove superiority. Gleaming, hot-dipped galvanized finish available—stays shiny and new—no painting needed. Design fully tested—proved by thousands of installations. Easily shipped and inexpensively installed. Cross pieces form natural ladder for servicing.

✓ Special Towers

—you're invited to submit your requirements. Towers will be built to your specifications if practical. Let us know your needs—ROHN can satisfy them **BEST** when it comes to towers of this type.



Shown here is a Rohn No. 30 tower used for radio communications by Central Illinois Light Co. Note slim, sleek appearance—takes little space—yet places antenna high into air for good communications.

FREE



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ROHN Manufacturing Co.

**116 Limestone, Bellevue
Peoria, Illinois**

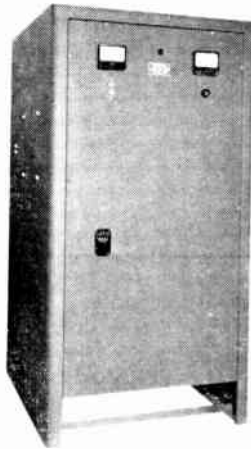
"Pioneer Manufacturers of TV and Communication Towers of All Kinds."

CIRCLE 30 READERS SERVICE CARD

balance and fidelity of pulse shaping.

Unless otherwise specified all standard models are equipped with a precision tertiary winding, accurately balanced for purposes of feedback. The use of high quality insulating materials, as interwinding isolation and external covering, and the highest quality magnetic materials allow minimum size requirements and optimum performance characteristics.

The company will quote on any quantity of prototypes or production to meet customers' special voltage and current ranges. Circle 68 on Reader Service Card.



**Supply Unit
for ground power**

PERKIN ENGINEERING CORP., 345 Kansas St., El Segundo, Calif., announces a 24-32 v at 1,500 ampere silicon rectifier type ground power regulated d-c power supply. The unit is completely tubeless, contains no moving parts (except cooling fan), and has a d-c output voltage of 24-32 v at continuous load capacities up to 1,500 amperes. Regulation accuracy is ± 1 percent over the entire output voltage range which applies for any combination of line and load changes under the worst conditions. The power supply is especially designed for ground power, missile checkout and testing applications. It is also well suited for centralized d-c power installations.

Designated model No. MRS-2432-1500, the unit has a ripple of 1 percent rms maximum. Fur-

ther details and engineering specification sheet may be obtained by writing on company letterhead.



**Generator/Scope
combination unit**

MARCONI INSTRUMENTS, 111 Cedar Lane, Englewood, N. J., announces a combined sweep generator and oscilloscope, model 1104/1, for visual alignment of tv and f-m receivers, production testing of i-f transformers and f-m discriminators and antenna matching.

The r-f range is 45 to 115 mc and 174 to 216 mc, frequency swept 500 kc to 10 mc. Output, via piston attenuator, is 250 mv maximum.

The instrument has i-f and video output in the range of 5 kc to 40 mc and built in crt display which can also be used as a normal oscilloscope. Three crystals provide markers at 5, 1 and 0.5 mc and there is calibrated variable marker to simplify precise measurements. Circle 69 on Reader Service Card.

BALCO WT-4

**Capacitors
for low voltage use**

BALCO RESEARCH LABORATORIES, Inc., 49 Edison Place, Newark, N. J., has available precision capaci-

tors for low voltage application. New plastic dielectric material offers exceptional space savings for transistor circuitry. Insulation resistance 10^{13} ohms at 25 c enables the units to hold a charge for long periods without derating. Operating temperature without derating is 55 C to 200 C.

Model HT-4 has capacitance ratings of 0.001 to 0.1 μ f; voltage rating, up to 50 v d-c; tolerance, as low as ± 1 percent.

A full hermetic seal plus extremely rugged construction prevents damage despite severe shock and vibration. Circle 70 on Reader Service Card.



Uhf Triode in compact envelope

AMPEREX ELECTRONIC CORP., 230 Duffy Ave., Hicksville, L. I., N. Y., has announced a new coaxial uhf transmitting triode, designated as type 7004 and characterized by outstanding high-frequency performance in a very compact envelope. It was developed for uhf oscillator, amplifier and frequency multiplier service, especially where space is at a premium. It has an external anode and is forced-air-cooled via an integral radiator.

Maximum ratings apply up to 900 mc, making it suitable for an unusually wide range of h-f communications applications. Maximum plate dissipation is 300 w. Both a glass and a ceramic version are available. Circle 71 on Reader Service Card.

**ALL GRADES
MIL-I-631C
VINYL INSULATION**

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Just two sleeveings—one source—can supply all your needs for every grade of MIL-I-631C vinyl insulation. Resinite EP-69A and Resinite Hi-Heat 105A not only meet every requirement, but far exceed specifications. Simplify ordering, reduce inventory with these two fine Resinite sleeveings.



EP-69A for low temperature and general purpose use. Wide working range from -48°C to 90°C . Dielectric to 750 volts/mil. Corrosion, oil, fungus and flame resistant. #20 AWG through $2\frac{1}{2}''$ ID. 5 standard colors, others available.



HI-HEAT 105A for high temperature use where outstanding resistance to heat and oils is required. For continuous operation from -21°C through 105°C . 1000 volts/mil average dielectric. Exceptionally high flame, fungus and cut-through resistance. #24 AWG through $2\frac{1}{2}''$ ID. 11 standard colors, others available.

Write us your requirements and we'll submit samples and performance data on appropriate sleeveings, tapes or lacing cords.

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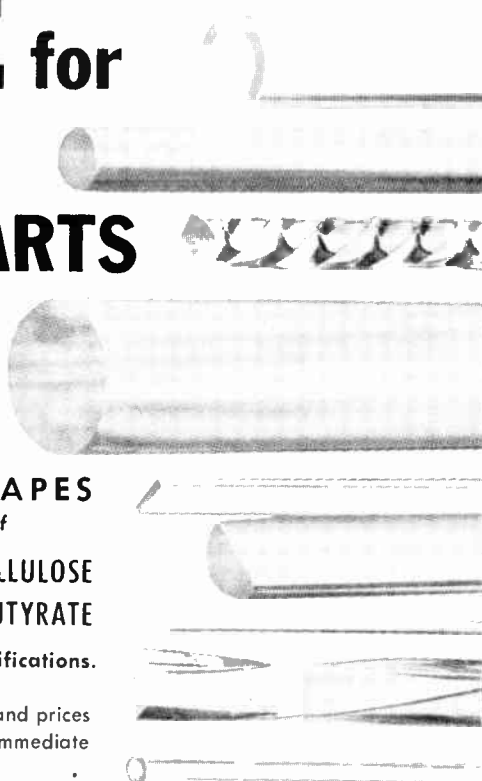
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ACE PLASTIC COMPANY

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Literature of

MATERIALS

Self-Adhesive Felt. W. H. Brady Co., 727 W. Glendale Ave., Milwaukee, Wis. Product data sheet No. 187 illustrates and describes a line of self-sticking Quik-Felt, pre-cut in a wide variety of shapes and sizes. The material described is designed for protection, cushioning, and sealing and insulation. Ordering information and prices are included. Circle 72 on Reader Service Card.

COMPONENTS

Custom Transformers For Industry. Light Electric Corp., 214 Lackawanna Ave., Newark 3, N.J. An 8-page catalog completely describes the company's general line of custom-built transformers and related products, giving application data and features. Circle 73 on Reader Service Card.

High Torque Motor. The Viking Tool and Machine Corp., 20 Main St., Belleville 9, N. J. Design features, specifications, dimensional drawings, photos and exploded views of a new miniature high torque motor are described and illustrated in a 2-color data sheet. Circle 74 on Reader Service Card.

Polarized Relays. Magnetic Devices, Inc., 712 East St., Frederick, Md. Bulletin PR-A deals with the type 300 polarized relays which features small size, ruggedness and comparatively simple design. Circle 75 on Reader Service Card.

EQUIPMENT

Square Wave Modulator. Weinschel Engineering, 10503 Metropolitan Ave., Kensington, Md. Bulletin No. 47 describes the MO-1A, which is used to 100-percent square wave modulate r-f signal sources including klystrons. The instrument discussed is used where

the Week

a high stability is required for the audio frequency of the modulated r-f signal. Circle 76 on Reader Service Card.

Closed Circuit TV. Insul-8 Corp., 1369 Industrial Road, San Carlos, Calif. A 6-page pamphlet describes Vicon closed circuit television systems. The pamphlet gives complete, easy-to-read descriptions of Vicon cameras, camera control, monitors, and accessories, with technical information confined to a specifications page. Circle 77 on Reader Service Card.

Power Supplies. Trans Electronics, Inc., 7349 Canoga Ave., Canoga Park, Calif. A file drawer folder (12 pages) contains catalog sheets on a standard line of electronically regulated laboratory power supplies giving specifications, dimensions and other characteristics. Circle 78 on Reader Service Card.

Transistorized Power Supplies. Hyperion, Inc., 1449 Washington St., West Newton, Mass. Transistorized power supplies, regulated and unregulated, are described in a new 4-page folder covering a-c to d-c, d-c to d-c and d-c to a-c equipment. Circle 79 on Reader Service Card.

FACILITIES

Engineering Jobs. CGS Laboratories, Inc., 391 Ludlow St., Stamford, Conn. The perplexing questions which face a graduating engineer looking for a job are informally discussed in a new 13-page booklet entitled "Getting an Engineering Job." Circle 80 on Reader Service Card.

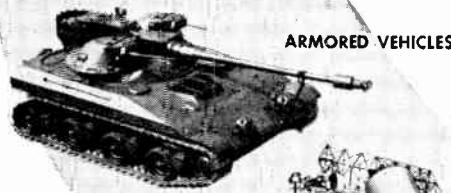
Induction Heating. Lepel High Frequency Laboratories, Inc., Woodside, N. Y. The second issue of the induction heating Review contains many interesting applications and articles on high frequency induction heating. Circle 81 on Reader Service Card.

AIRCRAFT ARMAMENTS, INC.

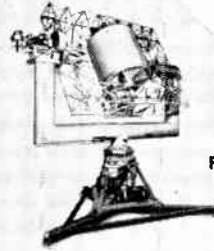
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MISSILE TRAINING SYSTEMS

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CIRCLE 34 READERS SERVICE CARD

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Provides simultaneous high and low intensity magnetic shielding as well as high and low frequency magnetic shielding for valuable magnetic tape recordings from all extraneous fields produced by generators, power supplies, transformers, magnetic tables on surface grinders, magnetic chucks, de-gaussers, soldering guns, motors, power lines, welding machines, solenoids, and other stray fields around radio and TV stations, factories, laboratories, etc.



Valuable tape recordings safely stored to remain clear and distinct, avoiding cracking and other distortions. Shielding strength continues undiminished indefinitely without periodic renewal or other servicing because Fernetic Co-Netic does not retain residual magnetism. Shielding qualities cannot be lessened by shock, vibration or other disturbances during handling or usage. Sturdy containers available in many convenient round or rectangular shapes.

Protect master tapes which run automatic machinery, guided missile flight recordings, radio & TV commercial and program tapes, hi fi and historical tapes, delicate instruments during transport, etc. Write today for details.

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1322 No. Elston Ave., Chicago 14, Ill.

P.S. Also available: Cathode Ray Tube Shields, Transformer and other high and low level shielding... constructed to your specification from non-shock sensitive non-retentive Fernetic Co-Netic.

Low-Cost Scenes for Color Tv

New device inserts backgrounds for shows by using slides, film on two-camera system

A RECENT DEVELOPMENT of interest to color tv broadcasters is slated for discussion this month at the National Association of Broadcasters convention in Los Angeles.

The device, Chroma Key, takes images picked up by two television color cameras simultaneously, and combines them into a composite picture. With this technique, actors on a bare stage will appear against scenic backgrounds provided by color photos, movie film strips, or miniature sets.

The device costs about \$750. RCA officials say that no current plans for merchandising exist at this time, but feel that such plans may materialize later when design and production figures, as well as applications, are thoroughly jelled.

The system uses two cameras. The first picks up the performer before a solid color background.

The second picks up the scenery. Both camera outputs are routed through the unit where the performer's image is "etched out" electronically and inserted in the scenery picture.

This effect is produced by having the solid color background trigger the scenery camera. During the interval when the live camera is scanning the actor, the scenery camera is turned off automatically in association with the special effects amplifier.

Actors must not wear clothing the same color as the background screen because the scanning action will key in the scenery whenever it encounters this color. An actor wearing a blue tie before a solid blue background, for example, will appear to have a tie-shaped hole in his body through which the background will be visible.

The device was first used on colorcasts last fall in Hollywood. Chicago and New York stations are now equipped with the new device.

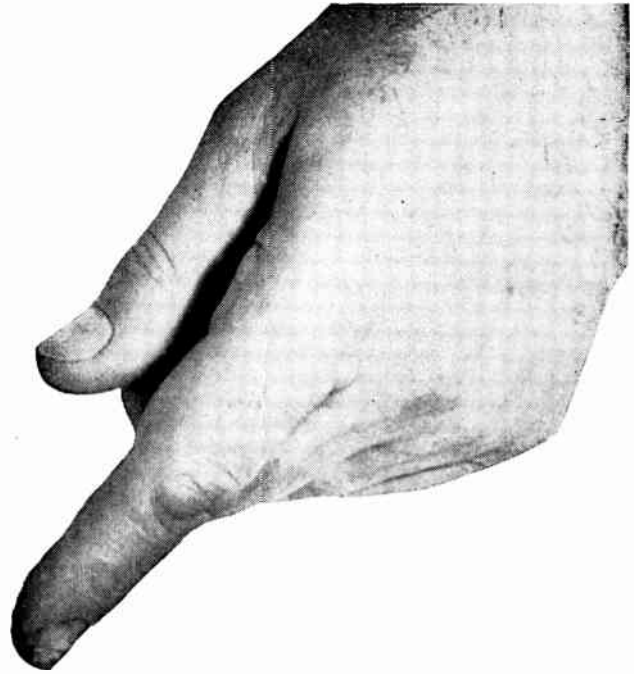
The effects do not require color receivers for successful viewing, but are picked up equally well by black-and-white sets.

FCC ACTIONS

- Revises Radio Equipment List, Part A. List now indicates that "type acceptance" is required for tv transmitters, and "type approval" is required for tv translators. Copies of the list are available for inspection at FCC offices.
- Grants request of WROW, Albany, N. Y., KSL, Salt Lake City, Utah, for extension of time to June 2, for filing reply comments on proposal to extend daytime a-m operating hours.
- Gives KINY, Juneau, Alaska, permission to determine operating power by direct measurement of antenna power.
- Amends Part 9 of aviation rules to reflect more clearly the "long established policy" that issuance of an aeronautical fixed station authorization is permitted only to the licensee of an aeronautical enroute station with which the proposed fixed station will be associated.
- Permits KWKH-KWKH-FM, Shreveport, La., to transfer control from W. H. Bronson to Times Publishing Co., Ltd.
- Grants authority to Pacific Telephone and Telegraph Co. to supplement existing facilities between San Bernardino, Los Angeles and San Diego, Calif.
- Grants Western Union special permission to amend tariff on not less than one day's notice to set up subscriber rates covering class M service on hockey games to be played at Arena, Philadelphia, and Arena, Washington, D. C.
- Grants c-p for one base station, 100 mobile units to Southern Bell Telephone and Telegraph Co. to be located in Huntsville, Ala., area.
- Dismisses KTVU, Oakland, Calif., application for completion date extension.

STATION MOVES and PLANS

- WHIM, Providence, R. I., seeks voluntary transfer of control from R. D. Buckley to J. P. Haney and R. H. Gerken.
- WRAC, Racine, Wis., asks permission to determine operating power by direct measurement of antenna power.
- KWHN, Fort Smith, Ark., files for renewal of license.
- WDOT, Burlington, Vt., tenders request for c-p change from 1,400 to 920 kc, power increase from 250 watts to 1 kw, and change from unlimited to daytime hours.
- KGMS-FM, Sacramento, Calif., asks for extension of completion date.
- WBWC, Berea, Ohio, applies for c-p for new f-m broadcast station at Baldwin-Wallace college.
- KPAX, San Bernardino, Calif.,



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AT YOUR FINGER TIPS, issue after issue, is one of your richest veins of job information – advertising. You might call it the “with what” type – which dovetails the “how” of the editorial pages. Easy to read, talking your language, geared specifically to the betterment of your business, this is the kind of practical data which may well help you do a job quicker, better – save your company money.

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Add up all the advertisers and you’ve got a gold mine of current, on-the-job information. Yours for the reading are a wealth of data and facts on the very latest in products, services, tools . . . product developments, materials, processes, methods.

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McGRAW-HILL PUBLICATIONS



A CONCEPT OF SCIENCE

Five years ago, The Martin Company conceived a unique undertaking in the field of pure science which grew out of a belief that our own and our country's resources in creative scientific research must be greatly enlarged and cultivated.

We believed that the country—and the Company—that concentrates on short-range material achievements, without a deep concern for the creative source of tomorrow's even greater achievements, will have no tomorrow.

It is now three years since that belief motivated management's action with the foundation of a program in pure research. Known as the Research Institute of Advanced Study, RIAS is now a substantial organization staffed by scientists who are working in many fields, including theoretical physics, biochemistry, metallurgy and mathematics, without short-range applied research requirements.

Today, the increasing appeals to industry and the nation for accelerated activities in basic research give the RIAS story a special significance. For creative research in pure science is the true life source of our technological security—the "seed bed" from which our national strength shall continue to grow.

MARTIN
BALTIMORE • DENVER • ORLANDO

submits application to allow voluntary transfer of c-p to S. R. Corwin.

WIOD, Sanford, Fla., has license assigned to Sanford Broadcasting.

WFPK, Louisville, Ky., receives c-p to increase crp to 20 kw, reduce antenna height to 245 ft. and change antenna system.

KAST, Ames, Iowa, is granted modification of license to change name to Story County Broadcasting Co.

KQIK, Lakeview, Ore., continues operations under authority which allowed sign-off at 7 p.m. from March 1 through May 31 due to severe economic conditions.

KSTR, Grand Junction, Colo., gets permission to change antenna-transmitter location.

KFDR, Grand Coulee, Wash., obtains c-p to install new transmitter.

KDCO, Durango, Colo., is granted modification of c-p to change studio location, remote control point, and transmitter site.

WCSC, Charleston, N. C., receives permission to operate transmitter by remote control while using nondirectional antenna.

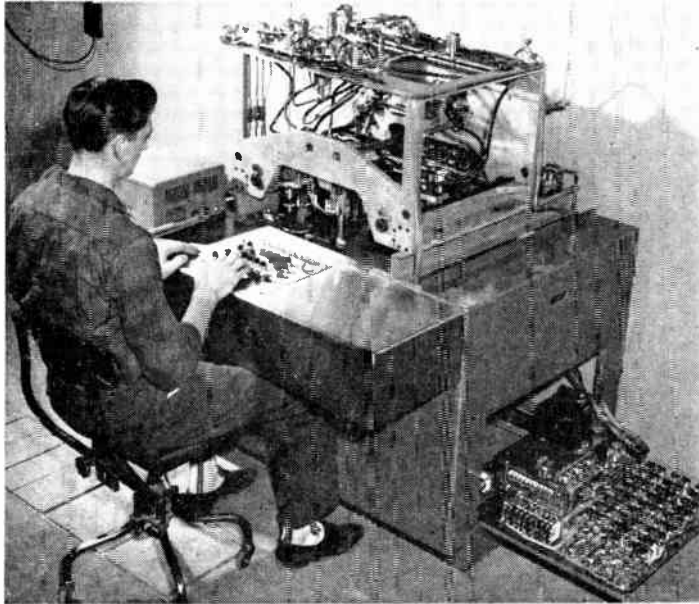
XETV, Tijuana, Mexico, slated to receive programs produced and transmitted by California Western University, San Diego, Calif.

WSAU-TV, Wausen, Wis., receives extension of completion date to the end of May.

KALI, Pasadena, Calif., seeks permission to change from daytime to unlimited broadcast hours, change location to San Gabriel, Calif.

KSFM, Dallas, Tex., files for license for new f-m station.

WTRN, Tryone, Pa., files for e-p to install new transmitter as auxiliary to present transmitter.



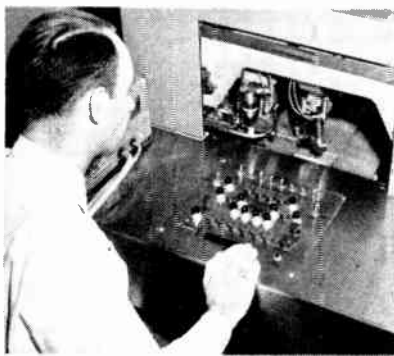
At top of machine are solenoid valves controlling pneumatic circuits. Cross slides, head driving and positioning assembly are in center area. Open rack at (bottom right) shows relay panel and transistorized numerical positioning control for use in . . .

Wiring by Machine

New wire wrap equipment places 10,000 wires on board 20 in. sq. Cost of unit is approximately \$40,000

GRAND HAVEN, MICH.—Automatic wiring of plug-in electronic computers for a new Air Force airborne communications system will soon get under way using a new electronically controlled wire wrapping machine.

The communications system, known as Lost Chord, will be made for Wright Air Development Center by Hughes. The machine is a punched tape or keyboard operated



Control panel for positioning wire heads over modular spaced terminal boards. Operator selects any one of 5,000 connection positions by pressing binary code buttons

pneumatic device with electronic control. It is being made by Gardner-Denver's Wire Wrap Division.

The \$40,000 machine takes panels 20 by 20 in. and wire wraps all terminals in a 10 by 10 in. section. The board is indexed so the whole panel can be wired.

According to the manufacturer, the machine reduces costs 500 percent over conventional wiring techniques. The entire unit is housed in a 4 by 4 by 5 ft cabinet.

The technician, operating the keyboard manually, works from a coded wiring list which specifies the operating sequence of the two wrapping heads.

Thus, 10,000 wires can be placed on a 20 by 20 in. board having a modular terminal spacing of 0.20 in. The wires are laid in straight lines or L shaped patterns. The wires are attached to rectangular shaped terminals by solderless wrapped connections. Two connections can be put on each terminal.

Describing additional savings in production costs and servicing, Howard Wilson, Wire-Wrap Div

manager, says, "The elimination of errors and reduction of inspection time will result in savings equal to or greater than that realized in assembly cost savings.

At the points of contact between wire and terminal, diffusion forces cause intimate contact to remain even under high temperatures, Wilson said. The unit uses commonly available wire sizes.

Operation of the machine begins when the depressed control button sets up a bridge circuit. As the working heads reach the programmed position, a linear potentiometer balances the bridge, stopping the driving motors and inserting the index pins for accurate positioning.

A transistorized amplifier circuit anticipates the final position to decelerate the heads. The rest of the sequence is controlled by cams. After dressing and wrapping the wire, the heads return to position for the next cycle.

The machine is air powered, using electronic circuits for control. The transistorized amplifier circuits themselves are assembled using the wire-wrap technique.

Atomic Sales Outlook Holds

CHICAGO—The sales outlook for electronic instrumentation in atomic industry in 1958 is at about the same level as '57, according to most firms at the Atom Fair last week. One notable exception was a company that felt a 25-percent sales upturn possible.

Competition is keen and growing in segment of industry producing training reactors. The field showed evolutionary, not revolutionary advances in instrumentation, as needs for specific types of instruments and controls were suggested by scientists and engineers.

Instrument experts noted fairly good standardization in nuclear instrumentation for deciding variables to be measured and controlled.

There is an apparent trend toward digital instrumentation rather than analog for simplifying the organization of data. At the re-

search and development level, a steady increase has been noted in automatic measurement and control utilizing industrial type instruments. Laboratory staffers want unattended operation of experiments. This situation, says J. C. Meleher of Leeds and Northrup, is partly due to manpower problems, and partly to the fact that such machines can do a better job in organizing and supervising gear.

The largest chunk of potential instrumentation business lies in the power-reactor field, says Henry Stewart, nuclear system sales manager for Curtiss-Wright's Electronics div. "But," he adds, "due to constant change in reactor design, no one is going to invest large sums for basic R&D on instrumentation. They could only hope to amortize it by large scale sales. For submarines or military applications, this does not apply. They are designed around a specific concept."

For mobile reactors a trend has begun toward transistorized instrumentation. An example of this, says Stewart, is the proposed instrumentation of the forthcoming Navy nuclear destroyer.

Minneapolis-Honeywell's research industries manager, Henry M. Schmitt, noted the industry is working on new types of sensing elements, new circuits and overall equipment simplification.

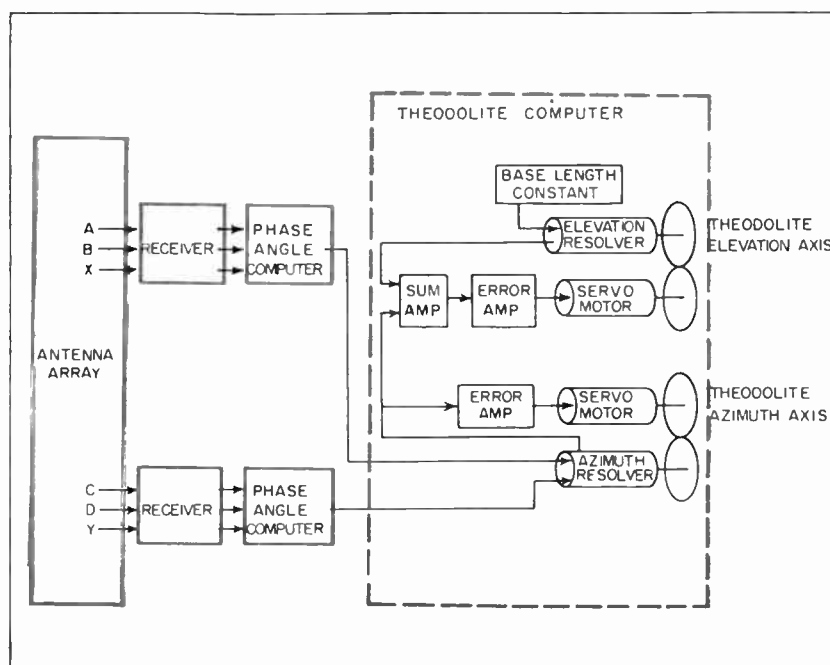
An example of gear simplification is a high-level safety amplifier. It will accept two inputs, feed current to four magnets holding reactor control rods. It does work of three amplifiers.

Soviets Test Sputnik Instruments

RUSSIA'S THIRD earth satellite is apparently near launching time—if it's not already in orbit as this issue of *ELECTRONICS* reaches readers. In recent weeks there have been at least two separate reports on rocket tests of instrumentation and another report on a new photographic tracking system.

The Soviet agency Tass said perfected apparatus for cosmic ray studies was being tested, apparently on vertical rocket flights.

Apparatus consists of an ionization chamber and a computer. Difference between cosmic ray instru-



Analog computers compare phase of radio signals from missile to keep theodolite, or optical tracking instrument, with motion-picture camera trained on missile throughout flight as . . .

Computers Direct Movies

ANALOG COMPUTERS permit replacing complicated scanning dish antennas with simple vertical whips in the Army's new electronic missile acquisition system, EMA II.

The computers, built by Magnetic Amplifiers, compare the phase of radio signals received from the missile. They put out position and error signals that make the optical theodolite with its motion-picture camera follow the missile in flight.

The Army is now testing the

first EMA II system at Aberdeen Proving Grounds. It is expected the system's overall accuracy will be 0.5 degree in both azimuth and elevation. A signal with a strength as low as two microvolts at the antenna will insure accurate and continuous tracking.

Complete system consists of an antenna array, two special radio receivers, three analog computers and the theodolite. Also required is a 74-megacycle beacon transmitter in the missile.

ment in the second Soviet sputnik and the new instrument, says Tass, is this: Sputnik II contains an instrument that measures only the number of cosmic rays it encounters, but the new apparatus can estimate each particle and determine its characteristics.

Another Tass report quoted meteorologist Evgeny Pyodoretv as writing in a Moscow magazine that one of the future Soviet sputniks may carry a radio frequency mass spectrometer to analyze ionized gas at great altitudes.

Meanwhile, the Kazakh academy

of sciences has reportedly developed a new method of photographing the trajectory of an earth satellite. There, affixed to a large telescope is a vibrating shutter which at regular intervals cuts out the trace left on the film by the earth satellite. The intervals are registered synchronously by an oscilloscope, says the Soviet report.

Photographs are said to show with precision of better than one-thousandth of a degree the visible positions of the earth satellite, as well as the time of its passage up to a few thousandths of a sec.

Japan Eyes Computer Market

Digital unit using transistors may be produced this year. Cost of manufacture estimated at \$60,000

JAPANESE company expects to produce this year the first commercial models of a transistorized digital computer developed by the Electro-Technical Laboratory, Japanese equivalent of the U.S. Bureau of Standards (ELECTRONICS, Mar. 7, p. 49).

Nippon Electric Co. has taken over the 1½-year-old government project which cost ETL about \$17,000. Full-scale world-wide marketing may come next year.

Shigeru Takahashi, who headed development of the computer, the ETL Mark IV, estimates that it can be manufactured in Japan for \$50-\$60,000. He says it compares favorably with many more expensive U.S. electronic computers, cites both transistorized circuitry and relatively inexpensive labor as factors in the computer's low production cost. Market price has not yet been set.

The computer, second transistorized one to be built by ETL, has been operating since November in the laboratory. It is being used to solve plant management problems. An improved model will be made by Nippon Electric which will be alpha-numerical, increase word size from six to ten digits

and substitute photoelectric reading for electro-mechanical reading of the paper tape.

Arithmetic and control unit consists of some 420 alloy junction transistors and 4,400 germanium diodes. Basic circuit consists of a novel pulse regenerative amplifier which can perform certain logical functions. Two types of etched-circuit, dip-soldered packages are used.

Internal storage capacity is 24,000 bits, with a magnetic drum rotating at 18,000 rpm. About 100 tubes are used to drive the writing heads that put information on the drum. Computer operates on only about 300 w, an important factor in power-short Japan.

Here are other characteristics:

- Synchronous computer with 180-ke clock.
- Operation serial-by-digit and parallel-by-bit.
- Internal notation in decimal-coded binary characters, with two code groups used for each alphabetic character.
- Addition or subtraction speed: 3.4 milliseconds; average speed of multiplication: 4.8 milliseconds, and division: 6.8 milliseconds; transfer or comparison: 1.7 milliseconds.
- Storage capacity 1,000 words; average word-access time 1.65 milliseconds.

DEVELOPMENTS ABROAD

- **Ukrainian** academy of science computer center is final-testing SESM, a digital computer for solving linear algebraic equations with up to 400 unknowns. Soviets say it will be used for construction, geodesy and mathematical problems. SESM occupies 86 sq ft, is reportedly simpler in design than previous digital models and uses transistors with ferrite memory storage.

- **Russia** plans to conduct an entire coal mining operation in the Donets coal basin with one operator watching a television screen and controlling coal cutting from a single panel. Work on the mine setup will start this year. System is expected to produce six million tons of coal a year.

- **Czechoslovakia** reports development of a table model electron microscope and a transistor receiver weighing 1.9 lbs. Microscope distinguishes particles measuring 50 angstroms; images on a screen may be enlarged 30,000 times and photographic plates 150,000 times. Receiver is 6.7 by 4.3 by 1.8-in., has nine transistors and needs only a 6-v current operating on two 3-v dry cell batteries.

- **Britain** will fire Skylark rockets from her Aberporth, Wales, rocket range in connection with the IGY, says the Ministry of Supply. Four Skylarks carrying up to 150 lbs of instruments to heights of 100 mi or more have already been fired from Woomera range in Australia.

EXPORTS and IMPORTS

In **Britain** the Gabor flat shadow mask color tv tube is a step nearer production, with some sign of agreement with American firms on patent problems. In about a month demonstrations of a tube with a diagonal measurement of 12-in. will be made to the London Institution of Electrical Engineers, reports Lord Halsbury, managing director of the National Research Development Corp., a body set up by the Board of Trade to develop and exploit inventions of government laboratories.

Although the demonstration tube will be continuously evacuated, a sealed-off prototype is expected soon with a 21-in. diagonal

measurement and front-to-back depth of 5-in. or less. Tube's advantages are said to be improved resolution due to close proximity (0.925 in.) of the mask from the phosphor screen, simplification of the deposition of color phosphors, and the absence of sweep circuits. "The patent position is very confused," says Lord Halsbury. "but an agreement of some unspecified kind has been reached with American firms."

Italy now appears to be opening up as a market for large and medium-sized computers. Olivetti is reportedly getting set to produce at its Ivrea plant a large digital computer, already tested at the University of Pisa. More Italian activity in the computer field is indicated by the formation of Societa Laboratori Elettronici Riuniti to study, research and develop computers. Announcements of the new organization came from Finmeccanica, government-backed industrial holding group with interests in Marconi of Genoa and Mircolambda of Naples, both radar manufacturers. Meanwhile, IBM Italia has installed two 650 data processing units—one at the Bank of Italy in Rome, the other at Dalmine, Milan tubing manufacturer.

Japan Ordnance Association, trade group of 118 companies, wants to send a mission to the U. S. to discuss Japanese manufacture of U. S.-designed missiles. Behind the scenes these companies, including Japan's biggest combines, are developing proposals to present U. S. manufacturers, possibly in the late spring. Commercial patent licensing agreements are believed to be the smoothest way Japan could circumvent whatever antirearmament sentiment is still a factor in her domestic politics.

Poland expects eventually to cut radar imports from the USSR and the West when she is able to mass-produce her own radars. Right now, prototype of radar system for her merchant marine nears completion at the "T-1" Radio Works in Warsaw.

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Adler Marks Tenth Year

SPECIALIZATION in systems engineering has been the success formula at Adler Electronics, Inc., New Rochelle, N. Y., during the past 10 years. Founded by Ben Adler as a consulting firm, the company has grown from small rented quarters in an unused shipyard to a modern 4-acre R&D and manufacturing facility.

Experienced in the fields of low power tv broadcasting and tv repeating, missile and aircraft ground support equipment, mobile communications systems, and precision test equipment, Adler has always prided itself in its willingness to tackle the tough ones. In the early days of the tv industry the company's activities centered around the design and installation of complete a-m, f-m and tv stations—including the world's first commercial uhf tv outlet.

A tribute to Adler's "can-do" attitude are the 160 mhf and vhf translators providing the only source of tv entertainment for a half-million people in isolated communities in the United States, Canada, Mexico, Cuba, Brazil and Guam. Designed for automatic unattended operation, translators have proved themselves to be a highly economical and reliable means of rebroadcasting signals from existing tv stations into areas denied direct reception by terrain anomalies.

The most important application for Adler translators lies ahead, according to top management (pic-

tured left to right: Harry Adler, vice president of manufacturing; Lawrence Marks, treasurer; Ben Adler, president; and Alfred Strogoff, vice president). Translators will soon be playing a major role in solving the need for extensive educational tv facilities. An entire state's school system can be covered by sufficient translator channels without interfering with existing commercial station allocations, the firm says. Also of importance is the fact that a translator system does not require high power, high cost stations with limited coverage.

Adler is also active in an area vital to the nation's security—missile ground support equipment. The company recently delivered to the Navy a series of missile testers that will be used aboard the fleet's first missile carrying cruisers. Performance standards for such precision test equipment as missile testers, extremely accurate frequency meters that can be used as secondary signal sources, and signal generators that measure the accuracy of an aircraft's blind flying instruments, are guaranteed the company says, by a comprehensive quality control and environmental testing facility.

A complete 50 kw broadcast station on wheels—including studios, transmitter, antennas and power supplies—was supplied by Adler to Radio Free Europe for use in sensitive areas close to the Iron Curtain. The Atomic Energy Commission's mobile communications system at

the Nevada Proving Grounds, as well as the voice of America's famous mobile system, also were supplied by the company.

Future plans at Adler include introduction of new commercial products. During the past year a half-dozen new products were added to the Adler line.



Engineer Named for FCC Post

PRESIDENT Eisenhower has tapped John Storrs Cross (picture), the State Department telecommunications officer, as the newest Federal Communications Commissioner replacing Richard A. Mack. Cross, a graduate of Alabama Polytechnic Institute, is an electrical engineer with considerable experience.

He began his government work in 1931 with the U.S. Dept. of Interior, where he became chief of all electric and radio design and construction work in 1935.

From 1942 to 1946 as a Navy captain he worked in a program that quadrupled the Navy's worldwide wartime communications system, helping to build radio stations and train the personnel to man them.

In 1946 he went to the State Dept. in the Telecommunications Division, an office charged with the duty of working out international agreements on frequency allocations, radio calls and similar matters. This work has sent him to 18

international conferences in the last 12 years and kept him in regular contact with the I'CC.



Promote Gundrum To Exec V-P

APPOINTMENT of Charles Gundrum (picture) as executive vice president of the Electronics Division, Van Norman Industries, Manchester, N. H., is announced. His appointment is another step in strengthening the Electronics Division, a recently formed concern formerly operative under the names Transiron, Inc. and Insuline Corp. of America. Prior to his promotion, Gundrum served as budget director to the treasurer.

Plant Site Market Place

ELECTRONICS FIRMS may save time and money by getting a bird's eye view of what's available in site locations at the 1958 National Industrial Development Exposition to be held April 7-11 at the Coliseum in New York City.

Prime purpose of the exposition, says its director, Raymond Y. Bartlett, is to save time and money of plant site seekers and development groups from all over the nation by providing them with a central market place.

Some 300 exhibitors are expected to display their offerings at this year's exposition, including development groups from 40 of the 48 states. Other exhibitors will include municipal development groups, chambers of commerce, public utilities, industrial parks, plant con-

struction firms and industrial architects and realtors.

The 1958 exposition will devote two and a half hours each morning to seminars on such topics as locating the new plant, financing the new plant, profit potentials of new plants and the plant of tomorrow.



Gulton Promotes Dranetz

APPOINTMENT of Abraham I. Dranetz (picture) as a vice president of Gulton Industries, Inc., Metuchen, N. J., is announced. Director of engineering for the company since 1949, he will assume the responsibilities of general manager of the newly created Glennite Instrumentation Division.

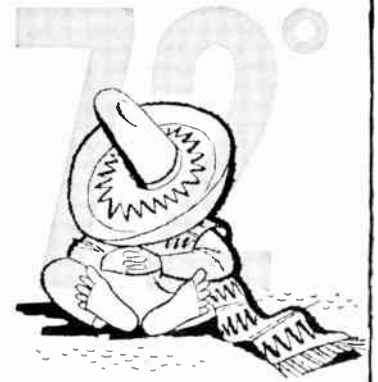
Activities of the new division will encompass research, development and production of electromechanical and electronic instruments and instrumentation systems.

Smith Moves To Tele-Tronics

THE Tele-Tronics Co., Ambler, Pa., has added to its staff Walter E. Smith as manager of engineering. He also serves as member of the board of directors.

Smith spent the past 15 years as head, test equipment department, of the Lansdale Tube Co. He had charge of the design, construction and maintenance of electronic and

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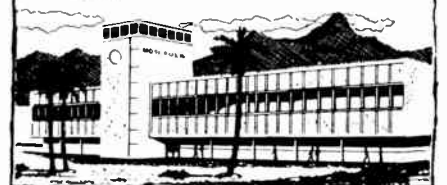
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In his new position, he is in charge of all engineering and manages the electronic fabricating shop. The company is a custom equipment design and fabricating plant combining mechanical and electronic fabricating facilities with engineering design service.

Consultants Get New Facilities

ALEXANDER KUSKO, INC., Consulting Engineers, have moved into new office and laboratory facilities at 141 Main St., Cambridge, Mass.

The company carries out research and development work in electrical engineering, with emphasis on the application of magnetic and semiconductor devices to the control and processing of electric power. This includes work on magnetic amplifiers, transistors, electric machinery, rectifiers, electronics and instrumentation.

The president of the company is A. Kusko, associate professor of electrical engineering at MIT.



Kaye Advances To Direct R&D

APPOINTMENT of Vincent Kaye (picture) as director of research and development for the Control Engineering Co., Detroit, Mich., is announced.

With Control Engineering for over four years as sales engineer,

Kaye will direct the efforts of a staff of specialists in electronics and other fields. Control Engineering Co., a division of the Jervis B. Webb Co., develops and manufactures control and testing devices.

News of Reps

ELECTRO-TEC Corp., South Hackensack, N. J., manufacturer of precision components for instrumentation, announces three new reps. Its line will be handled by W. B. Fry & Co., Inc., in the following territories: Nebraska (excluding counties of Sheridan, Garden, Deuel and all west of these), Kansas, Missouri, southern Illinois (excluding counties of Henderson, Warren, Knox, Peoria, Woodford, Livingston, Kankakee, Iroquois and all north of these), Iowa (excluding counties of Allamakee, Clayton, Delaware, Jones, Cedar, Muscatine and all counties east of these).

Henry W. Gebhard Co. will serve Electro-Tec in the following areas: northern Illinois (comprising counties of Henderson, Warren, Knox, Peoria, Woodford, Livingston, Kankakee and all north of these), Indiana, Wisconsin (except counties of Bayfield, Sawyer, Rusk, Chippewa, Eau Claire, Trempealeau and LaCrosse and all west of these), and Iowa (counties of Allamakee, Clayton, Delaware, Jones, Cedar, Muskatine and all east of these).

Norvell Associates is appointed as rep for Electro-Tec in the Oklahoma, Arkansas, Louisiana and Texas areas.

Midwest reps, Electro-Mec Associates move to a new building at 4012 E. Nine Mile Road, Hazel Park, Mich.

Boston's Epsco, Inc. strengthens sales coverage in the Southwest through appointment of the Kittleson Co. to handle its equipment and systems line in California, Nevada, Utah, Wyoming, Colorado, Arizona and New Mexico.

New rep firm in West: John Francis O'Halloran & Associates, 11636 Ventura Blvd., North Hollywood, Calif.

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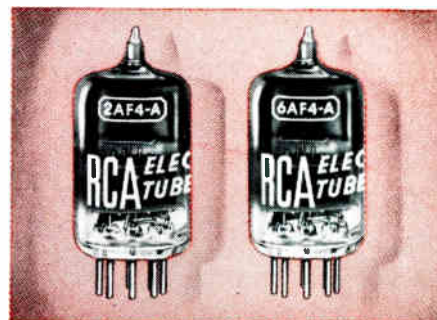
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