

electronics

business edition



INSTRUMENTS IN ATOMIC ENERGY



New Designs Swell Market... page 21

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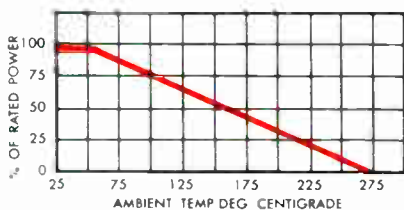


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Shoptalk . . .

WHAT ATOMIC ENERGY MEANS TO US. This issue features a special market report on trends affecting the sale of electronic instruments and controls to the atomic-energy industry, and on the future of nuclear electronics.

A few years ago, the atomic-energy business subsisted on faith, hope and government subsidy. That is changing fast. Peaceful uses of atomic energy are creating markets for instruments which already exceed military markets in volume of business.

In preparing this report, Associate Editor Sideris first reviewed a mass of information he had gathered in 18 months of following the electronics side of the atomic-energy business. Then he interviewed typical instrument manufacturers, their engineers and salesmen. His report "Instruments in Atomic Energy" begins on p 21.

TOWARDS JET-AGE FLIGHT SAFETY. After every tragic aircraft accident government officials, engineers and ordinary citizens start asking themselves "Could electronics have prevented this?" No one doubts the need for better air-traffic control.

President Eisenhower last month declared a state of extraordinary emergency in suspending overtime restrictions indefinitely for all people working on modernizing air navigation systems and equipment.

It's not surprising that a major share of the money to be spent on airways modernization will go to our industry (ELECTRONICS, Jan. 17, p 8).

To get an idea of how our national airspace will be controlled, Associate Editors Kinn and Leary checked the Airways Modernization Board. CAA, Air Transport Association and the Defense Department, followed up with calls on some of AMB's contractors. Their story on what's being done to straighten out our growing air-traffic control problems begins on p 17.

MARKETS IN RAILROADING. A big switch is on in railroading. Some \$4,500,000 worth of electronic instrumentation and control equipment was recently installed in three midwest railroad yards. Total cost of these three yards was \$40,000,000.

Midwestern Editor Harris visited the railroad yards at Elkhart, Indiana; Cicero and South Chicago, Illinois to find out how three different railroads approached the problem of automatically controlling freight-car movements.

Analog computers, radar, vhf radio, closed-circuit tv, talk-back intercoms and other equipment combine to save switchmen's time and company money in a constant battle by the railroads against rising operation and maintenance costs. See p 19.

Coming in our May 23 Issue . . .

Coming In Our May 23 Issue

● **Oil Logging.** The study of the flow of waters and brines in petroleum reservoirs gets an important assist from the Bureau of Mines gamma-ray detector. The instrument, described by F. E. Armstrong, is completely self-contained within a one-inch diameter steel pipe, and it operates up to 250 hours at depths of 5,000 feet and at hydrostatic pressures of 2,000 psig.

Essentially a transistorized probe, the detector uses Geiger-Muller tubes, detects and measures gamma radiation from radioactive tracers in oil wells. Instrument is stable between 70 and 130 F.

● **Alarm System.** Two neon oscillators, alternately keyed at 2 cps in a gated amplifier, provide a locally-generated warble alarm in Conelrad or carrier-off warning system. Modulation of the monitored signal, according to Ronald L. Ives, is audible only in case of alert or prolonged carrier interruption. The system is controlled by a.c. voltage of 15 volts or more from any receiver. Power to external circuits may be removed automatically on a.c. failure.

● **Airborne Tv.** An airborne tv system whose camera is simply carried by a military helicopter is described by Nisson Sher of Philco. The composite video signal from the airborne image-orthicon camera chain is transmitted to ground or surface installations by 30 watt f-r transmitter operating in 780 to 900-me band. System is valid within 50-mile line-of-sight range. Besides obvious military value, system supplies pickup for commercial network telecasts.

● **Beyond Sound Barrier.** Problems involving drag versus air speed while crossing the sound barrier can now be solved with photoelectric function generators. Used with analog computers, the function generator can simulate problems containing a variable which is an arbitrary function of another variable.

Robert Maloy of Convair-Astronautics points out that the photoelectric function generators provide smooth reproduction of complex curve slopes up to 90 degrees, with slopes greater than 90 degrees simulating switching with backlash. Distortion generated by nonlinearity of crt sweep and spot-to-phototube distance is corrected on an aluminum loft layout. And frequency response is flat to 300 cps.

● **Speech Control.** Two miniature electron tubes and four crystal diodes provide automatic amplitude control for speech frequencies to increase the amount of intelligence transmitted over radio under adverse conditions. Lyric R. Battersby of the Signal Corps Engineering Labs at Ft. Monmouth explains that he uses a differentiating network which changes the energy distribution of speech. Input amplitude variations of up to 35 db over a range from 300 to 3,000 cps are reduced to only about 1 db at output with relatively little distortion.

electronics business edition

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Issue at a Glance

- First Quarter Earnings.** Earnings are substantial but below last year's record high. Effect of increased defense orders not yet shown in profits... p 7
- Shares and Prices.** General-Purpose Analog Computers..... p 7
- Mergers, Acquisitions and Finance**..... p 8
- Figures of the Week**..... p 8
- Washington Outlook**..... p 10
- Executives in the News.** Hoffman of Hoffman..... p 14
- Comment**..... p 14
- What's Coming in Air Control.** Getting airways ready for the jet age will mean a lot of business for producers of radar, navigation gear, computers, approach control equipment..... p 17
- Production and Sales.** Communications Employment Holds..... p 18
- Control Freight Electronically.** Railroads buy millions of dollars worth of electronic equipment for new midwest freight yards, see savings in quicker freight handling, reduced damage to shipments..... p 19
- New Road Jobs for Computers.** Electronic computers slash costs and save engineering time on highway projects. Federal plans to spend \$100 billion on roads in the next 15 years assure a vast new market..... p 20
- Instruments in Atomic Energy—An ELECTRONICS Special Market Report.** Control and application of atomic energy will generate nearly \$50 million in electronics sales in 1958..... p 21
- Post Office Tries Sorter.** It's not as sophisticated as Canada's recently described system but it uses electronics and promises to help up-date our hard-pressed mail service..... p 27

DIGEST CONTINUED ON NEXT PAGE

DIGEST continued

Components and Materials p 30
 Etched Wiring Grows Firm Develops New Silicones
 Parts Suppliers Foresee Rise Miners Sponsor Research Study

Engineering Report p 33
 British, French Disclose Three-D Radar Technical Digest
 Tape Controls Coordinate Table Electronics Rides "Piggyback"
 Meetings Ahead

Industry to Get Space Work. Outside research sources will do the civilian space agency's electronics work under contract p 36

Military Electronics p 36

Contracts Awarded p 36

New Products p 39

Literature of the Week p 49

Components Gain in Britain. Trends in \$270 million business highlighted at electronics show; firms eye U.S. market for stereo..... p 50

Developments Abroad p 50

Exports and Imports..... p 50

Pushbutton Tv Stations. Talk at big conclave shows automatic operation of tv stations may be a coming trend. Engineers see more broadcasting uses for transistors p 52

FCC Actions p 52

Station Moves and Plans..... p 52

Plants and People..... p 54

News of Reps...... p 56

Index to Advertisers..... p 56

electronics

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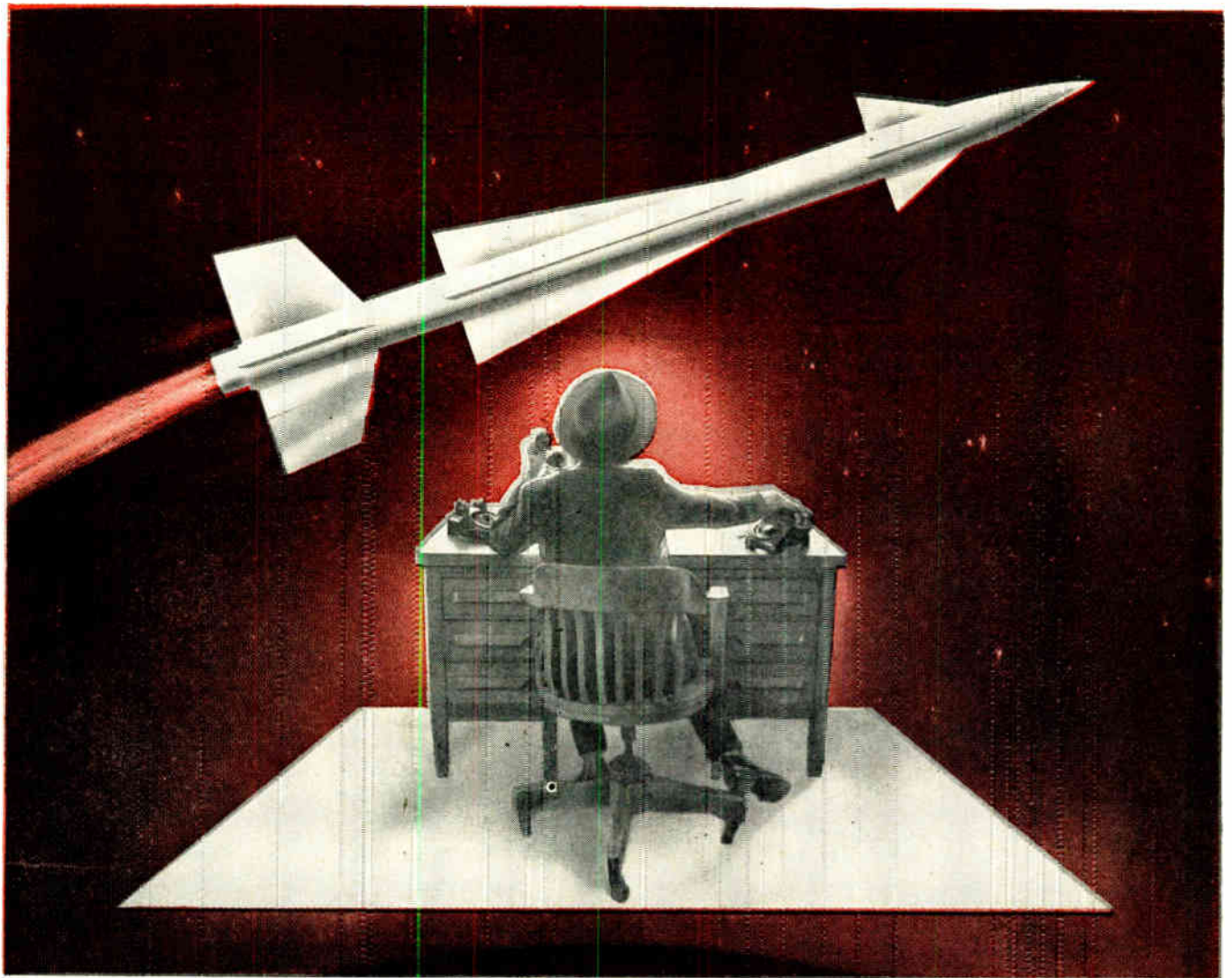
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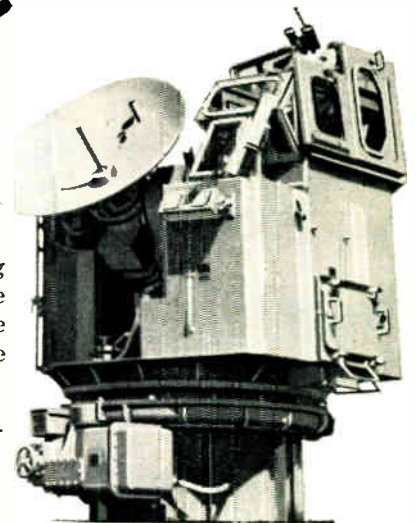
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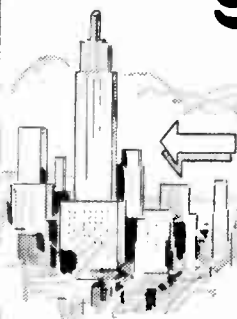


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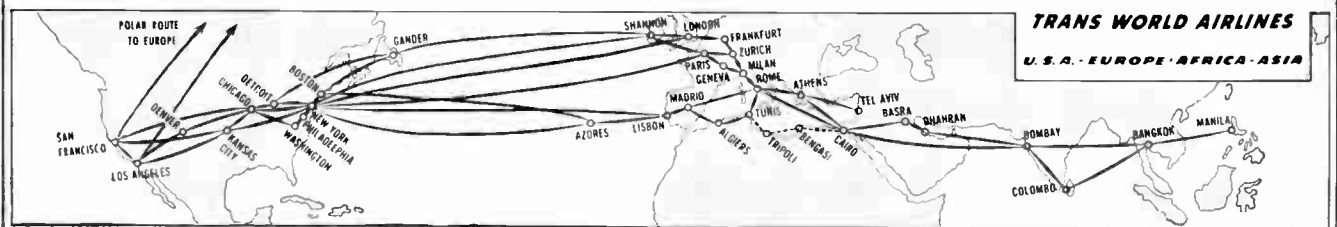
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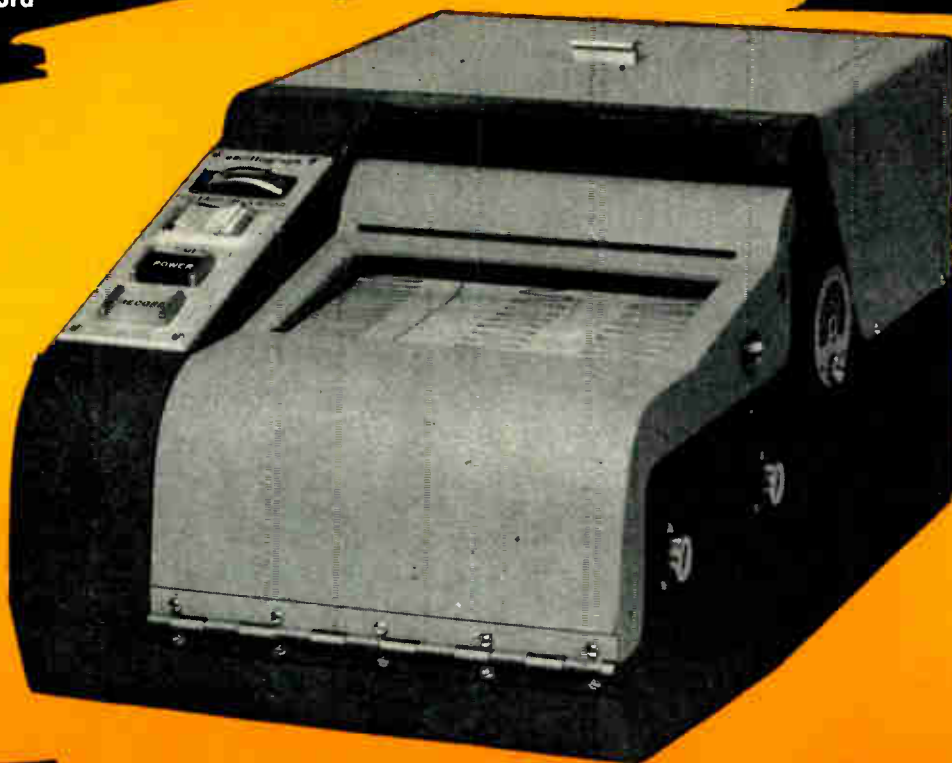


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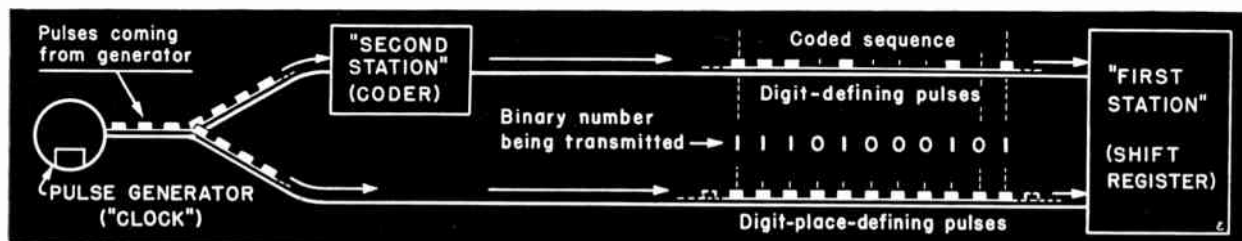
"SLEEPER" PATENT

IN THE

REMOTE CONTROL AND COMPUTER FIELDS

Despite its early filing date [1915], our patent involves *analog-to-digital converters* (electro-mechanical and optical types); *pulse generators* (see remarks on "clocks", below); "*memory*" devices for storing data in binary-digit form; *check-back means* for checking the accuracy of data transmission; *digital-to-analog converters* and unusual *hydraulic systems* for driving high-torque shafts to positions accurately determined in accordance with stored binary-number-type data; *calculating means* (analog form); and many other features. We do not claim priority in *all* of these categories, but we do hope that we have made still useful contributions to the art in *some* of them. For instance . . .

"CLOCKS" and clock pulses, in the electronic computer art, seem to be taken as much for granted as an a.c. power supply—yet our patent covers certain uses of pulses in determining the *digit places* and *digits* in binary-type code numbers. Part of this feature of our patent is illustrated by the following example:



The diagram indicates how our Patent Claim 14 (below) might read on at least one form of "shift register".

Claim 14, here paraphrased, deals with the basic idea of using binary code numbers to transmit information from one "station" to another in the following way:

A generator [at left in diagram] sends a sequence of pulses to a "first station" [at right] via a direct path, and also via another path passing through a "second station". An information-carrying code number can be introduced at the second station by *selectively* deleting pulses there to form a coded sequence [shown traveling along upper path]. At the

"first station", this information can be received by "reading" the code number—the uncoded pulses received over the direct [lower] path being used to define the *digit places* in the number, and the corresponding pulses and "absences" in the coded sequence received over the other [upper] path being used to define the *digits* at the respective digit places. Thus, a "1" is read each time a digit pulse [above] arrives with a digit-place pulse [below], and a "0" is read each time *no* digit pulse arrives with a digit-place pulse.

Our development work was done under a Signal Corps contract, and the United States of America has a royalty-free license under our patent. However, we retain all commercial rights in the development.

During the many years that the patent application was in the Patent Office, the Examiners cited 73 references against it. This evidence of thoroughness in searching leads us to believe that the 29 claims they allowed are quite sound. Nevertheless, in an effort to reduce the chance of lengthy bargaining and costly legal controversies with respect to technical points, we are trying the sales experiment of offering non-exclusive licenses at the following low rates: $\frac{1}{4}$ of 1% royalty on gross receipts (non-government) from selling, leasing, and/or servicing

complete mechanisms or systems that employ inventions covered by our patent claims, with a \$1,000 per year *minimum* that would insure future availability of the low rate whether you are currently using our invention or not.

This offer expires October 1, 1958.

Write to us for details. We shall be glad to supply a copy of our U. S. Patent No. 2,724,183 and a set of "index" notes that relate the claims to pertinent portions of the specifications and figures.



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First Quarter Earnings

Earnings are substantial but below last year's record high. Effect of increased defense orders not yet shown in profits

DURING the first quarter of 1958 the overwhelming majority of electronics firms earned substantial profits but, in most instances, not as much as the record earnings of first quarter 1957.

Included among electronics firms are manufacturers of electronic equipment and components and suppliers of basic materials and parts to the electronics industry. Also, large diversified firms having substantial interests in the electronics industry through subsidiary corporations.

Comments by company presidents and other high corporate officials on first-quarter returns indicate that no sharp pickup is anticipated for the second quarter of 1958. However, these officials expect generally that second quarter earnings will exceed first quarter 1958 earnings, although they will trail second-quarter earnings of 1957.

The increasing rate at which defense contracts are being awarded should help to produce strong third and fourth quarters this year. Other factors that may contribute to a year-end upturn are intensive selling efforts in both the industrial electronics and consumer durables sectors of the economy by some of the larger manufacturers of electronic equipment.

	First Quarter Earnings		Percent Change
	1958	1957	
	(\$000)		
American Bosch Arms.....	887	1,342	- 33.1
Burroughs.....	1,100	3,223	- 66.1

	1958	1957	% Change
Cons. ElectroDynamics.....	d-56	324	-117.2
Amer. Mach. & Foundry....	2,680 ^a	3,474	- 22.8
Electronic Associates.....	84	201	- 58.1
Foote Mineral.....	497	622	- 21.1
General Bronze.....	193	192	+ 0.5
General Cable.....	1,636	3,013	- 45.7
General Dynamics.....	8,974 ^a	8,974	no change
General Electric.....	49,184	64,006	- 23.2
General Precision.....	424 ^a	1,108	- 61.7
General Transistor.....	121 ^a	50	+142.0
IBM.....	23,396	18,746	+ 24.8
Mallory (P.R.).....	435	1,019	- 57.3
Minneapolis-Honeywell....	4,278	5,255	- 18.6
Philco.....	d-1,027	905	-213.5
Raytheon.....	1,734	1,143	+ 52.4
Rheem Mfg.....	d-170	611	-127.8
Rockwell Mfg.....	692	2,057	- 66.4
Sangamo.....	193	952	- 80.3
Sonotone.....	217	160	+ 35.6
Square D.....	1,436	2,523	- 43.1
Stewart-Warner.....	1,174	1,861	- 36.2
Sylvania.....	1,168	3,070	- 62.0
Temco Aircraft.....	597	295	+102.0
Texas Instruments.....	1,109	790	+ 40.3
Thompson Products.....	1,927	4,051	- 52.4
Van Norman Industries....	d-130	265	-149.1
Webcor.....	146	355	- 55.8
Westinghouse Air Brake...	2,302	3,170	- 37.7
Zenith.....	2,036	1,651	+ 23.3

^a estimate

d-deficit

SHARES and PRICES

GENERAL-PURPOSE analog computer manufacturers look forward to substantial sales over the next five years.

Last year general-purpose analog computer sales totaled about \$12 million to \$15 million. Manufacturers believe sales will increase

moderately this year. Over the next five years, they expect, annual sales should average at least \$15 million per year.

Typical General-Purpose Analog Computer Manufacturers	Recent Price	Indicated Dividend Rate	Percent Yield	Earned Per Common Share			1958 Price Range
				1958	Period	1957	
Beckman.....	20%	.....²	.....	d-0.06 ¹	(6 mos)	0.55 ³	NYSE 20¼-25¾
Daystrom.....	31%	1.20	3.8	1.94 ¹	(9 mos)	2.07 ³	NYSE 30-35
Dynamics Corp. of America.....	3¼	.....	.....	0.63 ⁴	(3 mos)	0.77 ⁵	ASE 2¾-4½
Electronic Associates.....	37 ¹	.....	.....	0.14	(3 mos)	0.70	OTC.....
Goodyear.....	73%	2.40	3.3	6.12 ¹	(year)	6.02 ³	NYSE 69-84¼

¹ bid

² stock dividend

³ plus stock

⁴ ending Dec. 31, 1957

⁵ ending Dec. 31, 1956

⁶ ending March 31, 1957

⁷ ending March 31, 1956

MERGERS, ACQUISITIONS and FINANCE

• **Capital goods producers** cooperating in the quarterly McGraw-Hill Machinery New Orders Forecast are a little less optimistic about prospects for new orders than they were three months ago. But, they expect new orders to pick up in the current quarter and continue to go up throughout 1958. They expect a gain of 13 percent in new order dollar volume between first quarters of 1958 and 1959. Gains forecast for various machinery groups over next four quarters range from 5 to 52 percent. Biggest increase, 52 percent, is expected by metalworking machinery builders. They are an important market for electronic gages and controls.

• **Statham Instruments**, Los Angeles, Calif., lists common stock on the American Stock Exchange. Stock was previously traded over-the-counter. Firm is primarily engaged in design and manufacture of transducers.

• **Cohn Electronics**, of Los Angeles, and **Massa Labs**, of Boston, announce agreement on merger terms. The Boston firm will be operated as the Massa Division of Cohn. Acquisition will give the diversified L.A. firm a place in production of underwater sound equipment, sonar devices, ultrasonic products and transducers, spokesmen say. Massa is the third company acquired by Cohn in recent months. Last December it merged with Millivac Instrument and Volkert & Schaffers, both of Schenectady, N. Y.

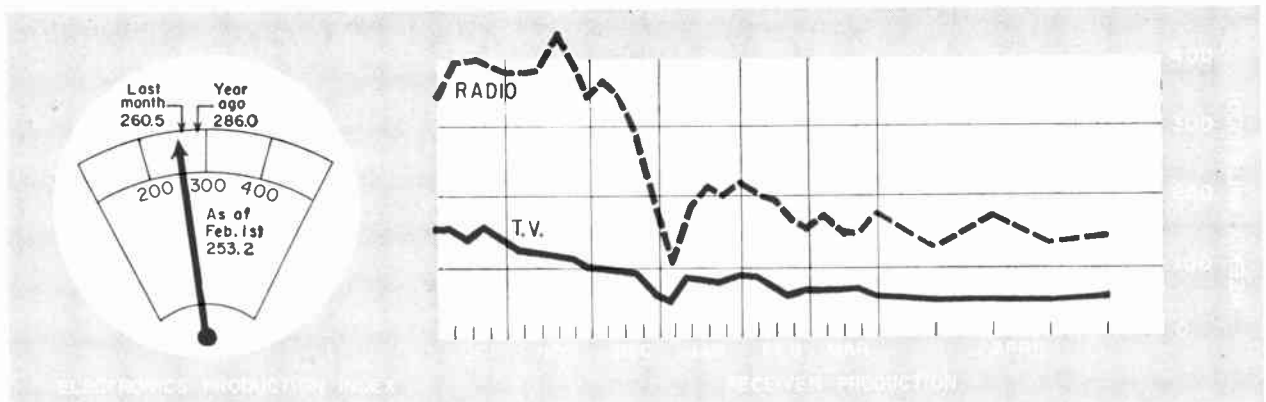
• **Seeburg Corp.**, Chicago, Ill., producer of juke boxes, missile components and facsimile equipment, purchases the electric cigarette vending machine business of **Eastern Electric Co.** Purchase is of particular interest to this industry as vending business is expected to make increasing use of electronic equipment in future

years. Seeburg, was formerly known as **Fort Pitt Industries**. Stockholders approved the name-change last month after Fort Pitt decided to dispose of its former brewing interests and concentrate on electronics.

• **Narda Microwave**, Mincola, N. Y., acquires **Alcar Instruments**, Little Ferry, N. J., maker of ultrasonic equipment. Narda makes microwave instruments, components, and ultrasonic gear through its subsidiary, **Narda Ultrasonics**.

• **Siegler Corp.**, Anaheim, Calif., declares regular quarterly dividend on common stock. Dividend is payable June 2 to shareholders of record May 15.

• **New York Security Analysts** form special electrical and electronics group which will be composed of 25 to 30 Wall Street security analysts who specialize in electrical and electronics securities.



FIGURES OF THE WEEK RECEIVER PRODUCTION

(Source: EIA)	Apr. 25, '58	Apr. 18, '58	Apr. 26, '57
Television sets, total	84,999	76,118	81,408
Radio sets, total	162,421	158,588	275,067
Auto sets	48,574	42,605	96,517

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Apr. 30, '58	Apr. 23, '58	May 1, '57
Radio-tv & electronics	45.57	45.49	50.30
Radio broadcasters	59.16	58.73	67.62

FIGURES OF THE YEAR 1958

	Totals for first two months	
	1957	Percent Change
Receiving tube sales	56,466,000	82,031,000 -31.2
Transistor production	6,061,955	3,221,000 -48.2
Cathode-ray tube sales	1,178,046	1,489,223 -21.1
Television set production	804,396	914,887 -12.1
Radio set production	1,903,418	2,350,294 -19.0

LATEST MONTHLY FIGURES EMPLOYMENT AND EARNINGS

(Source: Bur. Labor Statistics)	Feb. '58	Jan. '58	Feb. '57
Prod. workers, comm. equip.	349,800	362,000	394,600
Av. wkly. earnings, comm.	\$79.75	\$79.15	\$80.18
Av. wkly. earnings, radio	\$78.98	\$77.40	\$76.80
Av. wkly. hours, comm.	38.9	38.8	40.7
Av. wkly. hours, radio	39.1	38.7	40.0

TRANSISTOR SALES

(Source: EIA)	Feb. '58	Jan. '58	Feb. '57
Unit sales	3,106,708	2,955,247	1,785,000
Value	\$6,806,562	\$6,704,383	\$5,172,000

TUBE SALES

(Source: EIA)	Feb. '58	Jan. '58	Feb. '57
Receiving tubes, units	29,661,000	26,805,000	44,460,000
Receiving tubes, value	\$25,650,000	\$23,264,000	\$36,631,000
Picture tubes, units	556,136	621,910	728,363
Picture tubes, value	\$11,210,527	\$12,341,927	\$13,134,778

Now a standard in the industry

...the SPACE-SAVING 663UW



SUB-MINIATURE IN SIZE YET ELECTRICALLY RUGGED

The 663UW has gained wide acceptance among design engineers because it SAVES VALUABLE SPACE. It can do the same for you! (See size table below.) This entire line is designed for reliable performance and it's ratings are conservative. The use of MYLAR® dielectric provides excellent stability with life and high I.R. *Du Pont trademark for Polyester film.

This thin, tough, Mylar case provides excellent moisture and abrasion resistance.

Space saving Mylar dielectric gives a rugged, yet miniature, capacitor element.



Thermo-setting epoxy seals the ends and anchors the leads securely.

APPLICATIONS: Instrumentation, Filter networks, Transistor circuitry, Amplifiers, Test equipment, Computers.

SPECIFICATIONS

Insulation Resistance: See curve reproduced below for typical performance.
Lead Pull Test: Steady force of 10 lbs. applied axially for 60 seconds.
Life Test: 250 hours at 85° C and 125% of rated voltage.

Capacity Tolerances to ± 1%.
Humidity Resistance: Far exceeds requirements of RETMA Apec. REC — 118 — A.
Temperature Range: Operation at rated voltage from —60° C to +85° C; and to +125° C with 50% derating.

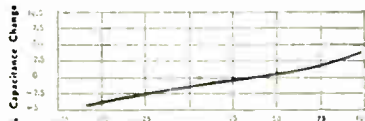
TYPICAL SIZES

Capacity	100 Volts	200 Volts	400 Volts
.001	.156 x 1/2	.156 x 1/2	.156 x 3/8
.0047	.156 x 1/2	.156 x 1/2	.186 x 3/8
.01	.156 x 1/2	.171 x 5/8	.250 x 3/8
.047	.234 x 3/4	.296 x 3/4	.343 x 7/8
.1	.281 x 7/8	.375 x 7/8	.421 x 1
.47	.468 x 1 1/4	.546 x 1 1/4	.671 x 1 3/8

Insulation Resistance vs. Temperature
Degrees Centigrade



Capacity Change vs. Temperature
Degrees Centigrade



Send for 4 page brochure with detailed specifications and complete sizes.

New — Convenient laboratory 663UW capacitor kit now available at industrial distributors.



GOOD-ALL ELECTRIC MFG. CO.
OGALLALA, NEBRASKA

In Canada, 700 Weston Road, Toronto 9, Ontario

NEW BULK PACKING FOR SOUTHERN SCREWS *... designed for you!*



DESIGNED FOR MODERN MATERIALS MOVEMENT, FITS ALL PRODUCTION LINES, WHETHER LARGE OR SMALL

Southern Screw's new bulk packing answers your long-time need for a conveniently sized industrial package that can be handled easily by one man without the use of power equipment, yet is ideal for mechanized mass handling with or without palletizing.

Here's how Southern's NEW BULK PACKAGE can save you handling time, production time, storage space and paperwork.

EASIER TO STORE • EASIER TO OPEN and CLOSE • EASIER TO USE • EASIER TO IDENTIFY • HEAVY DUTY CORRUGATED CARTONS • DISPOSABLE PALLETS AT NO EXTRA COST!

Based on the new pallet and carton system, standard packing quantities for each item have been established. For complete information, write for chart BP-1, to Southern Screw Company, Box 1360, Statesville, N. C.

Wood Screws • Stove Bolts • Machine Screws & Nuts • A, B, C & F Tapping Screws • Wood Drive Screws

Warehouses: New York • Chicago • Dallas • Los Angeles



CIRCLE 6 READERS SERVICE CARD

10

WASHINGTON OUTLOOK

ELECTRONICS PRODUCERS racked up sales of \$7.7 billion in 1957—roughly nine percent over the industry's 1956 volume.

This is the finding of the Office of Naval Material's sixth annual survey of the electronics industry's production capabilities. The survey covered 561 companies and was restricted to electronic end products, systems, equipments, major assemblies or subassemblies and parts produced for direct assembly by the fabricator. The Navy tried to omit figures on research and development, parts produced and sold as such and the industry's nonelectronic products.

For 1958, the forecast is for production amounting to \$8.3 billion.

The final 1957 sales figure of \$7.7 billion fell about \$800 million under the estimates reported to the Navy last year. Companies reported that the over estimate resulted from cutbacks and stretchouts in military orders and from unanticipated reductions in sales of consumer products.

- The \$7.7-billion sales figure for 1957 is pretty much in line with the \$7.6-billion estimate reported by the Electronic Industries Assn. covering consumer products, tubes, semiconductors, components, military and industrial equipment.

EIA reports electronics industry sales of over \$13 billion when distribution and maintenance costs and broadcasting revenues are included.

Total employment in the electronics industry dropped from 494,805 in 1956 to 492,391 in 1957.

Despite a reduction in work force, average sales or billings per employee rose from \$14,376 in 1956 to \$15,654 in 1957.

Seventeen companies with over 5,001 employees accounted for more than half the industry's sales.

The electronics industry's maximum capability on one shift increased slightly from \$11.3 billion in 1956 to \$11.5 billion in 1957.

In 1957, 99 companies reported a total backlog of military business, and 95 reported 100 percent planned civilian production.

In 1956, 92 companies were exclusively in military production and 87 wholly in civilian manufacture.

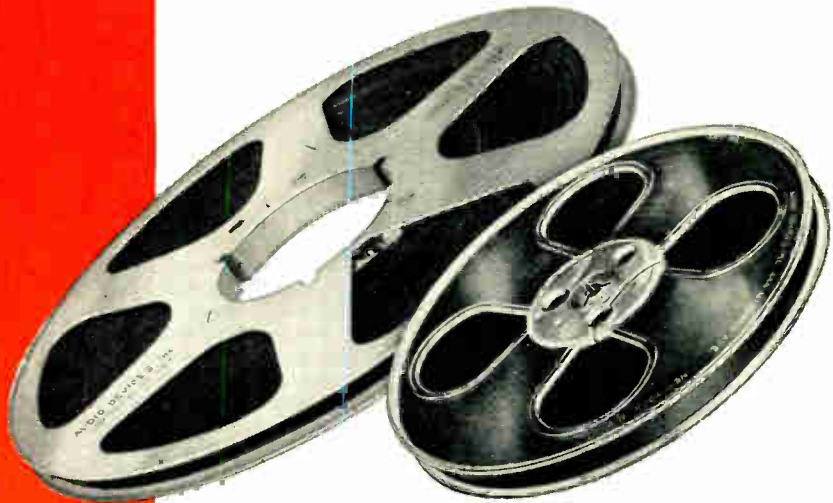
- Sperry Gyroscope, which has a production contract for the Army's new Sergeant tactical surface-to-surface missile, is making the airframe as well as the electronic guidance and controls. This is a big step in the trend for electronics and propulsion producers to take over the prime contracts on future missile and space projects.

The Army says, however, that initial award of Sergeant's airframe to Sperry doesn't preclude the selection of another company to take on manufacture later on of large quantities of the Sergeant airframe.

Still, Sperry may stick with the airframe phase of the project to the end. The missile is powered by a solid-propellant rocket which contains none of the elaborate plumbing that goes with liquid-fuel rocket engines, thus needs a simpler and cheaper airframe.

May 16, 1958 — ELECTRONICS business edition

NOW: a SUPER-THIN Audiotape
that's **SUPER-STRONG**



NEW Super-Thin Audiotape on TEMPERED MYLAR* gives you DOUBLE THE RECORDING TIME yet won't stretch or break on any machine!

FROM the laboratories of DuPont has come a great boon to serious tape recordists — Tempered "Mylar"! This improved base material is actually *twice as strong* as ordinary 1/2-mil "Mylar," giving you a double-length tape that can be used on any machine without danger of stretching or breaking under starting, stopping or rewind stresses. "Tempering" does away with the extra-careful handling required by ordinary double-length tapes.

With Super-Thin Audiotape on Tempered "Mylar," you get 2400 feet on a 7-inch reel — a *full hour* of uninterrupted recording time on each track, at 7 1/2" per second, or *two hours* per track at 3 3/4" per second. In effect, it gives professional 10 1/2" reel capacity to any portable or home-type recorder that will take a 7" reel!

The doubled length and strength are achieved with no sacrifice in magnetic characteristics. This tape has the same superior performance and consistent uniform quality that have made Audiotape the first choice of professional recordists the world over. It is available *now* — in the following reel sizes: 5" (1200 ft.), 7" (2400 ft.) and 10 1/2" (1800 ft.). Stock up on this, or any of the other seven types of Audiotape, on the next trip to your Audiotape dealer.

*"Mylar" is a DuPont Trade Mark

audiotape
TRADE MARK
it speaks for itself

AUDIO DEVICES, INC., 444 Madison Ave., N. Y. 22, N. Y.
In Hollywood: 840 N. Fairfax Ave. • In Chicago: 5428 Milwaukee Ave.
Export Dept.: 13 East 40th St., N. Y., 16 • Cables "ARLAB"
Rectifier Division: 620 E. Dyer Rd., Santa Ana, Calif.



new and unique!



**Eliminate
Breadboard Layout!**

**SPEED DESIGN OF TRANSISTOR CIRCUITS
With the SPRAGUE TRANSIMULATOR**

Bring transistor circuits to life in a matter of minutes with the Sprague LF-1 Transimulator. This new instrument lets you simulate any amplifier stage, a-c or direct-coupled, short of high power audio output; also multivibrator, switching, phasing, push-pull, Class A and B, and many others using cross-coupled Transimulators . . . whether the circuit is common or grounded emitter, base, or collector . . . whether the transistors are PNP, NPN, or Surface Barrier. You can simulate circuits stage-by-stage for cascade operation . . . or use a separate Transimulator for each stage to get simultaneous multi-stage operation.

Bring Circuit Diagrams To Life In Minutes

Everything you need for RC amplifier circuits is built right into the LF-1, including coupling capacitors . . . bias and load resistors . . . battery voltage supplies . . . Base Collector—Voltage Divider stabilization circuits . . . 5-way binding posts for transformer coupling and metering.

Whether you're designing audio circuits or switching circuits, you'll get a true picture of operating parameters minutes after you've drawn the circuit diagram . . . without wasting valuable time with breadboard and soldering gun.

Pays For Itself In A Matter Of Weeks

An ideal laboratory instrument, Transimulators are inexpensive enough to justify several on every bench. You can even use the LF-1 to test transistors *in the circuit* . . . the only real proof of design parameters. And a complete step-by-step instruction manual makes operation fast, simple, and easy.

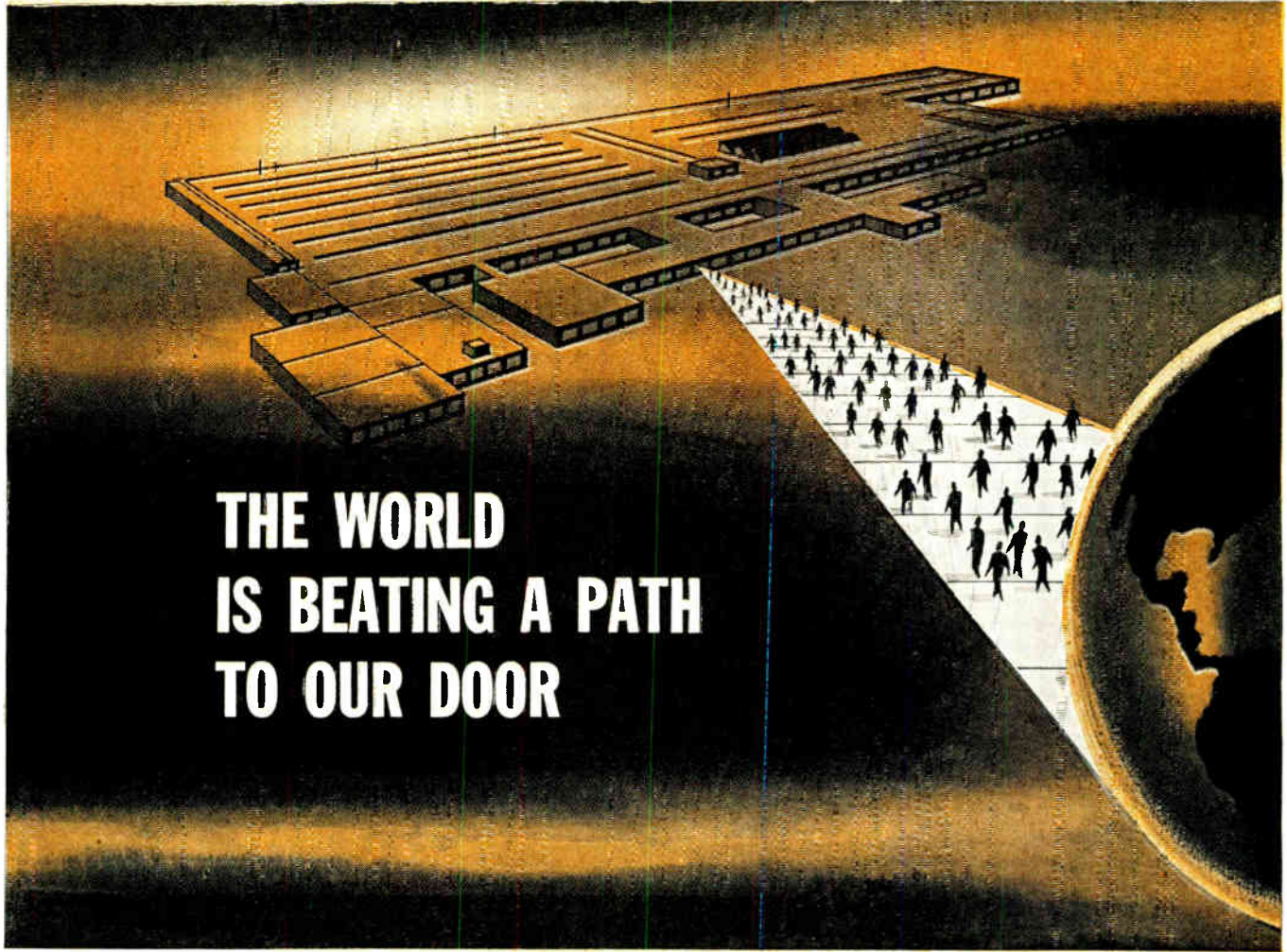
FEATURES OF THE LF-1 TRANSIMULATOR

- TRANSISTORS—PNP and NPN Junction, and Surface Barrier.
- CIRCUITS—Common or Grounded Emitter, Base, Collector.
- RANGE—Audio, up to 100 kc.
- TRANSISTOR POWER—Through medium power audio output.
- BATTERY SUPPLY—Separate bias and load. 1.5, 3, 4.5, 6 volts d-c. Polarity Reversing Switch.
- COUPLING—2 μ f and 20 μ f Direct, and Ext. C. posts, on both Input and Output.
- BIAS RESISTANCE—Up to 555,000 ohms continuously variable.
- LOAD RESISTANCE—Up to 277,500 ohms continuously variable.
- EMITTER RESISTANCE—Up to 2,500 ohms variable. Series resistor and bypass capacitor can be added.
- BASE COLLECTOR STABILITY—Up to 250,000 ohms variable. Series resistor and bypass capacitor can be added.
- VOLTAGE DIVIDER STABILITY—Up to 50,000 ohms variable.
- 5-WAY BINDING POSTS—For meters, transformer coupling, external supply voltage, degeneration, bypass, coupling, signal input and output, almost any connection required.

**only \$79.50
NET**



SPRAGUE PRODUCTS COMPANY, NORTH ADAMS, MASSACHUSETTS



THE WORLD IS BEATING A PATH TO OUR DOOR

(and we've never built a mouse trap in our lives)

"Build a better mouse trap," the old saying goes, "and the world will beat a path to your door." We've never built a mouse trap (although professional pride would never let us admit that we *couldn't* build a better one), but the path to our door is getting pretty worn all the same.

It all started back in 1946 when we first put Bendix Electrical Connectors on the market. We had built them during World War II for use in our own aircraft ignition systems.

The response surprised even us. You in the industry bought all the connectors we could produce—and you continued to do so throughout the ensuing years. As our output increased, so did our research and development program. The members of our engineering staff worked ceaselessly to ensure a continuing improvement in performance and reli-

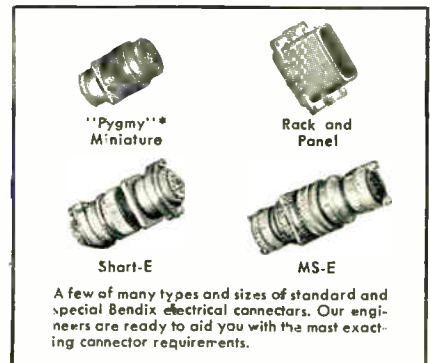
ability. We made them waterproof, shock-proof, and, above all, we made them smaller and smaller without the slightest reduction in performance standards. This, of course, is of vital importance to the aircraft, missile and electronic industries.

These advances in connector design at Scintilla Division of Bendix Aviation Corporation have been recognized by American industry. Acceptance has, in fact, been so enthusiastic that we are now engaged in the greatest plant expansion in our history. The new facilities will be devoted to the production of more and better electrical connectors. As your requirements increase, so will our production.

It has been your wholehearted acceptance of Bendix Electrical Connectors that has made this new manufacturing facility possible. We

are grateful for that recognition of the quality of our product. You may be assured that there will be no slackening of our efforts to continue to deserve that recognition. SCINTILLA DIVISION OF BENDIX AVIATION CORP., SIDNEY, N. Y.

Canadian Affiliate: Aviation Electric Ltd.,
200 Laurentien Blvd., Montreal 9, Quebec



*TRADEMARK

Scintilla Division
SIDNEY, NEW YORK



GERMANIUM PNP TRANSISTORS

For Standard Needs

For Special Needs

For Every Need



EIA TO-9

Outline package used for all Tung-Sol medium power and high-frequency transistors.



EIA TO-3

Outline package used for all Tung-Sol high power transistors.

A complete range of Tung-Sol types are immediately available in volume. Also, Tung-Sol stands ready to match special requests with exactly the transistor wanted. Every Tung-Sol transistor—standard or tailor-made—embodies design and construction features that assure consistent efficiency over full-value operating life. For instance:

- Industry standard packages widen flexibility, ease mounting problems.
- High gain factor.
- Excellent heat dissipation
- Strong resistance to shock and vibration, contamination and temperature.
- Electrical stability throughout life.

High quality over a complete line makes standardizing on Tung-Sol transistors good policy. Review your transistor needs! Then for full data, write: Semiconductor Division, Tung-Sol Electric Inc., Newark 4, N. J.

 **TUNG-SOL**

Sales Offices: Atlanta, Ga.; Columbus, Ohio; Culver City, Calif.; Dallas, Texas; Denver, Colo.; Detroit, Mich.; Irvington, N. J.; Melrose Park, Ill.; Newark, N. J.; Seattle, Wash.; Can.: Toronto, Ont.

CIRCLE 10 READERS SERVICE CARD

14

EXECUTIVES IN THE NEWS



Hoffman: a driver scrambles

NEXT WEEK, Chicago-born Leslie Hoffman will go back to the Windy City to receive the coveted Medal of Honor of Electronic Industries Association. It's natural that EIA would honor the 52-year-old president of Hoffman Electronics, who has invested a lot of himself in the growth of the industry over the years.

Quiet, genial Hoffman grew up in Jackson, Mich., and went to nearby Albion College (B.A. '28). He was immensely popular even then, played right end for the football team, was president of his class and of the student body. After graduation he went to work for Sparton Radio, left in 1929 to go West where he became sales manager for a division of Firestone Tire & Rubber.

In 1937 he took over as general manager of an electrical wholesaler in Portland, Ore., doubled the firm's business by the time he left a year later. He then set himself up in business as a manufacturers' rep. Three days before Pearl Harbor he bought up the bankrupt Mission Bell Radio Co., found himself making box-kite antennas for Gibson Girl air-sea rescue kits during the war. Since then, he's parlayed his firm into a \$50-million annual business.

Knowledgeable and capable, he arms himself with information and then uses it well. He's been getting away from the one-man-show concept of business lately. "He's a hard, fast driver," comments an aide, adding "we enjoy the ride."

Hoffman was a founder and first president of the West Coast Electronic Manufacturers Association, president of RETMA (now EIA) during 1955-56. He follows football and the horses, plays golf: "I scramble around a lot, but generally come in OK." Fed up with missing vacations, he's going to lock his house this summer, tour Europe for two months with wife Elaine and their teen-aged daughter.

COMMENT

Environmental Test

I've just finished rereading your special report on environmental testing (Mar. 28, p. 59). This makes about the tenth time, and each time I've gotten something

new and useful out of reading it.

The parts on testing equipment and environmental chambers were especially interesting to me, though I guess everybody liked different parts of it. This sort of report makes *ELECTRONICS* well worth the price of admission.

Incidentally, it's the first time

I ever saw allusions to Greek and Hebraic mythology in a technical magazine. Didn't know you had it in you!

H. N. STOVER
HADDONFIELD, N. J.

Well, some of our editors have read other things besides the Rad-Lab series.

Adjustment to Noise

I have read with considerable interest the article "Transistorized P-A System Adjusts to Aircraft Noise" (Feb. 14, p 106) . . .

In the course of this article the equipment is described as "the first known completely transistorized aircraft P-A system available to the aviation industry." This statement is not correct inasmuch as this company has developed such a system, which is now in production.

However, the system which we developed goes considerably further than that described in your article. It embodies certain quite revolutionary acoustic distribution techniques. Its installed weight is approximately 35 percent of the weight of a conventional aircraft p-a system. Its speech and musical quality provide a standard which has not yet been approached by any conventional system.

M. L. BERRY
TRIX ELECTRICAL CO., LTD.
LONDON, ENGLAND

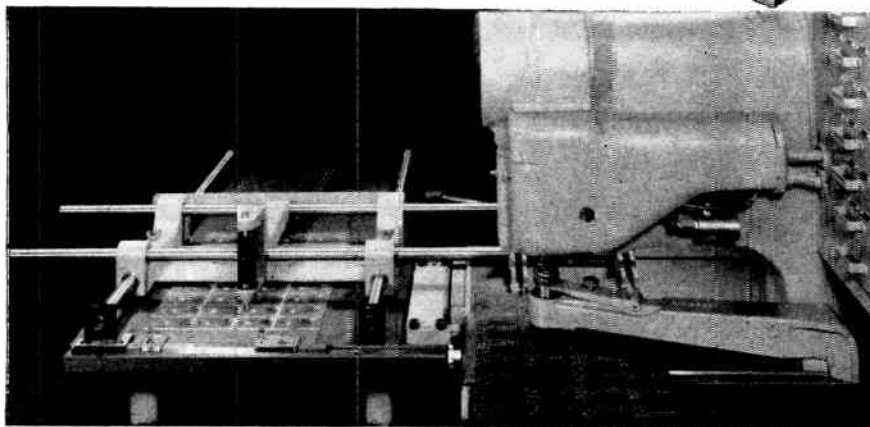
We received the following comment from author Tewksbury.

. . . We think it quite possible that Mr. Berry has a good case. In our own defense, our AMA-10A was the first known completely transistorized aircraft p-a system—known to us, that is. And it certainly was the first one made in this country.

Let me assure you that we had no intention of placing you in an embarrassing position. I think perhaps our choice of phraseology was bad, but the error was an innocent one.

J. M. TEWKSBURY
BENDIX AVIATION CORP.
BALTIMORE, MD.

drilling or die-stamping printed circuits?



cold-punch them for less on a **Strippit** **Fabricator-Duplicator**

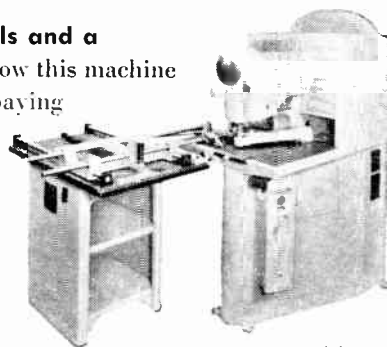
No matter how complicated the hole pattern, if it's a medium run within a capacity of $\frac{1}{4}$ " mild steel, there's no easier or faster way than with a Strippit Fabricator-Duplicator!

No heat, no fixed dies, no drilling. And hole quality is uniformly good, with no crack formation in your laminates.

It's simple to operate — anyone can be hitting high production after a few minutes' instruction. Place master template in Duplicator. Place up to 15" x 25" circuit board or other work in Fabricator. Then, as you place the Duplicator stylus in each template pilot hole, the work is automatically positioned and the punch tripped. Tool changes are made in *seconds*, using the complete line of standard punch and die buttons in the Fabricator's handy "file drawers" — or special-shape tools can be made to your order.

Write today for engineering details and a demonstration at your plant. See how this machine could be cutting your costs — and paying for itself in a hurry under our pay-as-you-produce plan!

Warehouse stocks in Chicago
and Los Angeles.



Wales **STRIPPIT** Company

225 Buell Road, Akron, New York

In Canada: Strippit Tool & Machine Limited, Brampton, Ontario



SANGAMO
TYPE 71

HIGH VOLTAGE CAPACITORS

OIL
FILLED
PAPER

for blocking and by-pass service
energy storage—power supply filters
and many similar applications

These hermetically sealed, compact units are designed for high voltage commercial electronic applications.

High volume resistivity, low power factor, and high dielectric strength are assured by impregnation with Sangamo Diaclor, a specially compounded chlorinated dielectric that is non-inflammable and non-explosive. Type 71 capacitors can be operated at temperatures up to 85°C with proper voltage de-rating.

WEATHER-PROOFED CASE

Tin-plated steel case is metalized with pure aluminum and finished with two coats of baked vinyl resin base paint. Rust and corrosion won't attack this case even if the finish is scratched through to the steel.

Type 71 High Voltage Capacitors are available in standard case sizes in ratings up to 25,000 WVDC.



VOLTAGES UP TO 25,000 WVDC

SANGAMO

Electric Company
SPRINGFIELD, ILLINOIS

6C58-2

MAY 16, 1958

Civil Aeronautics Administration Budget	Fiscal 1958	Fiscal 1959
Air Navigation Facilities		
Vortoc	\$ 41,891,145	\$ 38,320,606
Low-and medium-frequency markers	843,217	834,995
Instrument landing system	5,496,407	4,200,000
Approach lighting	3,847,378	9,452,811
Intermediate fields and beacons	279,366	1,816,551
Enroute Traffic Control Aids		
Long-range radar	11,770,873	25,623,681
Air-route-traffic control centers	9,813,286	12,854,771
Air traffic communications station	6,777,763	6,181,762
International air traffic communications station	1,447,447	1,889,176
Terminal Traffic Control Aids		
Airport traffic control towers	4,647,648	5,534,949
Terminal area radar	10,419,189	16,833,112
Supporting Facilities		
Flight inspection, logistic aircraft	4,924,269	11,219,802
Housing utilities, miscellaneous	3,842,012	7,737,784
TOTAL	\$106,000,000	\$142,500,000

Source: Bureau of the Budget

Funds listed above, plus \$35 million requested by Airways Modernization Board for fiscal year 1959, provide a hint as to . . .

What's Coming in Air Control

BEFORE Christmas, U. S. air carriers will begin flying their first Boeing 707 jet transports in commercial service. The event will catapult the nation's airlines into the jet age six months ahead of schedule, compounding the already complex picture of the airways.

To meet the challenge, two Federal agencies—the Civil Aeronautics Administration and the nine-month-old Airways Modernization Board—are rushing their respective plans. What they're planning is more and better electronic equipment to control traffic and keep the airplanes safe.

In fiscal 1958, CAA spent \$106 million on improvement of air traffic facilities. Three-fourths of this consisted of purchases of electronic products. Congress is now considering CAA's request for \$142.5 million for fiscal 1959.

AMB received \$15.1 million during fiscal 1958. Transfers from Air Navigation Development Board projects which AMB took over accounted for most of this money. Less than \$7 million has been let in

contracts, but of this, \$6.7 million went to electronics firms. AMB has asked Congress for \$35 million for fiscal 1959.

Air traffic is presently controlled by:

- **Air route traffic control centers**, concerned with enroute traffic. There are 28 of these in continental U. S. They are concerned with instrument flight rule (IFR) traffic only.

- **Terminal area facilities** (control towers, with or without approach control) associated with takeoff and landing operations at each airport. Concerned with both visual (VFR) and instrument traffic.

Enroute centers now use both radio and radar coverage, with heaviest reliance on radio. Ten-minute separation now required between aircraft means 50 miles for a 300-mph craft; with radar, a controller could vector aircraft to within 5 miles of each other, let them cross paths, and otherwise use airspace more efficiently.

Major problem at terminals is the random order of arrival, which causes stackups. AMB considered two

methods used by military for keeping arrivals less random.

One method requires complete radar coverage, with a radar tracking gate and analog director-computer for each plane under control. The other method keeps all controlled craft in constant communication with control center by data link. Ground-based computer figures out where planes are and where each should be to arrive over terminal at the right time to fit into the landing sequence.

AMB rejected both plans, is working toward a system that will fit into today's controls. A computer will figure out where the plane should be and send this to a ppi display. Controllers will see both actual and desired position and orally instruct the pilot.

So-called bright radar which can be viewed in natural light, and color ppi tubes that will permit separation of actual radar data and computer-supplied information, will both aid AMB's system.

Whatever gear is chosen, it must meet two key requirements: it must be introduced into the system without disrupting present methods, and it must permit immediate return to manual control at any time.

CAA's electronic purchases, aimed at relieving the current crisis as much as possible, are substantial:

- Vortac is a big part of the CAA budget, will have soaked up over \$80 million by the end of fiscal 1959. First station will go operational this year; hundreds will be working by this time next year.

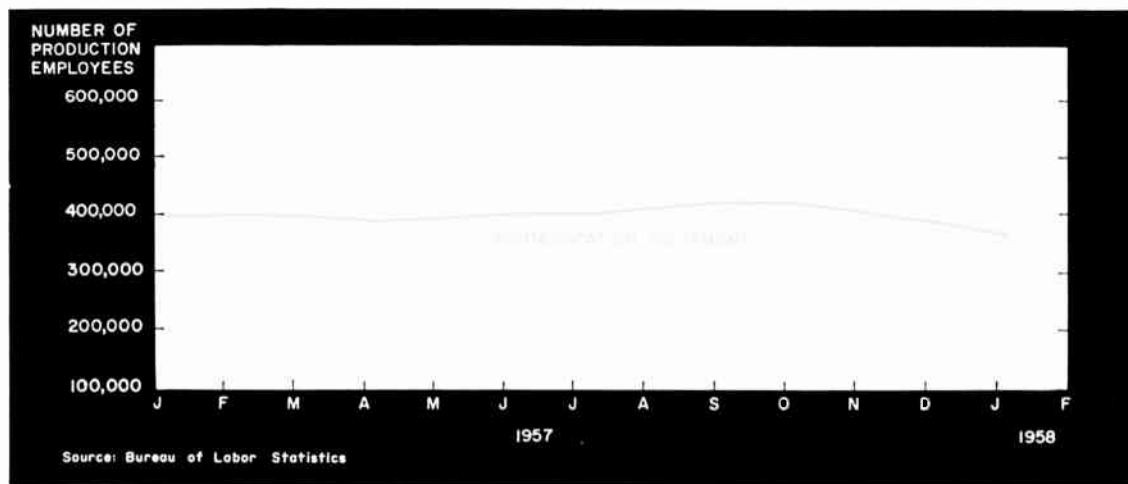
- Installation of long-range radar is stepping up. CAA will spend \$25.6 million on this item in fiscal 1959, more than twice fiscal 1958's \$11.8 million. Most of the 28 enroute centers will be outfitted by yearend. Radars will be aided by air-defense radar data remoted into the centers.

- Development of computers is being pushed. Flight-data entry device (FLIDEX) is first step; this device will standardize and control format for flight plans to prepare them for machine processing.

CAA has also been testing a medium-scale computer with large-volume storage since November, 1956, will soon install three for actual service at New York, Washington and Indianapolis.

Big problem yet to come: coordinating civil and military control. By 1964, military controllers will need to know speed, position, identity of all craft in the air all the time. Military controls must be capable of handling craft that can fly 100,000 ft up, move at 2,800 knots, climb 100,000 ft a minute, approach terminals at 200 knots. If the civil system can't handle such traffic, the military will have to duplicate it on a nation-wide basis.

PRODUCTION and SALES



Communications Employment Facts

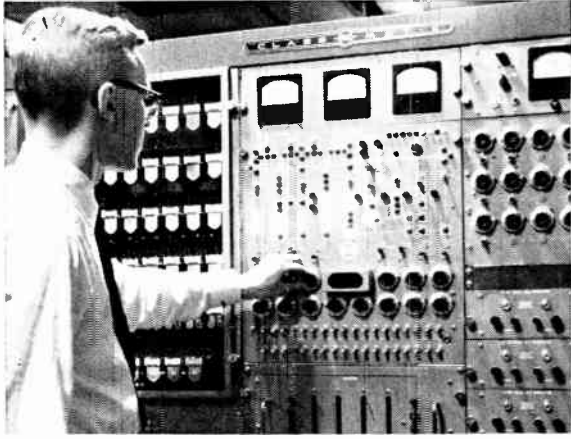
COMMUNICATIONS equipment production employment dropped only eight percent since Jan. 1957 while number of production employees in all manufacturing industries dropped 14 percent.

Number of employees in the communication equipment cate-

gory declined by 31,700 from 392,300 in Jan. 1957 to 360,600 in Jan. 1958. All manufacturing industries experienced a dip of production employees from 13,150,000 to 11,780,000.

In Jan. 1958, latest month for which Bureau of Labor Statistics

has released data, number of communication equipment employees dropped 20,000 or five percent. But, according to industry observers, rising electronics defense spending should step up communication equipment employment in the coming months.



Analog computer panel (left) made by General Railway Signal and various electronic units (right) from Union Switch and Signal play key roles as railroad men . . .

Control Freight Electronically

PROBLEM—Reduce high costs and lost time in switching railroad freight cars

SOLUTION—Use electronics to speed operations, cut materiel damage

METHODS—Install vhf radiotelephones, analog computers and remote controls

CHICAGO—SOME OF THE ROMANCE of railroading "went out" with the old-fashioned steam engine, but it's coming back fast with electronics—which today is also saving railroad men money and time. In the past few months, two railroads have sunk \$4.2 million worth of electronics into two midwest rail yards which together cost a total of \$18 million. A third railroad, by industry estimates, has put "additional hundreds of thousands in electronics" into a \$20 million Chicago switch yard.

The New York Central's \$14-million yard (electronics portion—\$3.7 million) in Elkhart, Indiana, "should pay for itself in about three years by reducing the Central's operating expenses some \$4.8 million annually," says President Alfred E. Perlman.

The Burlington Railroad's president, H. C. Murphy, sings similar praises for his system's \$4-million installation (electronics portion—\$525,000) at Cicero, Illinois. "Faster, more dependable freight schedules, reduction of damage to shipments, elimination of duplicate switching—all will effect operating economics approximating a 10-percent return on investment after taxes," he says.

Santa Fe's \$20 million terminal "will contribute substantially to carrying out the company's recent

one-day speedup in freight service to California," says Board Chairman Fred G. Gurley.

What did the electronics money buy? At Elkhart, for example, it bought: A closed-circuit tv network that allows inbound freight cars to be viewed instantly in the general yard office. Before the train stops its freight-car numbers are checked and recorded.

The money also bought a magnetic memory which stores each car's destination, later automatically routes the car in the correct one of 72 classification tracks on which outbound trains are made up.

Purchased also were nine analog computers that select and integrate information affecting the speed of cars as they roll down the hump—an artificial hill at the entrance to the classification tracks. Answer is computed instantly. The control system automatically operates retarders—clamps which slow the car down to the proper speed to reach its destination in the yard without jolting contents when it hits the rest of the cars.

Other equipment bought includes remote control for a car accelerator to push freight cars. It is operated by a dial at the retarder operator's desk.

Five separate radio networks were put in to speed assignments to the yard workers and switching locomotives. Communications include seven talk-back systems reaching all areas of the yard, plus teleprinter circuits.

Photoelectric cells were bought to detect cars approaching retarders. Electronic scales were installed to weigh cars in motion.

In the future, mechanization of car handling may extend to having route information for entire trains preprogrammed on tape and automatically introduced into the switching system through tape-reading equipment controlled from the hump tower.

New Road Jobs for Computers

Electronic computer sales to highway builders and consulting firms rise as U.S. swings into 15-year, \$100-billion highway program

LOS ANGELES—DURING THE NEXT 15 YEARS, about \$7 billion will be allocated annually to improve U.S. highway networks. Much of this money will go to the electronics industry—especially to computer manufacturers.

This shot-in-the-arm for digital computer makers is already being felt today. Machines are being used on dozens of projects to perform earthwork calculations, traffic studies, bridge analyses and so forth.

Twenty-eight state highway departments use various types of computers now. In two years, it's expected 40 to 42 departments will be using them. And at least the same number of consulting firms will be utilizing computers (for example, the IBM 650, above) on road projects (photo: Calif.).

Showing growing acceptance is this typical report from Oregon: "Our computer can solve in 10 minutes an earthwork volume problem that would take an engineer 200 hours to calculate by hand." Also, some state highway departments are getting double mileage from their machines by making use of the units' accounting capabilities.

One department of public works employs a computer for advanced highway studies and planning. "The machine," agency reports, "computes cut-and-fill requirements at a cost of \$50 per mile, compared with \$300 per mile when performed by an engineer with a desk calculator.

"More important in this period of manpower shortage is the engineer's time saved. Machine also sets boundaries for rights-of-way and dams, is used for computing steel needed in bridges and calculating water resources projects."

Manufacturers of lower priced computers are finding a market in independent consulting firms. Many



such firms are using units to perform civil engineering functions.

A major bottleneck in submitting highway bids lies in bridge work. Computers make possible optimizing of construction cross-sections, because more possible solutions can be investigated.

Civil engineering users usually lease, don't buy computers. Primary reason is that many consulting firms and highway departments don't have required maintenance personnel. Monthly lease fees range from \$1,500 to \$5,000.

Today many manufacturers sponsor program-sharing plans among customers. One firm's program supports two civil engineering subcommittees, one for structural and one for highway applications.

Computer programs developed by customers are punched into tape. The tapes are filed in a library and made available to any other member.

Washington spokesman for Bureau of Public Roads says: "One machine hour is equivalent to 350 man-hours in solving major horizontal alignment problems such as a complex highway interchange.

"Two years ago," he adds, "the average highway engineer knew little or nothing about a computer. Today this device is a major item of conversation at any gathering of highway engineers."

Instruments for Atomic Energy

- Domestic sales of radiation and reactor instruments estimated near \$50 million; profits are spotty but looking up
- Government programs support half the market, but civilian reactors and industrial uses are multiplying

By George Sideris—Associate Editor, ELECTRONICS

NUCLEAR instrumentation is on the threshold of becoming not only a large, but also a profitable segment of the electronics industry.

In 1958, domestic sales of instruments especially made for atomic purposes will bring in \$40 million. Conventional instruments used in the atomic energy program will add another \$8 million.

In 1948, nuclear instrument sales were under \$5 million. By 1950, the total had risen to \$15 million. Estimates for 1960 are \$60 to \$70 million (Fig. 1).

Over half the sales of nuclear instruments depend on government agencies, chiefly AEC. The proportion sold to industry directly, however, is rising.

Manufacturers see better future profits than the two percent average in the experimental past. Some are already doing well. Others are still taking a loss or subsidizing their nuclear instrument lines with more profitable bread-and-butter items and nuclear services (Table I).

The basic problem, many firms competing for a limited though growing market (Table II), is being

alleviated by the growth in sales. Free AEC patents or AEC lab experience enabled a large number of companies to enter the market with limited capital.

NUCLEAR REACTORS—Nuclear power plants, on the average, will devote 2.5 to 3 percent of capital costs to instrumentation. Conventional power plants require only about one percent. Research, test and other low-power reactors require 10 percent or more (Table III).

Reactor instrumentation rose to about \$10 million a year in 1955 and is now around \$15 million. The next few years will see a sharper climb. *Nucleonics*, a McGraw-Hill publication, last month listed 60 reactors in operation, 67 being built and 71 contracted (Table IV).

Industry opinion sees a momentary leveling of the civilian power program in the mid-1960's while prototypes are tried out. By then, however, research and training reactors will be using \$10 million a year in instrumentation, controls on naval reactors will

TABLE I—How Four Nuclear Instrument Firms Are Faring

	1955		1956		1957	
	Sales (\$000)	Profit	Sales (\$000)	Profit	Sales (\$000)	Profit
Company A.....	1,914	d-194	4,231	165	6,643	19
Company B.....	1,846	109	2,198	177	2,587	253
Company C*.....	12,820	46	11,692	d-1,336	12,061	d-1,399
Company D.....	2,026	d-27	1,614	d-298	3,068	303

d-deficit

* this firm reported a profit in early 1958

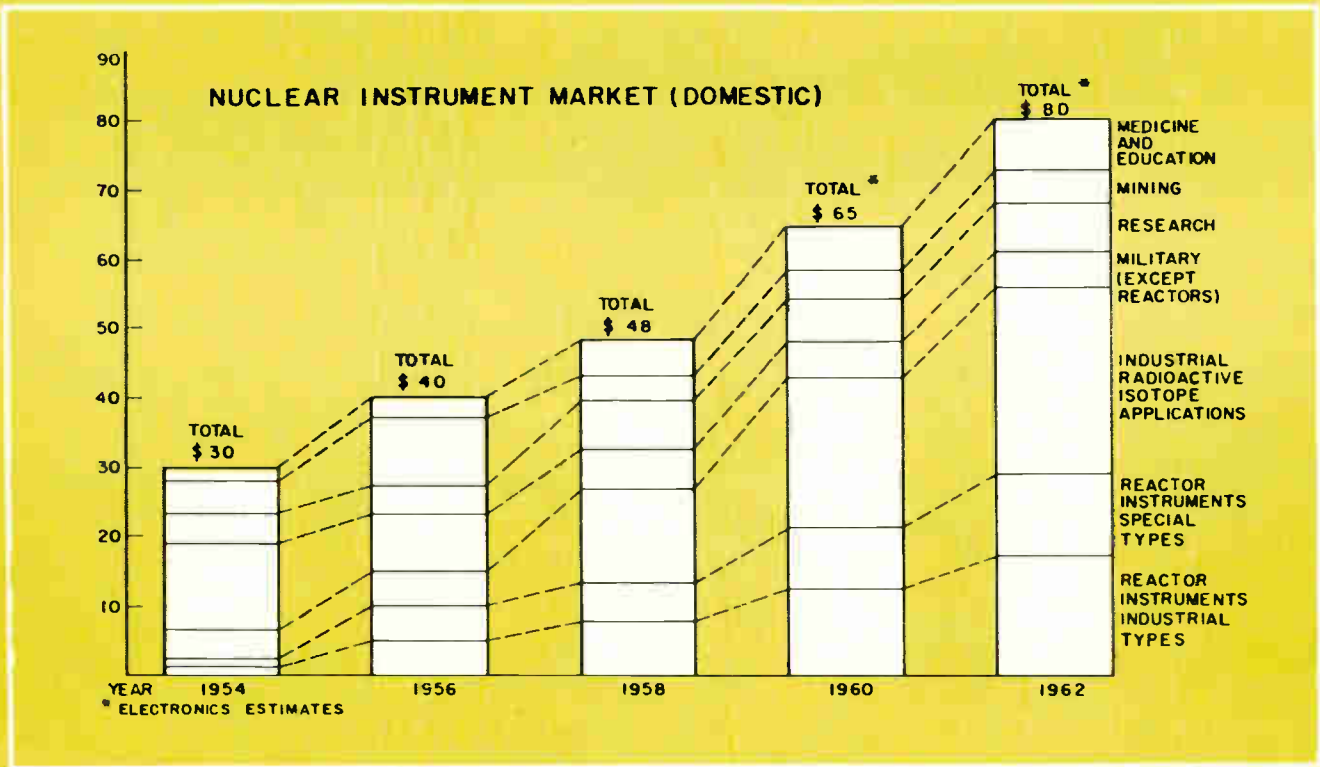


FIG 1—Reactors and industrial isotope applications are large radiation instrument market builders

cost another \$10 million or more and renewal of previously installed instruments will represent sales of \$5 to \$8 million.

After that, reactor construction could zoom, as shown by the maximum curves in Fig. 2. Or it could level off as shown by the minimum curve of the Atomic Industrial Forum's forecast. It will depend on the ability of nuclear engineers to make nuclear power competitive, as in Fig. 3.

Table V shows AIF's forecast of the delivered value of instruments for newly installed working reactors. The figures do not include installation costs, renewal sales to previously installed reactors, developmental facilities or the effect of the \$90 million-a-year aircraft-reactor program. All of these are swelling the instrument market.

COST TRENDS—Reactor instrumentation costs are higher now than they will be in the future. Most of today's installations are one-of-a-kind. Pro-

TABLE II—No. of Instrument Manufacturers*

Power supplies..... 125	Ionization chambers..... 36
Gamma counters... 48	Pulse-height analyzers.... 32
Decade scalars..... 44	Multichannel pulse-height analyzers..... 29
Beta counters..... 39	Thickness (beta) gages.... 29

* U. S. firms only. Most firms make several kinds of instruments

totype work is expensive and the reactors are also heavily instrumented for safety and experiments.

For example, Shippingport's instrumentation and controls cost \$1.9 million: three times the \$10/kw which AIF sees as likely for large power reactors in the future. Although the instrumentation cost per reactor will drop, the greater number of reactors built will continue to keep instrument sales rising.

In nonpropulsion power reactors, industrial-type instruments such as chart recorders, amplifiers and power supplies comprise 50 or 60 percent of the total cost. Conventional instruments represent 5 to 10 percent of the ship reactor instruments.

An important part of reactor instrumentation is monitoring instruments for personal and public safety. Future power reactors will probably each require about \$100,000 of these.

POTENTIAL REACTORS—Aircraft, missile and space ship power plants are still an R&D market. They will require a new breed of radiation-tolerant instruments and automatic control.

Some experts think that there is a waiting market for 50 to 100 industrial heat and steam reactors a year. Two firms have estimated that such reactors could be built for about \$2 million and would be competitive with large boilers. One firm is ready to produce them commercially. Instruments for these would average six or seven percent of cost.

Fusion power reactors are some years behind fission reactors. This could be a rapidly expanding market for research instruments and would bring microwave equipment into the atomic instrument area to measure electron density. AEC's total outlays for development have risen from \$7 million in fiscal 1956 to an estimated \$20 million in fiscal 1957.

RADIOACTIVE ISOTOPES—Radioactive isotopes are one of the mainstays of the radiation instrument market today. Their use generates much of the nuclear instrument sales to industry, medicine and nonreactor research.

Best augury of future sales is an AEC survey which shows that by mid-1957, isotopes were saving industry \$406 million a year (Fig. 4). Savings are considered near \$1 billion a year now and economies of \$5 billion are possible for 1960.

These savings represent improved products, processes and designs, better control of thickness, density and flow of materials; or use of radioactive tracers in product quality testing and process control.

There are nearly 4,000 licensed isotope users and applicants. Many others use radioactive isotopes under general licensing. About 100 firms process and distribute isotopes. Virtually all need electronic instruments ranging from simple radiation counters to computing analyzers for laboratories.

The number of customers in industry is expected to increase from 2,000 to 3,000 in five years. Each user is expected to substantially increase his use of radioactive isotope equipment.

Cited is the use by tobacco manufacturers of some 2,700 of the 4,000 thickness gages installed. A similar trend is developing in the paper and rubber industries. Textile manufacturers are expected to turn to radioactive tracers to control the use of dyes.

Although \$30 million to \$40 million worth of gages

TABLE III—Reactor Instrumentation Costs

Type of Reactor	Total Reactor Cost (\$000)	Instrumentation (\$000)
Power.....	72,500	1,900
Test.....	3,760	500
Heat (proposed).....	1,990	180
Medical.....	3,000	175
Research.....	760	77
Training.....	100	15

TABLE IV—U.S. Reactor Business, April 1958

Type of Reactor	Operating	Building	Contracted	Total
Research and test				
—domestic.....	43	24	38	105
—export.....	7	14	4	25
Military and naval.....	5	20	13	38
Power reactors				
—domestic.....	1	5	8	14
—export.....	0	1	5	6
Power experiments and pilot plants.....	7	3	3	13

Source: *Nucleonics*

have been sold, the market for radioisotope thickness gages is believed to be only 10 to 20 percent saturated.

RADIATION PROCESSING—Firms in the chemical, petroleum, plastics and food industries are actively researching radiation processing, which will require instruments and control devices.

However, this market has been delayed in most cases. The cost of using atomic energy is higher

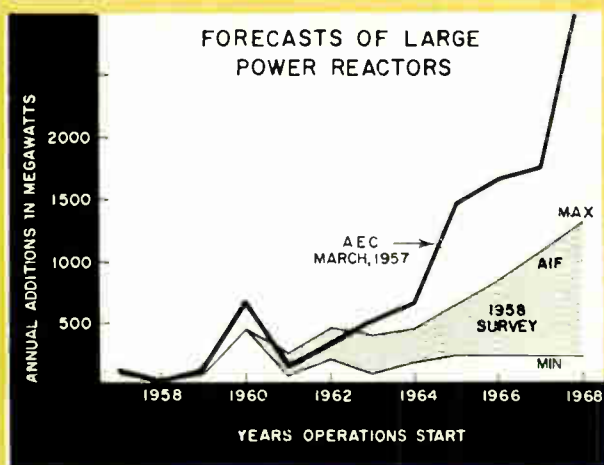


FIG 2—Future reactor construction volume is unsettled. Here are two forecasts

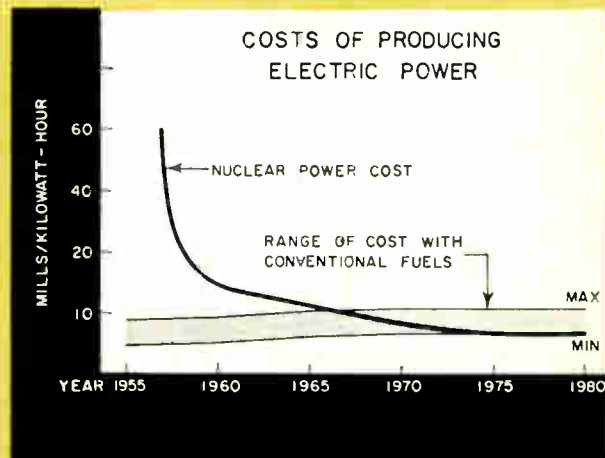


FIG 3—Nuclear engineers hope to make atomic power competitive with conventional power in next decade

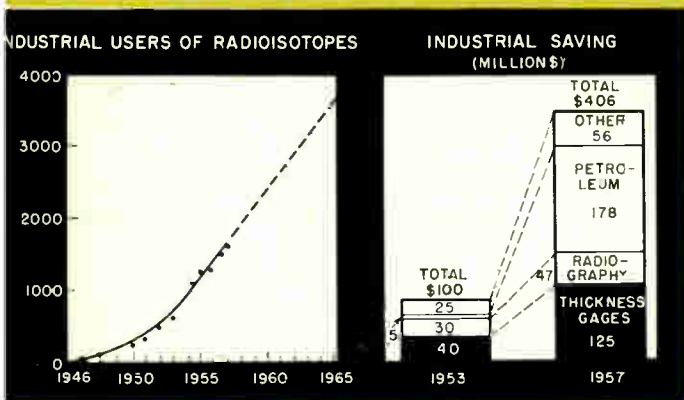


FIG 4—Industrial savings through use of radioactive isotopes indicate growing importance of the market for radiation instruments

than the cost of using heat, pressure and catalysts.

Two possible solutions are:

- The development of new products by chemical processes which are triggered by radiation.
- Cheaper sources, such as fission wastes now discarded and spent reactor fuel elements.

AEC last month cut the price of five long-lived isotopes to an average one-tenth of their former price. This year, AEC will spend \$5 million to spur the industrial uses of isotopes.

The Commission reports that only 0.6 percent of industry uses isotopes while eight to 10 percent could profitably put radiation to work.

MEDICAL—An estimated 900,000 to one million persons have been treated or diagnosed with radioactive isotopes, creating a \$4-million-a-year instrument market. Potential sales of cancer therapy units for the next 10 years is 1,500 to 2,000 machines.

Upcoming requirements for medical instruments include equipment able to sum up and sort out varying radiation fields. Diagnostic tracer equipment must accurately measure weak radiation.

MINING—Sales of portable radiation survey units enjoyed a greater market during the uranium prospecting boom of a few years ago. Scintillation count-

TABLE V—Sales of Reactor Instruments

Type of Reactor	1961		1964		1968	
	max (\$000)	min (\$000)	max (\$000)	min (\$000)	max (\$000)	min (\$000)
Naval, military (except aircraft)	5,200	5,000	7,400	6,300	10,900	7,600
Large, power	1,600	600	2,800	1,100	6,400	1,600
Small reactors	700	600	2,800	1,100	1,700	300

ers used in the oil fields and for mineral surveys and instrumentation for uranium refining mills will continue to provide a \$3 million to \$5 million market.

WEAPONS—Nuclear instrument purchases by military agencies, other than reactor instruments, reportedly peaked at about \$10 million a year during development programs in the early 1950's. Procurement is now believed about half of that.

Each series of atomic weapons tests consumes about \$3 million to \$5 million in instrumentation.

CIVIL DEFENSE—In fiscal year 1957, the Federal Civil Defense Agency ordered nearly \$4 million in radiation instruments, including \$2.8 million of radiation survey meters. While order-filling carries this business over, there are no new funds for fiscal 1958 and no plans as yet for 1959.

EDUCATION—A half-dozen firms sell small training reactors, two firms sell reactor simulators. Each requires at least \$15,000 in instruments. Another firm sells a subcritical lab system for \$30,000.

Some training reactors can produce limited quantities of short-lived isotopes, a feature that is expected to appeal to medical institutions as well as schools.

AEC grants during the past two years have bought almost \$7 million in educational laboratory equipment, including 17 training reactors and 15 subcritical assemblies. New grants are scheduled.

EXPORTS—Export sales of radiation instruments are now about 10 percent of the domestic market, compared with five percent in 1954. Current opinion is that we will hold the 10 percent level, or better it, for some years.

The number of foreign countries with atomic agencies has increased from 19 to 52 in five years. Most of the overseas programs are too small to support a home-based nuclear instrument industry. However, the nations with technical industries are shrinking the United States' headstart in atomic energy. The tendency is for U. S. firms to form joint enterprises with overseas firms.

DESIGN TRENDS—Instruments are beginning to borrow computer techniques. In the past two or three years, multichannel pulse-height analyzers, costing \$3,000 to \$40,000, have gained about 15 percent of the laboratory instrument market.

Automatic reactor controls, other than safety circuits, probably won't be widely used until power reactors are in everyday use. Computers are used, however, in design studies.

Instrument duplication and circuit redundancy is favored for safety and to avoid reactor shutdowns. This policy, one of the reasons reactor instrumentation is costly, is expected to continue for some years.

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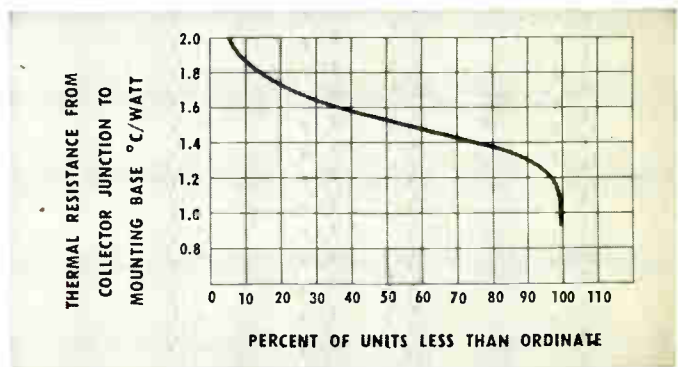
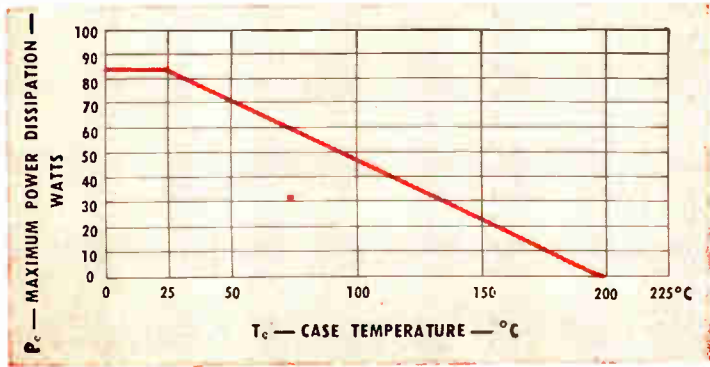
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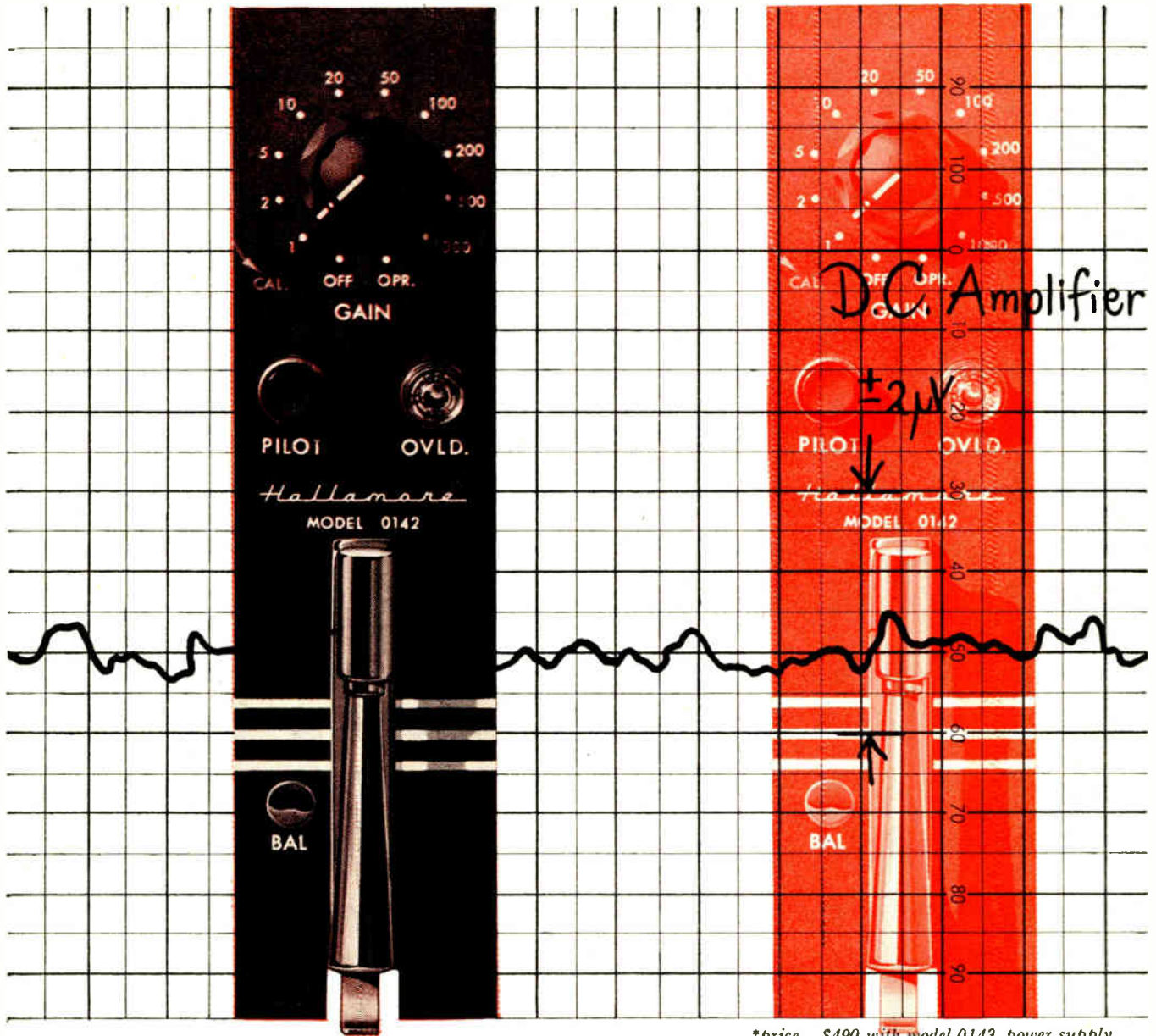
Test Conditions	2N389		2N424		units
	min	max	min	max	
BV _{CEX}	60	—	80	—	volts
BV _{EBO}	-10	—	-10	—	volts
I _B	10 mA	—	—	—	mA
R _{CS}	—	5	—	10	ohms
V _{BE}	—	8	—	—	volts
V _{BE}	—	—	—	8	volts
h _{FE}	10	60	—	—	—
h _{FE}	—	—	10	60	—
P _C	—	85	—	85	watts
P _C	—	45	—	45	watts
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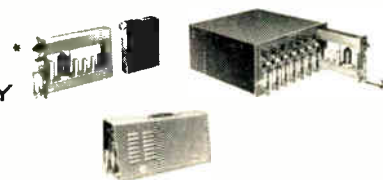


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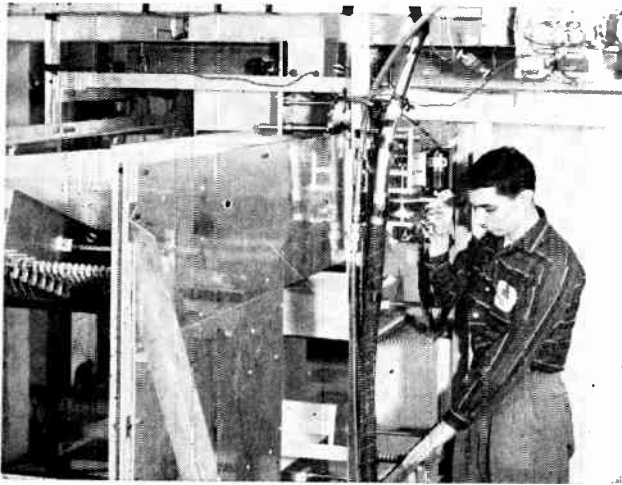
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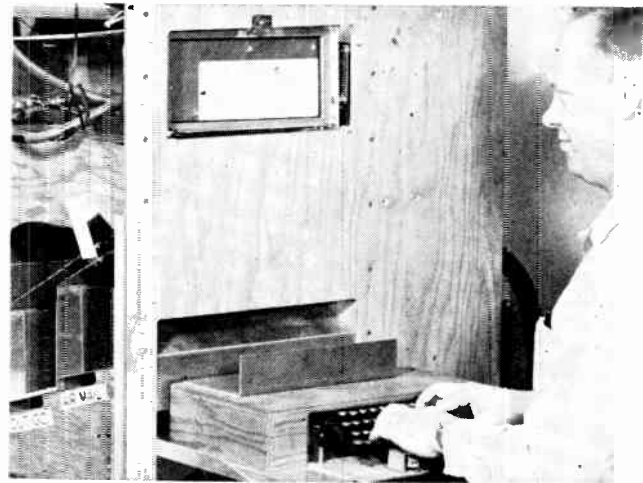


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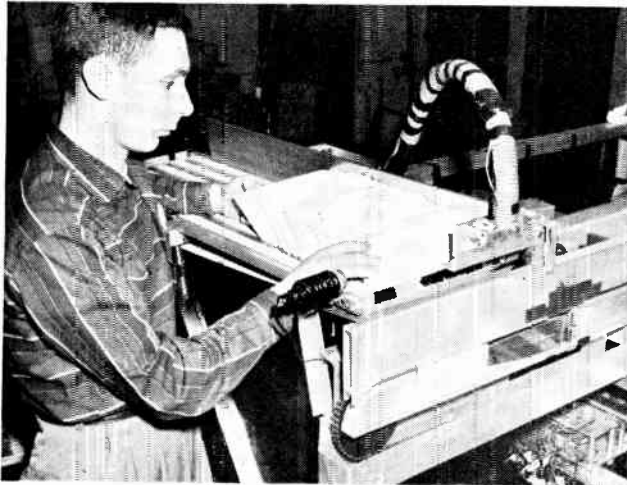




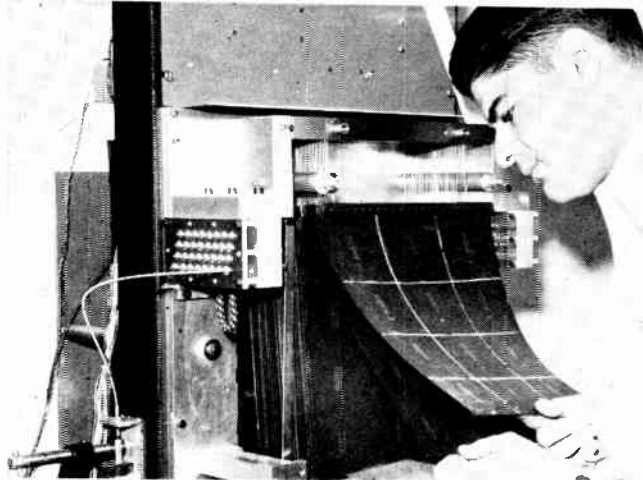
Pockets carry letters to bins



Operator prints address code on letter



Letters enter code reader



Directory puts out signals, as . . .

Post Office Tries Sorter

WASHINGTON—Post Office Department is trying out a 36,000-letter-an-hour mail sorter. An automatic version of the machine uses an electronic-mechanical function table as a directory.

Designed by Rabinow Engineering Co. under a contract arranged by National Bureau of Standards, the prototype cost \$500,000. Production models, one of which is now being built, will cost less.

Its electronics are elementary compared with the sorter developed in Canadian Post Office. That one is controlled by a magnetic memory, computer and other devices. The new machine avoids some circuitry by having the letters carry sorting directions as a printed binary code.

Basically, the U. S. sorter is a series of pockets on a conveyor. Each pocket drops its letter into a bin when 12 movable code wheels on the pocket mate with depressions in the proper bin.

The position of the code wheels is set by signals from the directory, which converts the 64-bit letter

code into a 12-bit output with phototubes.

The directory is a stack of 64 thin steel plates, each about a foot square and etched with 40,000 holes. Some holes are blocked and others cleared to provide the address conversion pattern for each dot of the 64-bit binary code.

The plates are suspended so they can be moved in one-tenth sec by an electromagnet. A plate moves right if its binary dot is present on the letter. The plates line up differently for each address.

A light shines through the stack. Each of the 12 phototubes behind the stack sees one-twelfth of the stack. The pattern of light reaching the phototubes represents a specific letter bin.

This directory, with 1.5-million-bit capacity, is big enough for a city of 100,000 to 200,000 persons. Larger directories can be made in a similar way.

The sorting system can also be directed by operators who read the code on a letter and set it into a keyboard. Some 10 to 12 operators would be required to handle 36,000 letters an hour.



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- ▶ Over 20,000 cable components are now in service, with no malfunctions due to cabling.
- ▶ Every test or launch facility is being completed on or ahead of schedule.
- ▶ Costs are far less than predicted.
- ▶ Superior design and layout, and simplified operational characteristics, have marked each facility.

So that this experience may be used to full advantage on each Army missile program, an early visit by PAPI with site or facility is recommended.

PRODUCTS:

PAPI products include neoprene and plastic jacketed cables of superior design, with special purpose cable for high temperature or under water use.

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PAPI offers the following services in the cabling and activation of missile test and launch facilities: *Systems Design*—working from schematics, PAPI design engineers will determine every conductor that is needed to link block houses, control centers, terminal rooms, and stands or platforms. Cables are designed to effectively accommodate these conductors, and include break outs, connectors, and accessories. *Systems Fabrication*—cable assemblies leave our plant in ready-to-install condition, with rigorous quality control procedures governing every step of the fabrication process. *Systems Installation*—PAPI's experienced personnel and proven methods are utilized in field installation of all inter-unit cabling, instrumentation, recorders, transducers, controls, consoles, and accessories. *Systems Checkout*—PAPI specialists checkout all circuits for conformity to specifications, confirm the operation of each instrumentation system, and validate the fire and launch control functions. *Systems Documentation*—working drawings of the entire installation are supplied in approved form.

CONCLUSION:

PAPI's engineering staff includes men with outstanding experience in every pertinent phase of the missile business. It is no accident, therefore, that we are the "take charge" sort of people who can take full responsibility for providing the services described in this message. We hope that you will accept this invitation and plan to utilize PAPI's great practical knowledge and experience in Army missile facility cabling and activation.

Arthur P. Jacob
ARTHUR P. JACOB, EXECUTIVE VICE PRESIDENT

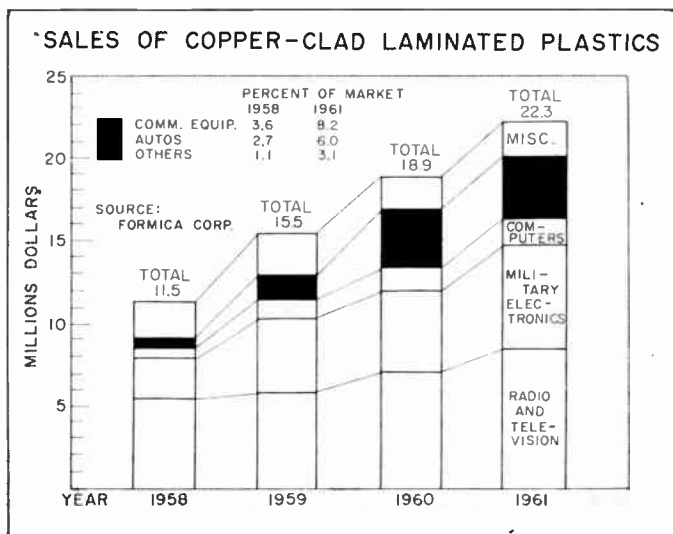


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Etched Wiring Grows

Survey of copper-clad laminated plastics sales sees new markets in other industries

COPPER-CLAD laminated plastics, base material for etched printed wiring, may rack up \$11.5 million sales in 1958 and over \$22 million in 1961. Sales in 1957 were about \$7.5 million.

The estimates are part of a market survey prepared for Formica Corp. covering present and potential printed wiring applications in electronics and other industries.

An even more rapid growth is expected after 1961. Changeovers from conventional to printed wiring are still being developed in many cases.

Radio and tv are moving toward more extensive use of printed wiring. Color tv, hi-fi tuners, amplifiers and assembly kits, built-in intercommunications systems for new homes are all market builders.

The crest of military applications of printed wiring is not expected until after 1961. Much of today's military electronic equipment uses printed wiring and more is still in development. Missile guidance computers are given as an example.

Plug-in circuits, to cut maintenance costs, are fostering use of

printed wiring in communications equipment. Dial telephones, central and private switchboards, toll-charge recorders and carrier equipment provide potential printed-circuit markets, with significant growth expected after 1961.

Computers under development will make use of printed-circuit boards.

Use of printed wiring is coming into extensive use in electronic instruments. Computer-type controls for vehicular and railroad traffic controllers, automatic elevator systems, heating and air-conditioning could spur the quantity of printed wiring used.

Hearing-aid manufacturers were large users of printed wiring in 1957. These firms see subminiature hearing aids, which use printed wiring, building up in sales volume.

Many dictating machine manufacturers are making some use of printed wiring. It has helped in the development of compact, portable machines and remote dictating machines.

Printed instrument panels are expected to be in general use in autos in 1960. The boards have

been introduced also in bus and truck voltage regulators and are planned for use in high-frequency ignition systems.

Domestic electric-stove control panels, which are becoming increasingly complex, will probably use printed wiring. Air-conditioning firms contemplate using printed wiring in remote-control thermostats.

Firm Develops New Silicones

MIDLAND, MICH.—JELLY-LIKE dielectric filling compound, a circuit-board adhesive which forms a built-in shock mount, self-adhering tape and a conductive plastic—all are being made of silicones with heat resistance of 200 C.

These examples of how Silastic silicones are now being adapted to new electronic requirements were shown recently at the Dow Corning Co., Midland, Mich. The firm says that it expects military emphasis on higher equipment operating temperatures to spread silicone uses.

The filling compound is intended for applications where liquid dielectrics are used. It goes into the component as a viscous liquid and may be jelled with heat and a catalyst. It has the electrical characteristics of silicone, is transparent and flows freely enough for use as an impregnant.

The circuit-board adhesive bonds copper foil to silicone glass laminate at temperatures to 200 C. The silicone adhesive acts like a shock mount and forms a barrier to humidity.

The laminate is radiation resistant and will take extended aging at temperatures up to 250 C. Its low dielectric constant reduces capacitance between wires.

The self-adhering tape can be used as jacketing on resistors, toroid coils and other odd-shaped components when moisture resistance is a prime need. Low loss suits it to high-frequency applications.

The conductive plastic has a conductivity of 0.1 mho per centimeter. Conductivity can be varied by blending.

Parts Sellers Foresee Rise

CHICAGO—MANUFACTURERS at the big (12,000 attendance) 1958 Electronic Parts Distributors Show here generally expect to wind up 1958 with a "big" six months of sales. The 1957 tapering off has, they report, carried over into the first six months of 1958, but the picture today shows:

Industrial distributor business is considered increasing in volume and in breadth of products. Prices are holding up "remarkably," although some extra discounts are being offered. Public buying is boosting sales of replacement items in the entertainment field.

Manufacturers see a marked trend for distributors to sell the public as well as servicemen. Frank Apple, assistant to the president at Centralab, says this "hasn't hurt the overall business toward the serviceman, either." Distributors, he adds, are trying to avoid duplication of product lines.

Manufacturers' inventories are said to be on the low side. Richard Hall, general sales manager of Amphinol Electronics, points out that "a few years ago there was a certain number of standard lines with one long production run. Now there are more complex items with shorter production runs."

Miners Sponsor Research Study

EIGHT MAJOR mining firms are sponsoring a research program to develop uses and understanding of selenium and tellurium, by-products of copper and lead refining.

The study will be made by Battelle Memorial Institute, which has done extensive work on the semiconductor properties of the two elements. Investigations will cover applications in semiconductors, electrochemical solutions, metals and organic chemicals.

Both are rectifier materials. In addition, both have promising uses in compound semiconductors. Fields of interest include electronic refrigeration, solar batteries, thermoelectrics and infrared.



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RADIO SHOW

**EARLS COURT
LONDON**

*August 26 –
September 6 1958*

Organised by
THE RADIO INDUSTRY COUNCIL
59 RUSSELL SQUARE, LONDON, W.C.1, ENGLAND
Telegrams: OIARION WESTCENT LONDON.



British, French Disclose Three-D Radar

THREE-D RADAR system of "almost fabulous performance" has recently been disclosed by Britain's First Sea Lord Earl Mountbatten. He said the radar serves as a general long-range warning system and gives accurate data on the ranges, bearing and height of enemy aircraft. And in Brussels, a "three-D" civilian adaptation of a military system developed by French firm Societe Nouvelle d'Electronique—Radio Industrie is being shown at the World's Fair. One has been ordered for Brussels air traffic control center.

SILICON CARBIDE RECTIFIER may be marketed in 12 to 18 months, says one industry source. Device would operate at 500 to 600 C compared to silicon's top of about 200 C and germanium's top of about 125 C. First units will probably be very expensive and limited in their application, but continuing development work may eventually produce devices with wider application.

MICROWAVE DIODES and power rectifiers made of gallium arsenide have been developed experimentally by RCA. Rectifier, says the company, operates effectively at temperatures above 286 C. Advances are also reported in the use of gallium arsenide in transistors. Object is to

combine h-f advantages of germanium with high-temperature advantages of silicon in one transistor. New gallium arsenide diode has operated at 6,000 mc and shows promise as an ultra-high-speed switch for electronic computers requiring speed measured in billionths of a second.

RUSSIAN BRAIN RESEARCHERS have devised an electronic helmet with 50 electrodes that is put on a patient's head. An equal number of luminous points appear on a tv-type screen. When the patient sits quietly in a dark room, scientists report, the brightness of all the blips is about equal. But if the patient is asked to divide 1,000 by four, some points go out, and others become brighter or blink. Soviet scientists say they have also devised a magnifying plate with 50 electrodes only a few sq mm in size. This is applied to the patient's head for detailed study of a given sector of the cerebral cortex. Thus, they say, electrical activity of a small sector of the brain is magnified and projected on the screen.

ROCKET TO VENUS will be launched by the USSR between 1962 and 1967, according to a Hungarian publication which quotes Soviet scientist Khlebtsevich. Plans reportedly call for a five-stage rocket with a takeoff weight of 250 tons. No other details available.

TECHNICAL DIGEST

- **Transparent metal film** can be placed on glass at room temperature, to give conductive coating through which heating current can be sent to prevent fogging and icing of aircraft and environmental chamber windows. Indium and tin are evaporated separately from concentric pools for 45 min in oxygen atmosphere while glass is rotated alongside. Subsequent baking at 200 C for one to 10 hours converts deposit to indium-tin oxide and develops maximum transparency in Battelle technique.

- **Fallout dose rate indicator** using photoconductive cadmium sulfide crystal permits miniaturized packaging yet gives ruggedness and high sensitivity. High-purity crystals are grown by placing CdS powder in sealed quartz tube filled with H₂S and heating to 1,000 C.

After slabbing and dicing, electrodes are applied by ultrasonically vibrating indium on desired crystal surfaces at 200 C. To overcome memory for past gamma irradiation, Victoreen unit for Signal Corps has built-in radium source to keep crystal in semi-activated state.

- **Solid-state power switch** action is obtained in new Westinghouse Dynistor diode by applying high-energy reverse pulses to increase inverse voltage past breakdown. Unstable negative-resistance region in characteristic curve makes on-off switching possible. This element performs some functions of sensitive relays in control circuits.

- **Digital integrator** developed by Eastman Kodak shows tristimulus values for unknown color to five decimal places in 167-sec

running time of GE recording spectrophotometer to which it is connected. Berkeley magnetic tachometer units convert analog readings of photometer to pulses for starting and stopping 9-ke pulses that drive the three counters. Punched tape driven in synchronism with wavelength cam feeds pulses in sequence to counters.

- **Ring-shaped probe** dropped over glass envelope of tube provides sufficient electrostatic pickup in r-f and i-f circuits for driving Kingston absorption analyzer, for showing circuit waveforms on cathode-ray screen. Semicircular version of probe permits waveform pickup of separate parts of twin-triodes such as 6SN7. Metal inner surface of phenolic probe ring goes to analyzer, while metal outer surface is grounded.

Tape Controls Coordinate Table

PROGRAMMED machine-tool control gets a push by a recently announced automatic coordinate-setting system. The equipment, developed by Airmec, Ltd., England, is said to provide programmed control of leadscrews of a coordinate table with a resetting accuracy of 0.0003 in. on a 100-in. table.

The table position may be set up manually or automatically by means of punched tape. The tape contains coordinate information for up to 300 operations. Information can be recorded for tool selection, a choice of ten tools being available for every recorded coordinate setting.

The positioner unit measures the total angular rotation of the leadscrew by means of a coded disk. System accuracy is achieved by ensuring that final approach is from the same direction and cumulative errors are corrected by a cam in the positioner.

The positioner measures absolute angle of rotation of the lead-screw and not the change of angle. Consequently, the table automatically repositions itself without further rezeroing.

When using punched tape as the input media, each digit in the coordinate is represented by a column having ten hole positions. A single hole is punched in the position representing the digit required. Hence each coordinate requires five punched holes.

Tool selection is provided by another column. A single hole in one of ten positions in the column records the tool required for the particular operation.

On a coordinate table having a

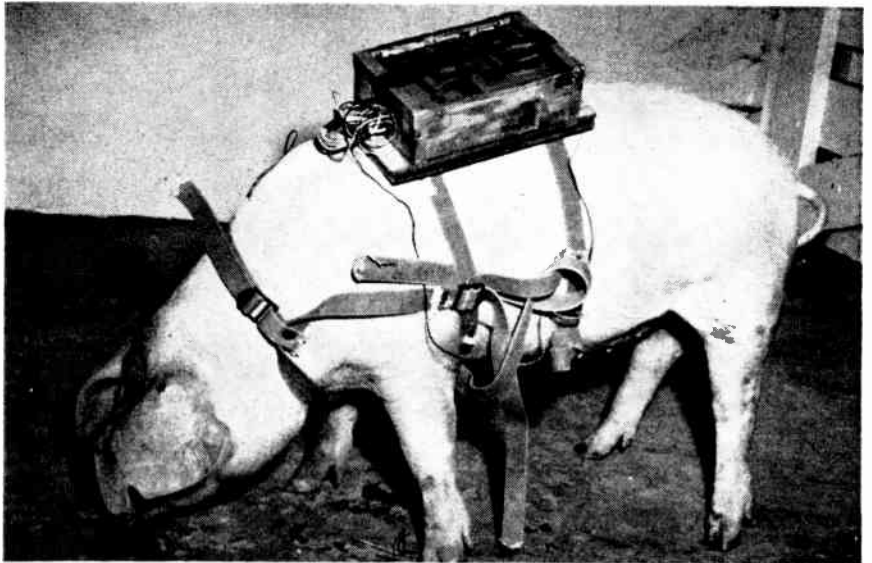
movement not exceeding 100 inches, the digits represent tens of inches, inches, tenths, hundredths and the final digit steps of 0.002 inch. Scaling factors can be employed to provide greater total traverse or less traverse with smaller setting intervals. However, this complicates planning the tape, since the scale must be taken into account when punching the coordinate information.

The setting accuracy of the system depends upon the degree of freedom in the slides, the inertia of the slides and the final approach speed. To obtain maximum accuracy, the motor speed is reduced by means of a gear box for the

final approach. In addition, the leadscrew drive is via two electromagnetic clutches that provide fast mechanical connection and disconnection to the required speed shaft, thus removing motor inertia from the system as soon as the correct position is reached. In this way, a setting accuracy of the order of one degree may easily be achieved, which on a 100-inch table represents 0.0003 inch.

When operating on punched tape, a signal starts the machining operation when the table has reached the correct position. At the same time, the control circuits are disconnected to ensure that no further table movement can take place. A signal for table clamp operation is also available.

Electronics Rides 'Piggyback'



Electrocardiograph telemetering system has been developed by Webb, Campbell and Hartscock of the Agricultural Engineering Div. of the Dept. of Agriculture. It measures heart beat of animals to determine effect of noise stress. Nearby receiver supplies data to recorder. Telemetering technique permits animal to stay in normal habitat

MEETINGS AHEAD

May 19-21: Electronic Parts Distributors Show, Conrad Hilton Hotel, Chicago.

May 19-23: International Convention on Microwave Valves, Institute of Electrical Engineers, contact secretary, Savoy Place, London.

May 21-23: Energy Instrumentation Conf., Automatic Controls Applied

to Gas, Electric and Steam Systems, ISA, New York City.

May 27-28: Second EIA Conf. on Maintainability of Electronic Equip., Univ. of Penn., Phila.

June 2-4: National Telemetering Conference, AIEE, ISA, ARS, Lord Baltimore Hotel, Baltimore, Md.

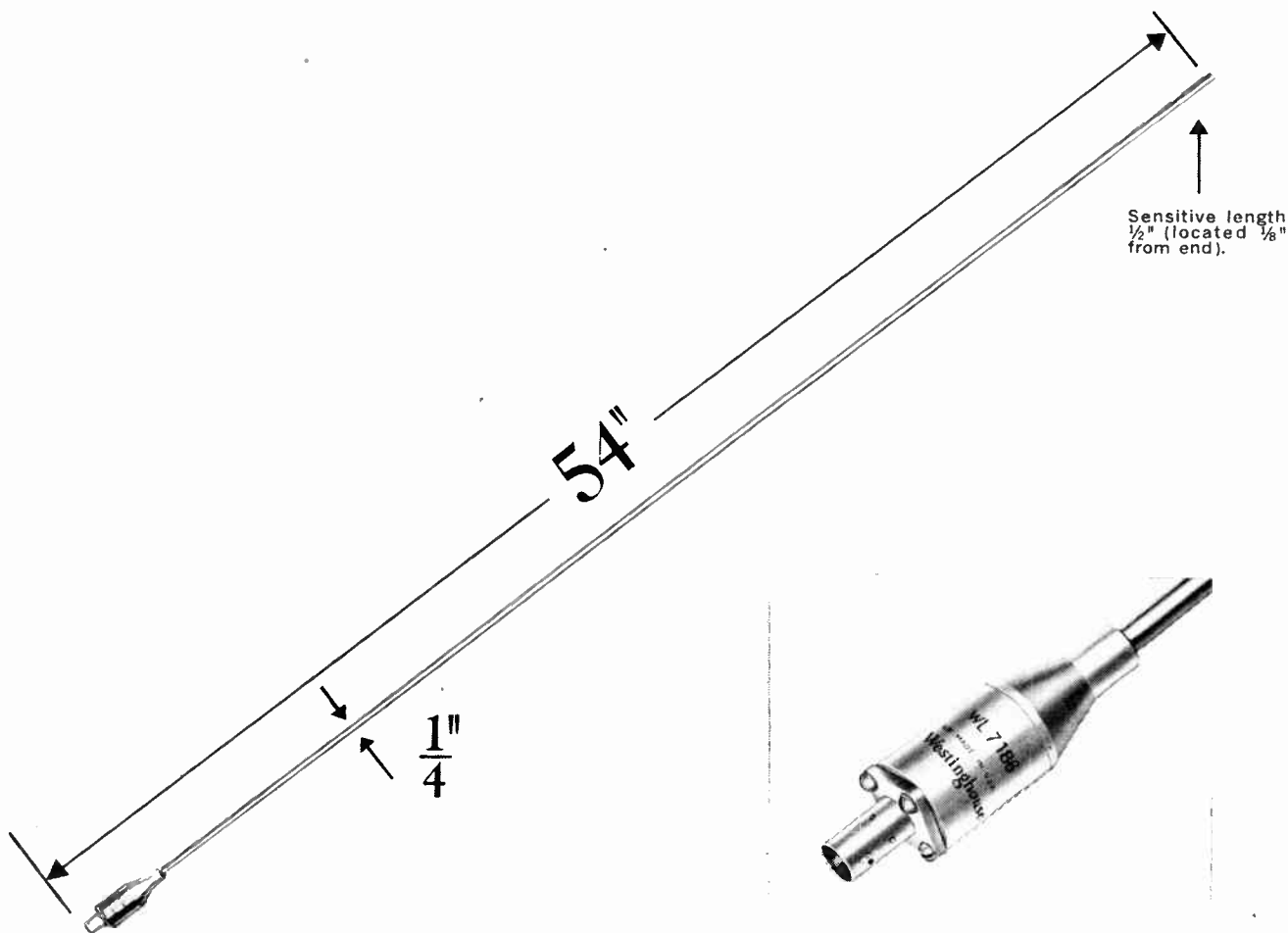
June 4-6: Armed Forces Communications and Electronic Assoc., Exhibit, Hotel Sheraton Park, Wash., D. C.

June 5-6: Second National Conference on Production Techniques, IRE, PGPT, Hotel New Yorker, New York City.

June 16-18: Military Electronics Second National Convention, Sheraton Park Hotel, Washington, D. C.

Aug. 19-21: Western Electronic Show and Convention, WESCON, IRE, WCEMA, Pan Pacific Auditorium & Ambassador Hotel, Los Angeles, Calif.

Versatile New Westinghouse Miniature Fission Counter!



NEW WL-7186 OPERATES IN ANY POSITION ... AT TEMPERATURES UP TO 125° C!

The rugged new WL-7186 is ideal for thermal neutron flux mapping, for taking low power reactor data, or for control channels. It operates efficiently in any position . . . at temperatures up to 125° C . . . and since the chamber and integral cable are of stainless steel, it can be immersed in water.

The sensitive material is highly enriched U-235. Sensitive length is $\frac{1}{2}$ " and is located $\frac{1}{8}$ " from end.

Characteristics of the WL-7186 are:

Sensitivity: .01 cps/nv
Operating voltage: 250-400 v
Output pulse: 10^{-4} volts

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Industry to Get Space Work

Outside research sources will do the civilian space agency's electronics work under contract

THE NATIONAL Aeronautics and Space Agency—recently recommended by President Eisenhower to grow out of the National Advisory Committee for Aeronautics—will farm out, on a contract basis, research studies in the fields of electronics, guidance and physiology.

Budget increase to take care of NASA during fiscal year 1959 is expected to be \$100 million over and beyond NACA's current \$100 million. Increase for fiscal year 1962 will be at least \$300 million.

Reason given by NACA director Hugh L. Dryden for subcontracting electronics and guidance work: "Over the years, NACA has concentrated for the most part on flight problems in the fields of aerodynamics, propulsion and structures and structural materials."

Although it would be possible for NASA to estab-

lish new research centers, Dryden said, doing so would be expensive as well as a personnel drain on industry and other government sources.

Of the three top priority space problems the nation faces, NASA will handle satellites and space craft to probe the secrets of the solar system. (ELECTRONICS, May 9, p 7). ARPA will manage military reconnaissance satellite and space craft projects.

Space projects useful to both military operations and civilian science will be reviewed jointly by NASA and ARPA to determine which agency should get the assignment or whether both should work on it together.

About 200 satellite and space craft projects have been proposed by American industry—mostly by the aircraft industry—to date, Dryden says.

Dryden predicts "the construction of satellite observatories within a few years that will circle the earth at altitudes of several thousand miles and transmit data from interplanetary space." Later: "lunar circumnavigation."

MILITARY ELECTRONICS

- Five new telemetry ships are now part of the Air Force Missile Test Range that begins at Cape Canaveral, Fla., and ends some 5,000 mi away at Ascension Island.

Known as CIMAVI's, the new ships record impact data and chart the flight of the long-range missiles between St. Lucia Island and the 3,000-mi gap to Ascension. They supplement the fleet of six FS (Freight Supply) vessels which started servicing the tracking range about a year ago (ELECTRONICS, Aug. 20, 1957, p 40).

Both fleets of tracking ships are operated by Pan American's Guided Missiles Range Division as part of its contract with ARDC in establishing, equipping and operating tracking bases along the 5,000-mi missile route.

- Several Titan ICBM's have been built and are currently set up in new 13-story vertical test facilities near Denver. Largest of the

lot is the two-stage, 6,300-mi-range Titan, said to be scheduled for firing at Cape Canaveral this year. The missile also has been proposed, with added stages, for flights to and around the moon.

- Development of a "Tactical Army Operations Center" (TAOC) is currently underway at Aeronutronic Systems, a subsidiary of Ford Motor Co.

To be mounted in vans, TAOC will give an army commander a refined means of selecting targets, determining priorities and coordinating the weapons, electronic warfare, tactical aircraft and combat surveillance elements in his command.

A computer complex, data processing and visual display equipment form the heart of TAOC. Army Signal Research and Development Labs will administer the \$6.85 million contract. The project is expected to take four years.

CONTRACTS AWARDED

Hazeltine gets \$946,215 contract with the Army Signal Supply Agency for 12 ground transportable radar detection sets, AN/TPS-25.

Motorola wins a \$918,053 contract with Army Signal Supply Agency for 740 ground vehicular radio communication sets, AN/VRC-6.

GE will supply Air Materiel Command with automatic flight control system, AF/A42G, initial spares, spare parts and data for the F-105 under \$3,617,800 contract.

Kearfott will sell vertical control components for the AN/AJN-3 compass system to be used in the F-101 Air Materiel Command under a \$180,120 contract.

Arma div. of American Bosch Arma will supply ANIC with components of the tv fire control system to be

used in the B-52 under a \$885,000 contract.

Servo Corp. of America gets a \$326,090 contract with AMC for airborne infrared receiving sets, AN/AAR-12.

Minneapolis-Honeywell sells an armament control system to AMC under a \$387,335 contract.

Andrea Radio sells interphone control systems including panel for use in the KC-135, B-52G and F-100F to AMC under \$1,156,890 contract.

Collins gets \$394,095 contract with AMC for h-f radio communication sets for the C-130A.

RCA sells a microwave system for Spain to Rome AF Depot for \$1,274,148.

Roanwell sells 13,690 microphone and earphone headsets to Rome AF Depot under \$510,844 contract.

Bendix International sells telemetry equipment to Navy Purchasing Office, Washington under a \$236,765 contract.

Boeing gets a \$202,866,300 production contract with Air Materiel Command for 130 more KC-135A tankers, bringing the total now on order to 345. Production, expected to last through 1959, will reach a peak of 15 a month this year.

Fairechild Engine and Airplane sells C-123B cargo planes to AMC under a \$1,448,969 contract.

Martin gets a \$10,192,000 contract with AMC for production of the TM-76A Mace surface-to-surface Air Force missile, data and spares. Inertial guidance is produced by AC Spark Plug.

Burrughs is awarded a \$10,831,000 contract to produce electronic equipment for Army Signal Corps. Army spokesman says equipment is to transmit secret and confidential messages.

FREE ANALYSIS OF YOUR DIFFICULT MACHINING PROBLEMS

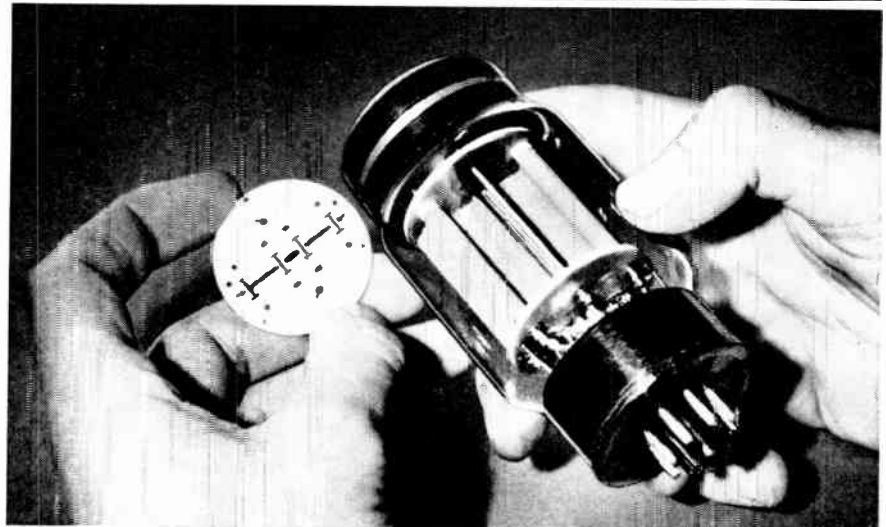


Photo courtesy C-MAR Corp., Manasquan, N. J.

23 HOLES AND SLOTS DRILLED IN CERAMIC AT ONCE!

PROBLEM: drill 23 holes and slots in a mica wafer for radar tube spacers, then repeat the process time and again with exact spacing and tolerance. **SOLUTION:** A Raytheon Impact Grinding Analyst recommended using aluminum oxide ceramic spacers in place of mica. He suggested machining the ceramic by building a jig template to hold the 23 tool bits in precise location and silver brazing them all to a Raytheon Impact Grinder tool holder. **RESULT:** the successful production of ceramic spacers with precise accuracy. The ceramic rather than the usual mica provides quiet tube performance, doubles tube life.

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Whatever your difficult cutting, slicing, drilling, engraving or shaping problems—in hard or brittle materials—a Raytheon Impact Grinding Analyst can help you find the answer—without cost or obligation. For full details, mail the coupon below ... today!



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WALTHAM 54, MASSACHUSETTS

- Please send me literature on Raytheon Impact Grinders.
- Please have a Raytheon Impact Grinding Analyst contact me.

My problem is: (describe metals, or non-metals involved, tolerances, etc.)

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COMPANY _____

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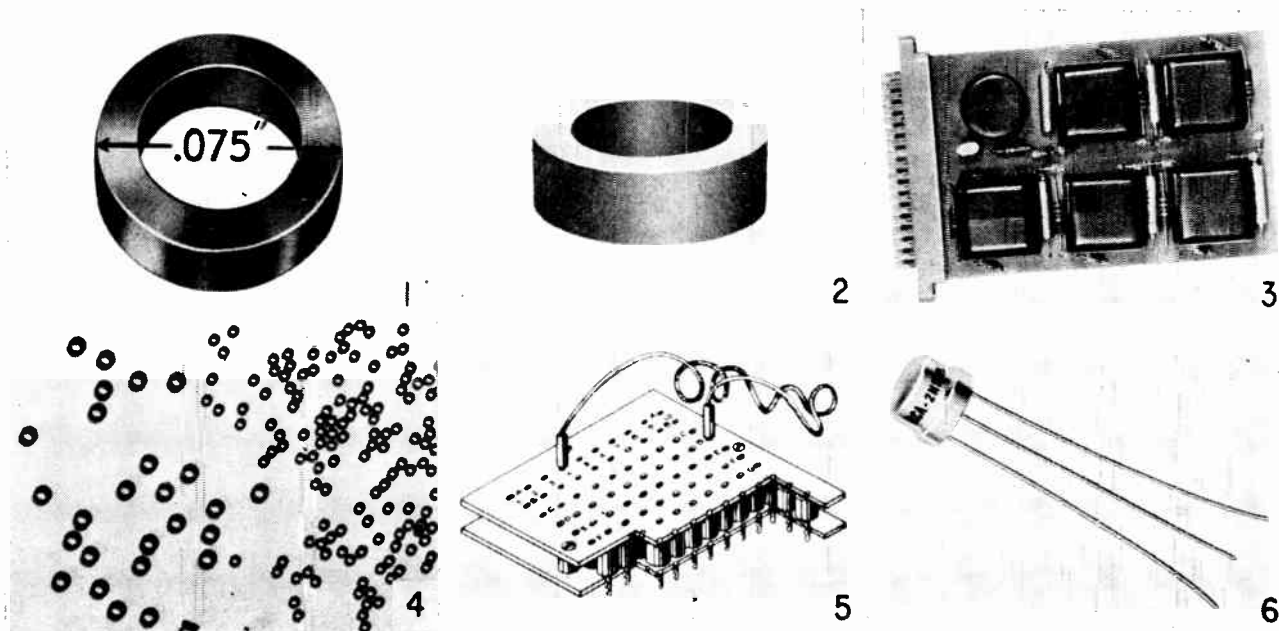
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One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

Computer Parts Flourish



(1) Ferroxcube Corp. of America, memory core. (2) Thermo Materials, Inc., ferrite cores. (3) Magnetics Research Co., shift register. (4) General Ceramics Corp., memory cores. (5) Vector Electronics Co., computer patchboard. (6) RCA, switching-circuit transistors

COMPUTER designers and control engineers are faced with an increasing complexity of circuitry in military and commercial systems. Manufacturers are offering more compact components to fit those needs.

Ferroxcube Corp. of America, 50 E. Bridge St., Saugerties, N. Y., (50), has the M3 memory core designed for transistorized memory circuits. Switching time is $2 \mu\text{sec}$ with a current of 450 ma at 40 C.

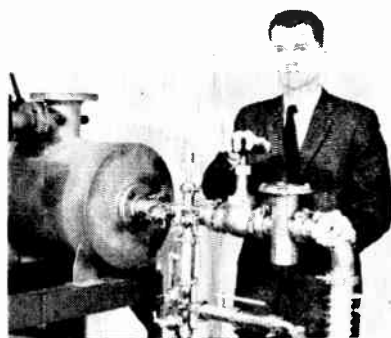
Now available from Thermo Materials, Inc., 4040 Campbell Ave., Menlo Park, Calif., (51), are ferrite cores designed for logic and switching circuits controlling flow of information in and out of memory systems. Switching time is about $1 \mu\text{sec}$ at about a $0.3 \mu\text{sec}$ rise time.

Magnetics Research Co., Inc., 255 Grove St., White Plains, N. Y., (52), produces a 5-bit magnetic shift register. Timing and driving is accomplished by a single transistor mounted on the p-c board. Output voltages are trapezoidal in shape with a minimum $5\text{-}\mu\text{sec}$ flat top.

A line of ferrite magnetic memory cores for transistorized memories is announced by General Ceramics Corp., Keasbey, N. J., (53). Switching time is less than $1 \mu\text{sec}$ with 550 ma full drive. Dimensions are 0.050 in. o-d, 0.030 in. i-d and 0.015 in. in height, all with a tolerance of ± 0.002 in.

Vector Electronic Co., 1100 Flower St., Glendale 1, Calif., (54), presents a line of computer patchboards that provide a simple answer to the need for multiconnection single conductor patching. They are useful for test panels and computers where preprogramming is not a necessity.

Three new junction transistors of the germanium *pn-p* alloy types designed for use in high-current switching circuits of military and industrial computers and in other on-off control circuits are presented by Radio Corp. of America, Somerville, N. J., (55).



Pumping System building block type

NRC EQUIPMENT CORP., 160 Charlemont St., Newton Highlands 61, Mass., announces an integrated line of high vacuum components equipped with mating quick-connect flanges. The 3350 series building block pumping system permits operation down to 10^{-7} mm Hg, and should find application in pilot plants and small production operations as well as in laboratories. Among its uses are semiconductor research and manufacture, development and small scale manufacture of precision capacitors, resistors and other electronic products. Circle 56 on Reader Service Card.

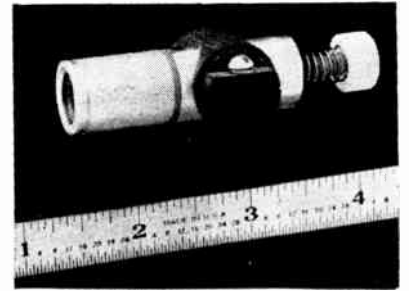
(CONTINUED ON PAGE 40)

For more information use **READER SERVICE Card**

Inertia Switch miniature, rugged

INERTIA SWITCH Division of Safe Lighting, Inc., 527 Lexington Ave., New York 17, N. Y. This miniature, rugged inertia switch operates on a new principle using only one moving part. A precision ground steel ball normally rests on an inverted cone in the brass switch body. The hollow body below the

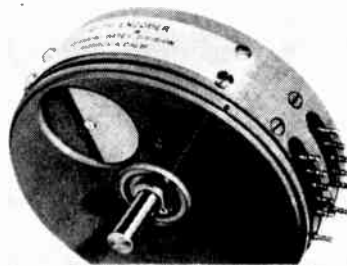
cone is threaded, permitting the insertion of an Alnico magnet which is mounted on a vibration-proof screw. Strength of the magnetic field holding the ball in the center of the case can be precisely adjusted over a wide range of G levels by screw adjustment of the distance between the magnet face and the apex of the cone. When acceleration or shock reaches a sufficient level the ball rolls up, contacts the



cap, closing the electrical circuit. Circle 57 on Reader Service Card.

Shaft Encoder multiposition unit

DATEX DIVISION of G. M. Giannini & Co., Inc., 1307 S. Myrtle Ave., Monrovia, Calif. The C-700 series shaft encoder line features compact, rugged units with up to 1,024 positions in one revolution of the input

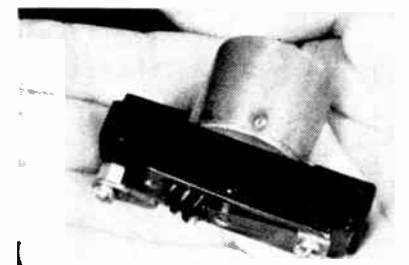


shaft. Accuracy of the C-711 series is better than \pm one bit and the transition points of each bit are held to within \pm 0.05 deg. Torque is less than 0.4 in.-oz and inertia is less than 150 gm-cm². Dimensions are 3 in. in diameter by 1.000 in. in depth. Circle 58 on Reader Service Card.

SPST Switch omnidirectional

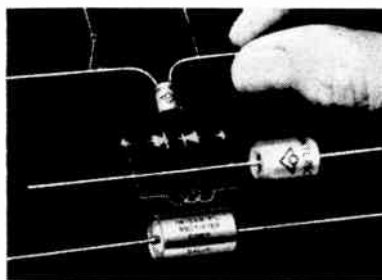
THE W. L. MAXSON CORP., 47-37 Austell Place, L.I.C. 1, N. Y. Model 117 is a low-cost spst acceleration switch with omnidirectional sensitivity in a single plane and adjustable acceleration setting. Features

include 2-ampere d-c resistive load contacts, minimum life of 10,000 operations, acceleration setting range of 1.5 to 5.0 g with a setting accuracy of \pm 0.25 g, temperature range of - 50 to + 130 F, and immunity to vibration of 5 to 500 cps at 5 g. Circle 59 on Reader Service Card.

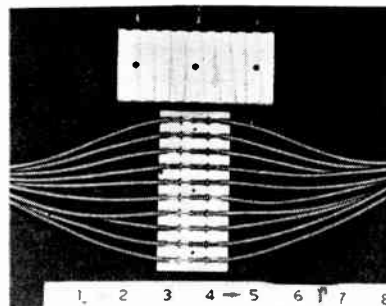


Contact Protectors for arc suppression

INTERNATIONAL RECTIFIER CORP., 1521 E. Grand Ave., El Segundo, Calif., has developed a new series of selenium contact protectors for a-c voltages, to eliminate arcing and erosion across the contacts of relays, switches and other compo-



nents. Standard contact protector types are now available for a-c working voltages ranging from 26 to 156 v, with coil currents from 0.20 to 1.2 amperes. Pigtail-type construction of the suppressors assures ease of mounting in any position. Bulletin SR-150A is available. Circle 60 on Reader Service Card.



Ten-Wire Connector split ceramic block

AMP Inc., Harrisburg, Pa., has developed a high temperature and radiation resistant 10-wire split case connector block (No. 16 Awg), designed for 1,000 F working temperature, 100,000 ft plus altitude, 560 v corona starting voltage and 960 v flashover. It consists of a

split rectangular section ceramic block sandwich nesting 10 silver contacts. The ceramic halves mate to close tolerances. The silver contacts, male and female components, are separately crimped using standard AMP tools, hand mated, then placed in one half of the ceramic nests. Circle 61 on Reader Service Card.

(Continued on page 42)



YOUR FUTURE IS GREAT IN A GROWING AMERICA

AMERICA ALWAYS OUTPERFORMS ITS PROMISES

We grow so fast our goals are exceeded soon after they are set!

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- 1. More People**—Four million babies yearly. U. S. population has *doubled* in last 50 years! And our prosperity curve has always followed our population curve.
- 2. More Jobs**—Though employment in some areas has fallen off, there are 15 million more jobs than in 1939—and there will be *22 million more* in 1975 than today.
- 3. More Income**—Family income after taxes is at an all-time high of \$5300—is expected to pass \$7000 by 1975.
- 4. More Production**—U.S. production *doubles* every 20 years. We will require millions more people to make, sell and distribute our products.
- 5. More Savings**—Individual savings are at highest level ever—*\$340 billion*—a record amount available for spending.

6. More Research—\$10 billion spent each year will pay off in more jobs, better living, whole new industries.

7. More Needs—In the next few years we will need more than *\$500 billion* worth of schools, highways, homes, durable equipment. Meeting these needs will create new opportunities for everyone.



Add them up and you have the makings of another big upswing. Wise planners, builders and buyers will act now to get ready for it.

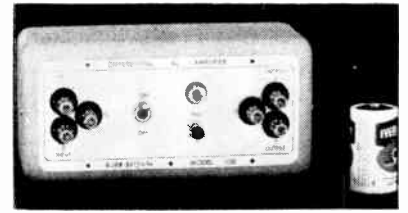
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Your
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A-C Amplifier differential type

BURR-BROWN RESEARCH CORP., Box 644, Tucson, Arizona, announces the model 120 differential a-c amplifier. The instrument is completely transistorized and self-powered from ordinary flashlight cells. Essentially, a broadband

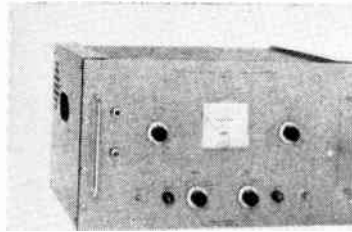
center-tapped transformer, 1 cps to 500 kc, it is useful in applications requiring isolation or measurement of "floating signals." It is claimed to be ideal for bridge circuit pickoffs, measuring feedback voltages in amplifiers, and as a pre-amplifier for transducers having a balanced output working into unbalanced meters, recorders, or



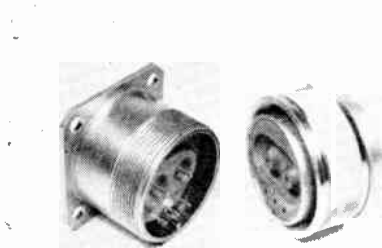
amplifiers. Circle 72 on Reader Service Card.

TWT Amplifier simple to operate

ALFRED ELECTRONICS, 897 Commercial St., Palo Alto, Calif. Now available is a wideband microwave amplifier for 2 to 4 kmc operation that provides 1 w peak pulse power output at 30 db gain, or 100 mw



e-w with 20 db gain. A grid connection is available for pulse modulation or age applications. High phase and amplitude stability are obtained through use of twt electrode supply regulator circuit and transformer regulated t-w and control tube heater power. Circle 73 on Reader Service Card.



Connector carries 7,500 v

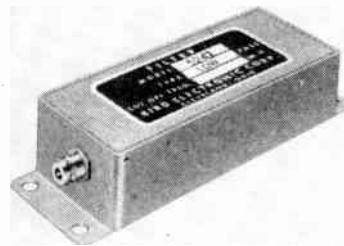
THE DEUTSCH CO., 700 Avalon Blvd., Los Angeles 3, Calif., has developed a new h-v connector designed to carry 7,500 v. Utilizing miniaturized, gold-plated pins and sockets, the unit has a molded-in insert with two h-v contacts and

three l-v carriers.

The receptacle is a large, 2-in., square-flange type. The plug uses a coupling ring retained by a tru-arc snap ring. The connector is sealed according to standard AN-E methods. Solder pot ends can be potted to make the unit completely environmental if desired. Circle 74 on Reader Service Card.

R-F Filter small and light

BIRD ELECTRONIC CORP., 1800 E. 38th St., Cleveland 14, Ohio, has engineered a new low-pass r-f filter to meet the requirements of limited space and low weight. The filter is designed for low insertion loss in



the communication band of 225 to 400 mc with attenuation in the 950 to 1,200 mc band of 80 db.

Size of the miniature r-f filter is $4\frac{1}{4}$ in. by $\frac{3}{4}$ in. by $1\frac{1}{4}$ in., and weight is less than 5 oz. The illustrated filter is equipped with type MB connectors. Circle 75 on Reader Service Card.

Glass Capacitors meet MIL-C-11272A

CORNING GLASS WORKS, Corning, N. Y. The miniature CY-type fixed glass capacitors are made with a full rating at 125 C. Available in



voltage ratings of 300 v and 500 v d-c, they have a continuous operating range of -55 C to 125 C. Vol-

ume of the capacitors ranges from 0.005 to 0.080 cu in. Temperature coefficient is within the limits of $+140 \pm 25$ ppm per deg C. Capacitance drift is less than 0.1 percent or $0.1 \mu\mu\text{f}$, whichever is greater. Circle 76 on Reader Service Card.

Eyelets funnel flange type

CIRCON COMPONENT CORP., Santa Barbara Municipal Airport, Goleta,

Calif., announces a line of funnel flange eyelets for p-c and electronic applications. Used for terminal and feed-through connections on printed circuits, the flared flange



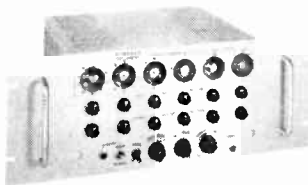
of these new eyelets provides an excellent fillet of solder between the eyelet and the circuit pattern. No under head flux inclusions in the connection are possible because of the open character of the installed eyelet. Circle 77 on Reader Service Card.



Delay Lines meet MIL specs

CONTROL ELECTRONICS CO., INC., Huntington Station, N. Y., has available special application distributed constant delay lines with delays ranging from 8 through 30 μ sec. The FD288-C pictured has an overall delay of 8 μ sec with a fast rise time of 0.8 μ sec. Attenuation is only 3 db total, less than 0.5 db per μ sec. Impedance is 3,300 ohms. Additional taps are furnished at 3, 5, and 6 μ sec. Total delay and tap delay accuracy can be held to 1 percent.

The units are offered in standard, hermetically sealed, metal containers 1½ in. in diameter by 3½ in. high. Circle 78 on Reader Service Card.

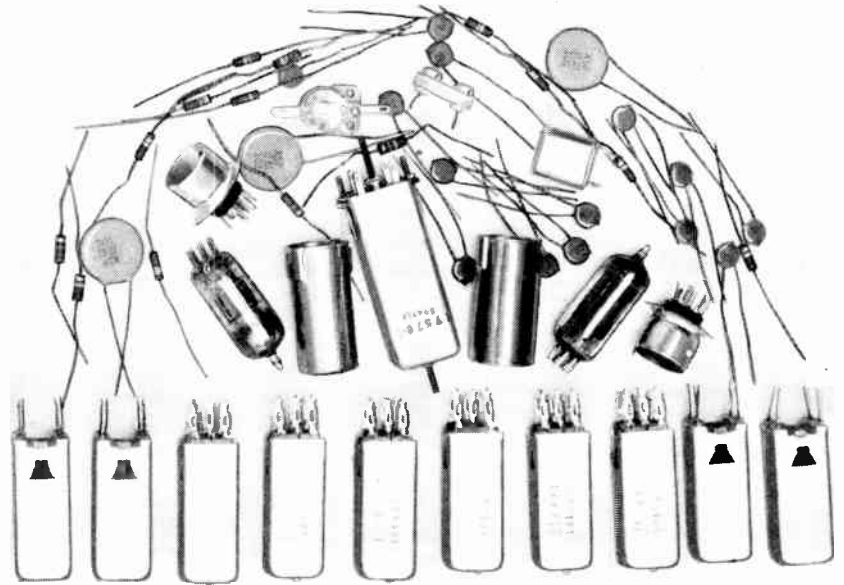


Preset Counter transistorized

DYNAPAR CORP., 5150 Church St., Skokie, Ill., announces a new tran-

CRYSTAL FILTERS

NOW YOU CAN REPLACE ALL OF THESE COMPONENTS



Shown approx. ½ size

WITH A SINGLE HYCON EASTERN CRYSTAL FILTER



Shown approx. ½ size

AND REDUCE WEIGHT, SAVE SPACE,
IMPROVE PERFORMANCE AND RELIABILITY

It will pay you to investigate how this unique component can improve performance and reduce costs of your communications equipment. Hycon Crystal Filters make possible single conversions in AM and FM receivers while retaining the important advantages of double and triple conversions. These units permit excellent reception in the presence of strong jamming or interfering signals. Center frequencies are accurate to .001%. Insertion loss is 1/10 of other filtering methods. Aircraft and guided missile environmental requirements are exceeded. Write for Crystal Filter Bulletin.

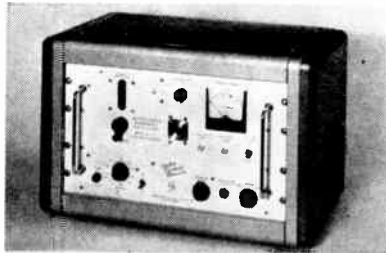


HYCON EASTERN, INC.

75 Cambridge Parkway Dept. A, Cambridge 42, Mass.

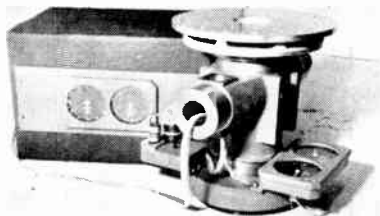
sistorized preset counter featuring: (1) virtually unlimited life; (2) etched circuit plug-in construction; (3) use of only cold cathode glow counters and transistors—no hot cathode tubes.

The unit will give service indefinitely, maintenance being confined to replacement of cold cathode glow counters which have a rated life of 5,000 to 10,000 hr. Circle 79 on Reader Service Card.



Oscillators microwave type

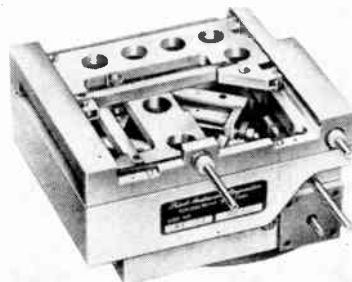
LABORATORY FOR ELECTRONICS, Inc., 75 Pitts St., Boston, Mass. Series 814 is a line of 23 standard tunable microwave oscillators. They span the microwave spectrum from 2,500 to 17,500 mc, with power outputs ranging from 20 mw to 1.5 w. Short-term frequency stability averages 0.05 part per million and long term frequency stability averages one part per million. Circle 80 on Reader Service Card.



Test Stand for specialized use

STERLING PRECISION CORP., 17 Matinecock Ave., Port Washington, L. I., N. Y., has developed the T-806E test stand. It is generally used for specialized production line or laboratory testing where a sturdy, rigid servo turntable is required and the limited tests do not justify the cost of a complete turntable testing assembly. The unit includes a turn-

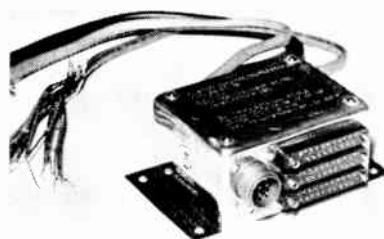
table and a trunion with only servo drive, quick reading dials and a two speed rotation transmitting system. Mounting may be vertical or trunioned for tilting. Circle 81 on Reader Service Card.



Component Solver weighs only 3 lb

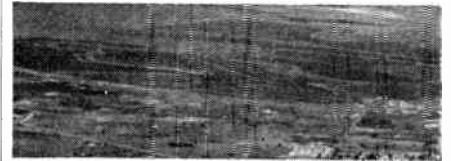
BELOCK INSTRUMENT CORP., 111-01 14th Ave., College Point, N. Y., has designed and developed a mechanical component solver for use in aircraft instrumentation systems. The new mechanism weighs only 3 lb and meets the present demand for miniaturized computer components. The component solver is used in lightweight electromechanical and mechanical analog computers.

From inputs in polar coordinate form representing the magnitude and direction of a vector, the component solver produces outputs in X and Y which are representations of the vector in Cartesian coordinates. Circle 82 on Reader Service Card.

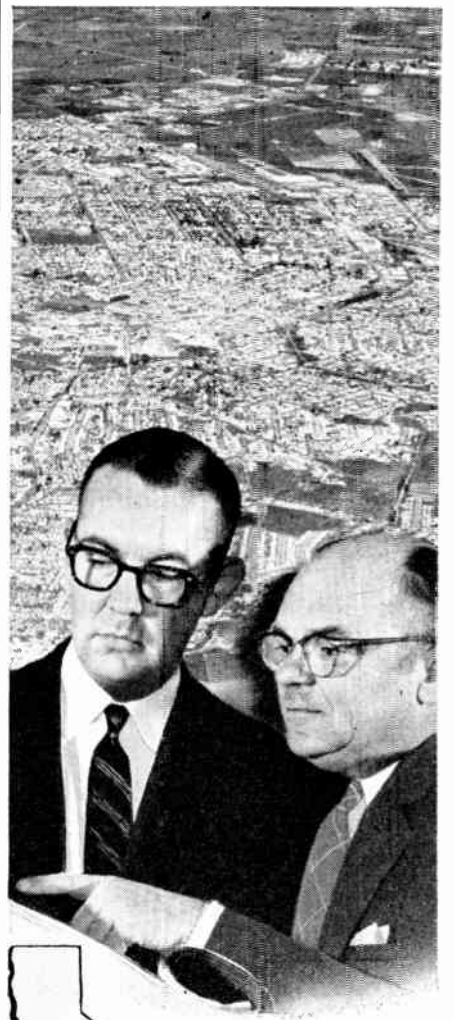


Reference Junction for thermocouples

AERO RESEARCH INSTRUMENT CO., Inc., 315 N. Aberdeen St., Chicago 7, Ill., announces a miniature multi-channel thermocouple reference junction for airborne and

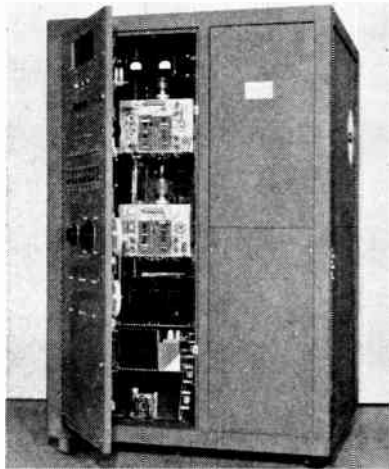


Yes, we chose
Santa Clara
County*
California...



SAN JOSE
Santa Clara County
California

test cells. The instrument is designed to replace the conventional ice bath as reference temperature for thermocouples. It offers precision and regulation to 0.5 F° or even better by multiple temperature control. The warm-up time is ½ hr at -65 F°. Circle 83 on Reader Service Card.



Grid Pulser high repetition rate

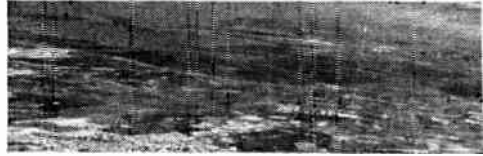
LEVINTHAL ELECTRONIC PRODUCTS, Inc., 760 Stanford Industrial Park, Palo Alto, Calif. Model 64M grid pulser is isolated 40 kv from ground and produces pulses from 0 to 10 kv at repetition rates from 100 cps to 60 kc and with pulse lengths from 1 to 10 μsec into a 150 μμf load. Equipment includes a 0-to-10 kv bias supply, a pulse generator, the grid pulser, and all necessary controls, meters, interlocks, indicators and safety features as required.

Total power requirement is 70 amperes from a 115-v, 60-cps single-phase source. Circle 84 on Reader Service Card.



Two-Way Radio for aircraft

COMMUNICATIONS CO., INC., 300 Greco Ave., Coral Gables, Fla. The new vhf/f-m Flightcom two-way



and we're glad to be here!

When industrial leaders are enthusiastic over choosing a particular community, their reasons are important. Comments from these men point out the degree to which their success can be attributed to a location in Santa Clara County.



Mr. David Packard, President of Hewlett-Packard...



"A good location is directly related to the growth of a new firm. For this reason, we feel that Santa Clara County has made a major contribution to our development. Its all-year mild climate and nearby higher educational institutions serve as a magnet for the kind of scientific manpower we need."

Mr. J. E. Jennings, President of Jennings Radio...



"In our case, it was primarily the availability of good land for low cost single story construction that made this area so desirable. Of course, we are pleased with our location in Santa Clara County for other reasons, too. These include the variety of excellent service industries nearby and the highly skilled technical help which is so necessary in the manufacture of vacuum electronic components."

Mr. H. Myrl Stearns, President of Varian Associates...



"Clean atmosphere ranks first among the reasons for our enthusiasm over this area. However, other advantages are also important in the manufacture of products such as our Klystron tubes. The many electronic research facilities, an ample supply of skilled technicians, plus top-ranking educational institutions nearby, have all been key factors in our rapid growth."

Before you make a decision, talk with people who chose Santa Clara County. Their experience makes it easy to forecast your future in this livable community at the southern tip of San Francisco Bay.



SAN JOSE
Santa Clara County
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WRITE FOR FREE
REFERENCE DATA

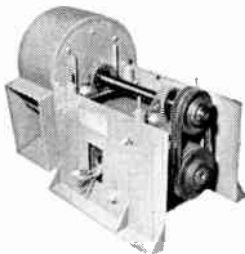
Take a minute now to send for the informative booklet, "What Does Santa Clara County, California offer the ELECTRONICS INDUSTRY?"

Greater San Jose Chamber of Commerce Dept. 6, San Jose, California

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

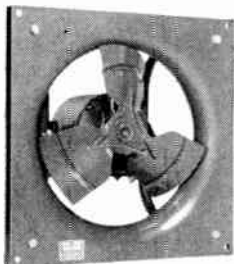
Problem: End malfunctions from self-generated heat in sensitive electronic equipment. Solution: Provide dependable cooling with an American Blower packaged air-moving unit. Numerous sizes and designs to choose from—many can be modified as needed. Or, if necessary, we can start from scratch and design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

FOR COOLING TRANSMITTERS



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

FOR COOLING CABINETS



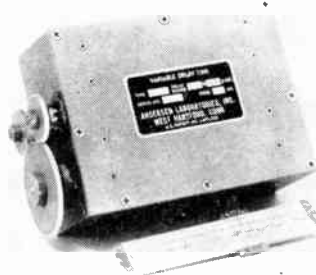
Propeller fan. Capacity: 1325 cfm @ 0" sp to 310 cfm @ 0.62" sp @ 1725 rpm. Write for Bulletin 4812.

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



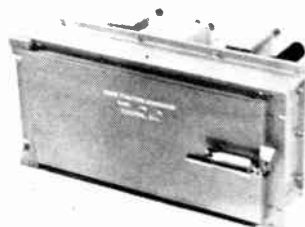
CIRCLE 23 READERS SERVICE CARD

radio is especially designed for aircraft requiring communications with ground vhf f-m mobile radio systems. A complete package weighs 21 lb including an ATR type of shock mount, control box with cables, and microphone. Transmitter power output is 35 w in the 25-54 mc band and 25 w in the 144-174 mc band. Low band model costs \$585, and high band, \$600. Dual frequency operation adds \$30 to the prices. Circle 85 on Reader Service Card.



Delay Line uses fused quartz

ANDERSEN LABORATORIES, INC., 501 New Park Ave., West Hartford, Conn., has developed a variable ultrasonic delay line in which fused quartz is used as the delay medium. Outstanding feature of the unit's design is a precision mechanical driving system. The unit has been designed for special purpose use, including target simulator applications and all operations in which control in setting the delay time is vital and bandwidth is required. Circle 86 on Reader Service Card.



Function Generator for computation

ELECTROL, INC., 9000 W. Pico Blvd., Los Angeles 35, Calif. The punched card memory of the model

100 diode function generator enables preprogramming and therefore eliminates costly idle time on the entire computer facility while programming nonlinear functions. It is ideal for data correction and data handling operations. Continuous operation in unattended systems is made feasible by the excellent long term stability. Circle 87 on Reader Service Card.



Tiny Connector for p-c uses

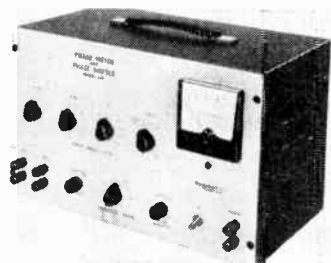
CANNON ELECTRIC CO., 3208 Humboldt St., Los Angeles 31, Calif. A new series of D subminiature connectors is now available for printed circuit applications. Withstanding a 1-minute test voltage (60 cps a-c rms) of 1,300 v with no evidence of breakdown, the new D series is well adaptable for miniature equipment and components. Shell material is of steel with cadmium plate finish. Contact material is copper alloy with gold over silver plate. Insulation material is Zytel or diallyl-phthalate. They are available with 9, 15, 25, 37 or 50 contacts. Circle 88 on Reader Service Card.



Dual Rate Meter log, linear displays

BAIRD-ATOMIC, INC., 33 University Rd., Cambridge 38, Mass. Model 412 precision dual rate meter is available. This premium log and linear multirange rate meter is useful for fast quantitative analysis of

medical or industrial samples, as well as for reactor monitoring. Selectable by a 10-position front panel switch, the linear scale has ranges of 0 to 30 cpm, 0 to 100 cpm, 0 to 300 cpm, etc., to a range of 0 to 1,000,000 cpm. A special five-cycle log scale provides a logarithmic range of 10 to 1,000,000 cpm. Circle 89 on Reader Service Card.



Phase Meter and phase shifter

DYTRONICS CO., P.O. Box 3676, Columbus 14, Ohio. Model 340 phase meter and phase shifter provides phase measurements and a phase source having an accuracy of 0.1 deg. A bridge null method is used in measuring phase. Phase angle is continuously adjustable from 0 to 400 deg and is easily set on digital dials. Circle 90 on Reader Service Card.



Transformers, Coils for p-c use

COIL WINDERS, INC., New York Ave., Westbury, N. Y., has available a new series of sealed miniature tuneable transformers and reactors for printed circuit use. The units will meet the requirements of specification MIL-T-27A, Class R, Grade 2 or 3, and may be provided with electrostatic shielding. They are of the plug-in type with provision for assuring clearance of body of unit from p-c board. Circle 91 on Reader Service Card.

A New Concept of TIME . . .

. . . this Complete.

NEW Line of HAYDON* TIMING MOTORS

Here is a complete line of timing motors that includes the right choice for every APPLICATION . . . entirely re-designed for finer performance. Features include: slower basic rotor speed (450 rpm), controlled lubrication, total enclosure, smaller size, superior accuracy, quieter operation and longer life.

HYSTERESIS . . . the ideal general-purpose motor.

INDUCTOR . . . extra torque (30 ounce inches) for display and other heavy-duty jobs.

CLUTCH . . . allows automatic re-setting without external clutches.

REVERSIBLE . . . a hysteresis type with 2 coils, each producing opposite rotation.

DIRECT CURRENT . . . a permanent magnet type for 6 to 32 volts.

400 CPS . . . miniature and heavy-duty models for airborne instrumentation.

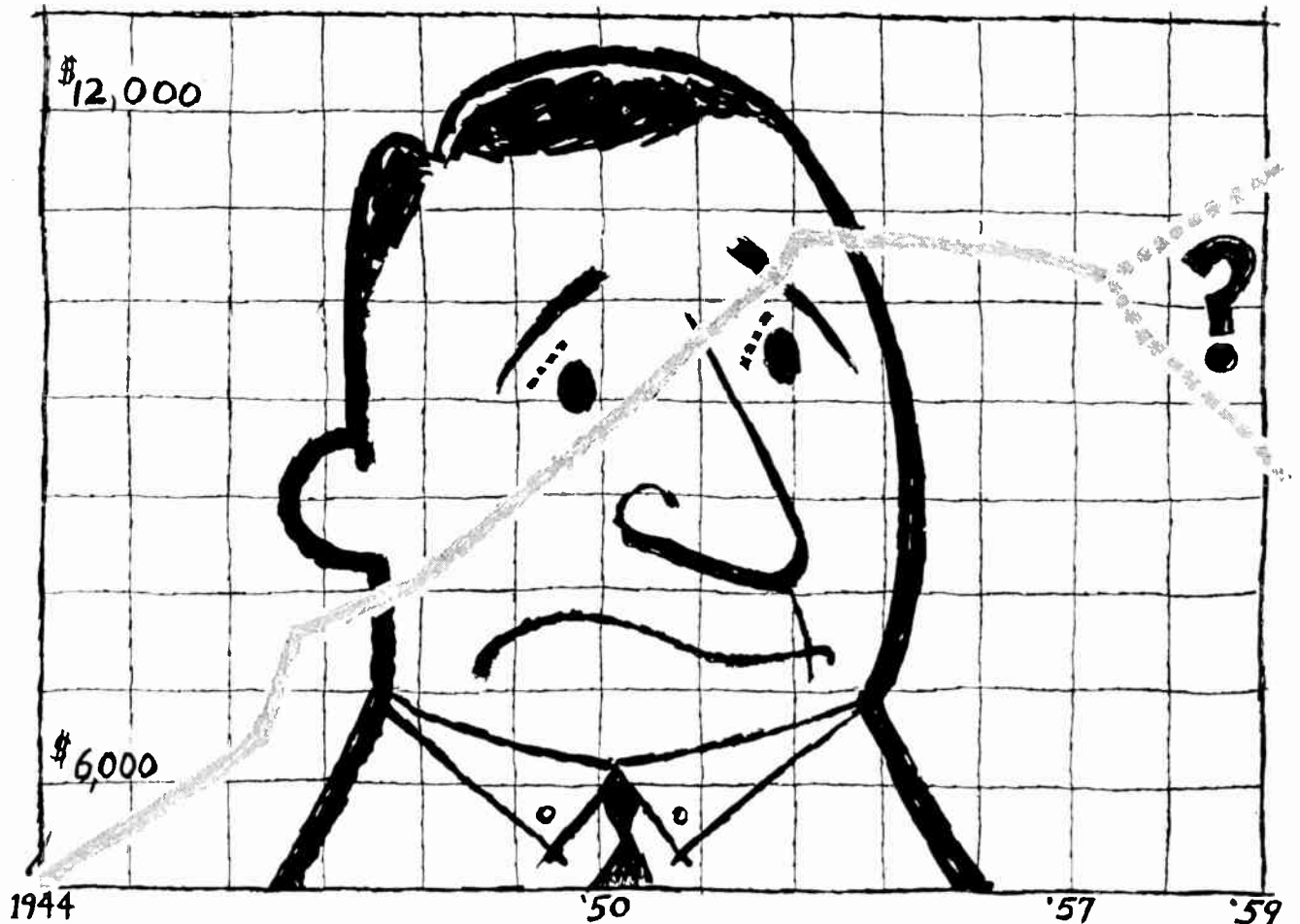
FOR COMPLETE INFORMATION, write today for new catalog . . . or contact the HAYDON Field Engineer nearest you.

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*The
"career-curve"
of a
man named
Carter*

Charlie Carter started out like a ball of fire. First ten years — terrific! Then he seemed to slow down. Other men — younger newcomers — passed him by. Why?

What happened to Charlie? Nothing. It's what has been happening to industry. Business has become so big and busy, it moves too fast for men who seem satisfied with the status quo. Never have management ranks been so wide open for "get-up-and-go" men.

Look ahead, read ahead, get ahead. Know your job inside out. Be an "authority". But don't stop here. Be a growing man . . . equally knowing on the cross-currents of other job functions within your company — well-informed on the working inter-relationship of all operations — the big picture.

How can you do this comfortably? With the business publication you have in your hand right now. Its editors know

your field. They work in it — right at your side. They are your eyes and ears. They go to the places you would go if you had the time. They look, listen, question for you. They review, analyze, edit . . . deliver all that is important to you. They eliminate the non-essential and the time-wasting. They do this fast and accurately. And because they write about that which is as close to you as your own family — your future . . . you will find your favorite McGraw-Hill publication more and more a pleasure as well as a profit to read.

The big benefit to you is simply this: The greater time you put into reading this magazine, the greater your gain in "time saved". You handle your present job faster and with far greater effectiveness. And you reward yourself with bonus hours of new opportunity to look up and do something about that bigger job ahead.

McGRAW-HILL SPECIALIZED PUBLICATIONS

The most interesting reading for the man

most interested in moving ahead

Literature of the Week

MATERIALS

Epoxy Resin. Permacel-LcPage's Inc., New Brunswick, N. J., has available a brochure outlining the physical and electrical properties of 25 of the epoxy resin systems offered by the company. The brochure contains a list of definitions of terms used in connection with epoxy resin system. **Circle 40 on Reader Service Card.**

COMPONENTS

Delay Lines. Columbia Technical Corp., 61-02 31st Ave., Woodside 77, N. Y. A 12-page booklet, bulletin No. 18, contains a comprehensive, detailed compilation of data for the proper use and installation of delay lines, delay line flats and Minilines. Included are oscillograms and drawings to facilitate testing these lines. **Circle 41 on Reader Service Card.**

Retaining Rings. Industrial Retaining Ring Co., 57 Cordier St., Irvington 11, N. Y., has published a 16-page illustrated engineering specifications catalog on its expanded line of industrial retaining rings. **Circle 42 on Reader Service Card.**

Tantalum Capacitors. Fansteel Metallurgical Corp., 2200 Sheridan Rd., North Chicago, Ill. A 4-page folder covers VP type tantalum capacitors. Included are application information, specifications, ratings and ordering references, and performance characteristics curves. **Circle 43 on Reader Service Card.**

EQUIPMENT

Mobile Radio. Radio Corp. of America, Camden, N. J. An illustrated case history brochure which documents the speed, efficiency, and economy of mobile radio systems operating in a broad range of industrial, utility, business and professional service organizations is

announced. Copies are available on letterhead request.

Anechoic Chambers. Enterson & Cuming, Inc., 869 Washington St., Canton, Mass. Ecosorb anechoic chambers is the subject of a new eight-page brochure. The brochure contains a description of electromagnetic energy absorbers manufactured by the company for vhf, uhf and microwave free-space rooms together with details of construction. **Circle 44 on Reader Service Card.**

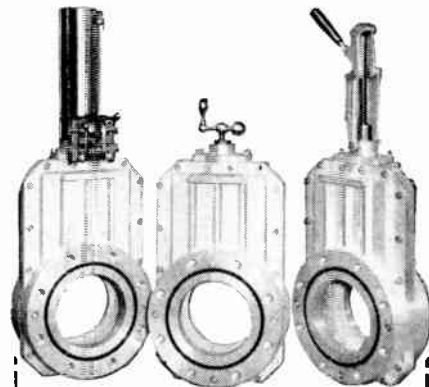
FACILITIES

Printed Circuits. Arthur Ansley Mfg. Co., New Hope, Pa., has published a booklet entitled "Some Suggestions on Printed Circuit Layout and Design". It is based on the company's own experience in the printed circuit field and discusses the company's facilities for help in the field. Information on the Ansley Plus Module is included. Price of the 14-page booklet is \$1. **Circle 45 on Reader Service Card.**

Research and Development. Electronic Engineering Co. of California, 1601 E. Chestnut, Santa Ana, Calif. A four-page illustrated brochure "Decade of Experience—Electronic Research & Development" is available. Included are a description of the background of the ten-year old company and its facilities. **Circle 46 on Reader Service Card.**

Wiring System Testing. DIT-MCO Inc., 911 Broadway, Kansas City 5, Mo., has available a brochure titled "How To Be Sure Your Electrical Wiring Systems Have The Highest Possible Reliability Factor." It describes the services which the company offers to industry and the military on a consulting basis to help them set up this testing system. **Circle 47 on Reader Service Card.**

need high vacuum components?



Stokes ST gate type high vacuum valves are available for manual or air operation. Straight through openings provide maximum conductance. Small installation space required... can be mounted in any position. Flanges are standard ASA dimensions. Each valve is helium leak tested with mass spectrometer. Manual and air operated types in 2-, 3-, 4-, and 6-inch sizes—air operated only in 8-inch sizes and over.

STOKES makes a complete line of vacuum components... advance-designed and engineered to help make your vacuum systems more productive. Each unit reflects Stokes' unparalleled experience, pioneering leadership and wealth of basic vacuum technology.

The product list includes: Diffusion Pumps, Vapor Booster Pumps, Mechanical Pumps, Mechanical Booster Pumps, Vacuum Gages, and Valves.

Send for data.

High Vacuum Division
F. J. STOKES CORP.
5563 Tabor Road, Phila. 20, Pa.

STOKES

CIRCLE 25 READERS SERVICE CARD

Components Gain in Britain

Trends in \$270 million business highlighted at electronics show; firms eye U. S. market for stereo

LONDON—"As the components grow smaller, the crowds grow bigger." These were the words of an exhibitor last month after some 20,000 persons had viewed Britain's 15th Radio and Electronic Components Show.

Britain's electronic component business is now flourishing at a level of \$270 million a year. Production exceeds 7 million units a day, of which some 20 percent is exported. Australia is cited as Britain's main overseas market. The U.S. is her leading customer for sound reproducing equipment, with purchases worth \$9 million a year.

And the 1958 U.S. market looks even better to the British. One firm, hoping to cash in on an incipient stereophonic sound boom, has announced shipments of record changers totaling \$1 million.

The trends, apparent at the show and most commented on by British and American observers, are:

- British transistor production advances.
- Full-scale commercialization of printed circuit techniques, now appearing in the majority of home entertainment sets.
- Higher temperature ratings of components, with

transformers regularly operating at 250 C and experimental designs appearing for operation at 500 C.

- A vigorous miniaturization campaign as missile component techniques go commercial.

At virtually every booth, the miniaturization theme was evident. These highlights showed:

Tv/f-m tuners are growing smaller with one occupying only 20 cu in. Also smaller are i-f transformers, down to ½-in. sq by 1 1/16 in. high.

Latest British-manufactured mercury cells give a capacity of 160 mah from a size less than 0.2-in. high and 0.45-in. in diameter.

While American-designed transistors still top the power output race in Britain, British manufacturers are now offering in quantity a type designed for servo amplifiers for 14-w, 47 C operation.

These trends were noted too:

- Government-sponsored research has produced film resistors and capacitors capable of successive deposition on ceramic baseplates. Work is proceeding on oxide film resistors for temperatures up to 120 C using solid oxide, molybdenum disilicide and metal and oxide tracks.
- Magnetic tapes on bobbin cores giving fast switching characteristics for shift registers and matrix driving cores are down in thickness to 0.0003-in. Also anisotropic barium ferrite magnets are on their way in.

DEVELOPMENTS ABROAD

• In Estonia research is underway into transmission of tv signals over distances as much as 370 to 1,865 mi, according to a Tass report in Moscow. Signals have been received from France, Britain, Sweden, Switzerland, Italy, West Germany and other countries, it is said. A special group coordinates observation points, and various types of antennas are being designed and manufactured. Tass says observation covers the 174 to 230-mc range. Another report says experimental tv broadcasts have been made over a radio relay system between Tallin, Estonia and Leningrad.

- In the Philippines a telecom-

munications survey will be carried out under an International Cooperation Administration technical assistance contract by National Scientific Laboratories, Inc. of Washington, D. C. Object, says NSL, is an operating plan compatible with the economy and projected needs of the Philippines.

• In Britain a transistorized civil version of the Royal Air Force Doppler navigator system is now under development at the Royal Radar Establishment, the Ministry of Supply discloses. New model will weigh less than 70 lb, compared with 250 lb for conventional equipment in service for about four years with the RAF.

EXPORTS and IMPORTS

British stereophonic disks are now available in 10 and 12-in. sizes for 33 1/3 rpm and 7-in. sizes for 45 rpm. Records and equipment to play them are made by at least one firm. The 45/45 stereo system uses a special stylus; signals are amplified separately and reproduced in speakers 6 to 8 ft apart. Complete kits including amplifiers, two speakers and stereo transcription unit will retail in Britain for about \$240 for a 7.5-w system and \$180 for a 3.5-w system.

West German exports of electrical and electronic medical apparatus accounted for nearly 40 percent of world exports last year compared

to 21 percent for the U. S., according to the Association of the German Electrotechnical Industry. Exports of medical gear last year amounted to \$19 million against \$16 million in 1956. Steady rise in German exports is attributed to the relative stability of the price index which now stands at 111 compared to 100 in 1950. Overall sales of \$47 million, including \$25.2 million worth of X-ray apparatus, were reported in 1957 for 105 manufacturers of electromedical gear.

In Canada the U. S. Navy's Sparrow II air-to-air guided missile will be produced for the RCAF's air defense command under license from Douglas Aircraft. Canadair Ltd., a General Dynamics Corp. subsidiary, is the coordinating contractor, and will make the airframe and test equipment. Canadian Westinghouse will produce the radar seeking system as associate contractor.

West German firm Leybold-Hochvakuum-Anlagen GmbH, of Cologne, and National Research Corp. subsidiary, NRC Equipment Corp., have signed a 5-year cross-licensing agreement. It covers new German and American methods of high-vacuum drying, degassing, impregnating and filling of transformers, switchgear, capacitors and other gear.

British firm S. G. Brown, Ltd. of Watford, has been licensed by American Bosch Arma Corp. to manufacture the Arma subminiature gyro compass and sell it in Europe, Africa and Asia.

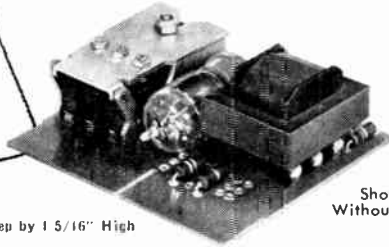
In London a new Philips company, Research and Control Instruments Ltd., has been established as distributor of instruments and scientific equipment made in Britain by Philips and its subsidiary, Mullard Equipment Ltd. The new firm will also act as importing distributor for industrial X-ray equipment made by C. H. F. Muller AG of Hamburg; electronic instruments made by Elektro-Spezial AG of Hamburg; and Norelco X-ray diffraction and spectrographic gear made by North American Philips.



COMPACTROL

AN Ultra-Sensitive **ELECTRONIC CONTROL**

MINIATURIZED
PRINTED CIRCUIT
PLUG-IN TYPE



Shown Without Case

3" Wide, 2 13/16" Deep by 1 5/16" High

COMPACTROL is a thyatron amplifier with power relay, associated circuitry and 115 v. a.c. power supply. It is self-contained and compactly packaged in a plastic case of high impact styrene.

INPUT — ¼ microwatt to operate

OUTPUT — 1 to 3 poles, each 5 amps. at 250 volts a.c.

APPLICATIONS

- Super-sensitive relay
- Temperature control
- Automation
- Time delay relay
- Touch control
- Photo-electric device
- Intruder alarm
- Safety device
- Sales promotional display

Victory ENGINEERING CORPORATION

WRITE FOR DESCRIPTIVE FOLDER V-318

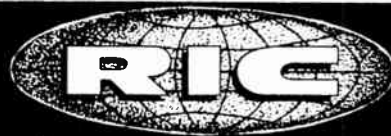
101 SPRINGFIELD ROAD

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Pushbutton Tv Stations?

Automatic operation of tv stations may be a coming trend. Engineers see transistor uses in color cameras

LOS ANGELES—Among new developments revealed here at the recent convention of the National Association of Broadcasters was an automatic television programming system capable of handling up to 20 events.

The system designed by RCA is built around a memory unit using binary relays and stepping switches to store information. Programming is initiated on punched tape. A pushbutton selector unit operating in conjunction with a time select switch does the rest. The new system will perform all switching operations now done manually—keying in projectors, slides, sound sources and special effects.

Further evidence of the convention's interest in automatic processes was brought out in a talk by NAB's engineering manager Prose Walker. He described a petition to FCC asking permission to use automatic equipment to log frequencies, power outputs and antenna performance of broadcast stations. According to Walker, equipment is now in test that will make automatic logging possible.

Another automatic development that attracted the convention's attention is an amplifier made by General Electric. This unit automatically controls transmitted sound level, increasing or diminishing volume as actors change distance from studio microphones.

A long standing sore spot in the broadcaster's life, reradiation from towers near directional antennas, was probed early in the convention. CBS engineer O. L. Prestholdt described a new development in coaxial chokes which has substantially reduced interference when properly positioned on the offending structure.

Station engineers listened with interest to a paper describing a transistorized color television camera. The new device is 34 in. long and 14 in. high. It weighs 215 lb with its viewfinder. The reduced size is due chiefly to printed wiring, transistors and a redesigned optical system.

Also shown was a new camera cable that packs six coaxial cables and 44 single wires in a 1 $\frac{1}{8}$ -in. neoprene jacket. GE, designer of the new equipment, reports excellent stability, and good serviceability due to the pull-out assembly of the three color channel amplifiers.

FCC ACTIONS

- **Amends** Citizens Service rules to speed administration and eligibility servicing; reserves judgment on proposals relating to frequency availability and technical standards.

- **Initiates** rule-making to incorporate parts of Conelrad plan into Citizens Radio and Disaster Communication Services during alerts.

- **Makes** 156.65-mc space available for voluntary bridge-to-bridge communication systems for ships. Shipowners may evaluate system until July 1, 1959.

- **Proposes** to open 12 a-m clear channels to additional unlimited time stations. Comment must be filed by July 15.

- **Announces** proposed changes to international and domestic fre-

quency allocations in connection with July meeting of International Telecommunication Union in Geneva. Copies of proposal will be sent by return mail by FCC while supply lasts.

- **Amends** organization rules to return Division status to what is now the Hearing Branch, presently a part of the Broadcast Facilities Division. This change in status involves no changes in personnel.

- **Advises** activation of tv translator station for Guam's one tv station, KUAM. Installation was by Navy.

- **Amends** tv assignment table to make Walla-Walla, Wash., all nbf by deleting channels 5 and 8, adding 44 and 50, and making channel 22, formerly educational, available for commercial use.

STATION MOVES and PLANS

KWIN, Ashland, Ore., files for c-p to change from 1,400 to 580 kc, drop unlimited schedule, increase power from 250 to 500 watts.

KFOX, Long Beach, Calif., asks for more time to change antenna-transmitter site, and operate transmitter by remote control.

KJCK, Junction City, Kans., seeks c-p to install new transmitter.

KCMR, McCamey, Tex., requests permission to go from unlimited hours to 6:00 a.m. to 6:00 p.m. on weekdays, 7:00 a.m. to 6:00 p.m. Sundays.

WAWK, Kendallville, Ind., asks permission to change to nondirectional antenna.

WULA, Eufaula, Ala., seeks to

transfer control by stock shift from L. H. Christian to C. A. McLure; same parties involved in transfer of control of WGBA, Columbus, and WCIK, Canton, Georgia.

KFBI, Wichita, Kans., license assigned to Mary Pickford, Buddy Rogers for \$450,000.

WJMW, Athens, Ala., seeks permission to determine operating power by direct measurement of antenna power.

KZOL, Mulshoe, Tex., receives change in c-p to allow change in transmitter type.

WGFM, Skowhegan, Me., seeks permission to boost power from 1 to 5 kw, install new transmitter.

WHFM, Rochester, N. Y., files for license to cover c-p which authorized reactivation of f-m station, move transmitter to a-m site.

WVUE, Wilmington, Del., asks for extension of completion date of auxiliary transmitter.

KTBS-TV, Shreveport, La., files for renewal of license.

KCLE, Cleburne, Tex., requests c-p to raise height of antenna, and side mount f-m antenna near top.

KCBQ-FM, San Diego, Calif., asks switch from channel 300 to 299.

WAGA-FM, Atlanta, Ga., files for c-p to establish a new subsidiary communications service, multiplex basis to be operated on subcarrier.

WECT, Wilmington, N. C., gets license for tv station.

WYSO, Yellow Springs, Ohio, receives license for educational f-m station for Antioch College.

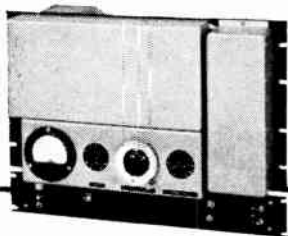
KMAN, Manhattan, Kans., is granted authority to sign off at 6:30 p.m. until August 31.

KFJM, Univ. of North Dakota, plans operation for only six hours a day from June 2 to Sept. 30 due to college vacations.



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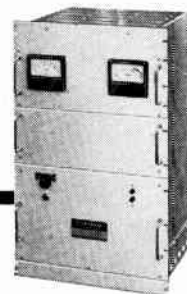
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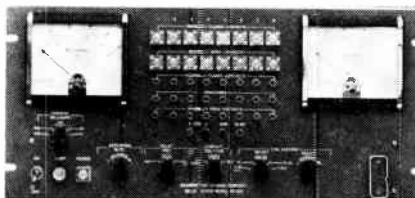
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PLANTS AND PEOPLE



H&H Expands On West Coast

A NEW 25,200 sq ft precious metals facility (picture) was recently opened by Handy & Harman in El Monte, Calif. It replaces the former H&H plant in the Los Angeles area, more than doubles the production area and leaves room for additional expansion.

At opening ceremonies, H&H president J. C. Travis said the new plant is evidence of the tremendous expansion in the company's west coast activities in the past decade.

The Handy & Harman plant will provide west coast industry with new and improved facilities for all forms of precious metals and alloys, he said. These products include silver, gold, the platinum group metals and their alloys, and brazing alloys and fluxes. The plant has facilities for melting and casting, rolling, rod and wire drawing, bright annealing, and finishing to shapes and forms specified by customers.

"Handy & Harman silver", Travis said, "is coursing through the skies in the form of contacts and conductors in our earth satellites. Silver and other precious metals are vital to air frame, guidance systems, and propulsion units of rockets, guided missiles, and jet speed aircraft," he continued. "Silver is used to save weight and space in the complex electrical circuits of those craft because of its outstandingly good electrical conductivity."

The new plant, he said, will supply more diversified forms of precious metals for west coast industrial manufacturers. Its location

permits fast delivery throughout the heaviest industrial area of the Southwest.

ORRadio Sets Up New Division

CURRENT growth and plans for future expansion of ORRadio Industries, Inc., Opelika, Ala., has led to the establishment of two new divisions.

The two sections are headed by James D. Grady, Jr., as manager of the Instrumentation Tape Division and Robert D. Browning as manager of the Audio Products Division.



Scientist Takes New Position

SCIENTIST and educator, A. R. Teasdale (picture) is named to the newly-created post of director of

advanced technology at Temco Aircraft Corp., Dallas, Texas. He has been serving as chief of aircraft electronics.

Teasdale will direct the efforts of a group of engineering and scientific specialists devoted to advanced technologies and advanced studies. Part of his duty will be to keep in constant touch with advanced scientific developments and with scientists throughout the profession.

Teasdale joined Temco in 1954 as chief of electronics design. Since that time he has had executive responsibility for the company's expanding activity in this field.



Gulton Names Division G-M

BERNARD BERNSTEIN (picture) has been appointed general manager of the new advanced development and systems division of Gulton Industries, Inc., Metuchen, N. J.

The new division is the result of the integration of four existing departments within the company. Included in the consolidation are the ordnance systems department, the underwater sound laboratory, the fuze development group and the atomic energy research program.

Bernstein joined Gulton in 1956 as chief of the ordnance systems department. Previously he was employed at the Knolls Atomic Power Laboratory, General Electric Co. in Schenectady, N. Y. Prior to that he

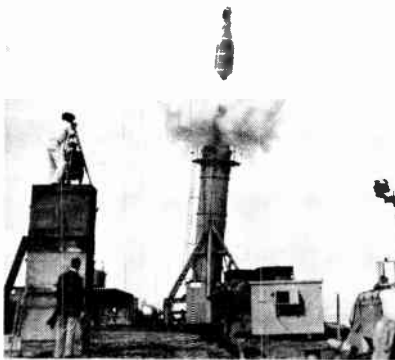
was associated with the U.S. Government Naval Ordnance Laboratory, as chief of electric explosive components section.



Hire Lique As Sales Manager

FORMERLY with Allen D. Cardwell Co., Vincent J. Lique (picture) joins Condenser Products Co., New Haven, Conn., as sales manager. His new employer makes plastic capacitors, h-v power supplies, pulse forming networks and other electronic components.

Polaris Launcher



Prototype of Westinghouse's launcher for Lockheed's Polaris IRBM hurls a multiton, concrete and steel dummy missile into San Francisco Bay. Readings from strain and pressure gages, accelerometers within the dummy missile are communicated through a tough electrical cable. It extends from projectile's nose, out mouth of launcher and to instruments in nearby hut

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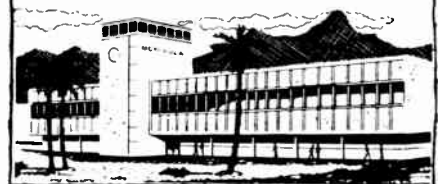
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News of Reps

APPOINTMENT of George Kneepfer, president of the Midwest Semiconductor Sales Co., Skokie, Ill., as exclusive midwest rep of the semiconductor Division of Hoffman Electronics Corp., Evanston, Ill., is announced. His territory will include Illinois, Indiana and Wisconsin.

Don J. Bacher was recently added to the sales staff of Belchamber and French, San Francisco, Calif., electronics manufacturers reps.

San Fernando Electric Mfg. Co. appoints S. Forrest Brooks as representative for Arizona and New Mexico, to handle its line of capacitors, filters and potentiometers.

R. G. Sidnell and Co., Cleveland, Ohio, is named sales rep in Ohio and western Pennsylvania for Clevite Transistor Products, Waltham, Mass.

Tri-Point Plastics, Inc., Albertson, N. Y., names Jack Berman Co., Inc. of Los Angeles, Calif., as West Coast technical sales reps for Trintseels and machined components.

The Victoreen Instrument Co. announces the appointment of Stanley K. Wallace Associates, Inc., as sales reps for the company's electronic components division in the Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina and Tennessee territory.

Hubbard Potentiometers, Inc., Pomona, Calif., has selected Kittleston Co. to serve as its sales engineering rep in several western states.

Frank Malley Co. of Albuquerque, N. M., now represents Sealectro Corp., Mamaroneck, N. Y., in Idaho, Wyoming, Montana, Utah and Colorado. Rep firm handles terminal board components and miniaturization hardware lines.

Appointment of Maitland K. Smith Co. as its representatives is announced by Delttime, Inc., Mamaroneck, N. Y., makers of magnetostrictive time-delay lines and associated equipment.

INDEX TO ADVERTISERS

American-Standard Products American Blower Div.	46
Anaheim Electronics Corp.	53
Audio Devices Inc.	11
Bendix Aviation Corp. Scintilla Division	13
Bomac Laboratories Inc.	3rd Cover
Calibron Products Inc.	6
Christie Electric Corp.	53
Dale Products Inc.	2nd Cover
Daystrom Instrument Div. of Daystrom Inc.	3
Good-All Electric Mfg. Co.	9
Hallimore Electronics Co.	26
Haydon Division of General Time Corp.	47
Hyeon Eastern Inc.	43
Knights Company, James.	53
MacDonald Inc., Samuel K.	54
Midwestern Instruments	5
Pacific Automation Products Inc.	28, 29
Radio Corporation of America.	4th Cover
Radio Industry Council.	32
Raytheon Manufacturing Corp.	37
Rocke International Corp.	51
Sungamo Electric Co.	16
San Jose Chamber of Commerce.	14, 15
Scientific Company, Edmund.	54
Southern Screw Company.	10
Sprague Products Co.	12
Stokes Corp., F. J.	49
Texas Instruments Incorporated	25
Trans-World Airlines	4
Tung-Sol Electric Inc.	14
Victory Engineering Corp.	51
Virginia Dept. of Conservation & Development	31
Wales Strippt Corp.	15
Westinghouse Electric Corp.	35
•	
MANUFACTURERS REPRESENTATIVES	54
•	
PROFESSIONAL SERVICES	54
•	
CLASSIFIED ADVERTISING F. J. Eberle, Business Mgr.	
EMPLOYMENT OPPORTUNITIES	55
ADVERTISERS INDEX	
MOTOROLA, INC.	55

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34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77
78	79	80	81	82	83	84	85	86	87	88
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34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77
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APR. 25	MAY 2	MAY 9	MAY 16
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A Viking Fable

When the terrible green monster suddenly appeared alongside the good ship Viking Queen, all hands save one promptly disappeared over the side into the chill waters of the North Atlantic. Only Lief Smorgasbord, radar operator, remained aboard to face the beast.

If we may take a trembling Lief from history, we will follow the conversation that ensued:

Lief (trembling): Why . . . why didn't you show up on my scope?

Monster (in a high, feminine voice): I'm enchanted, that's why! Oh, Mr. Viking, I'm just a poor princess who has been bewitched and transformed into a teen-age she-sea serpent! If you could answer the

Mysterious Riddle, you could break the spell and marry me!

Lief (still trembling): The Mysterious Riddle?

Monster (hopefully): It goes like this.

Heart of that which has no ears, but hears;

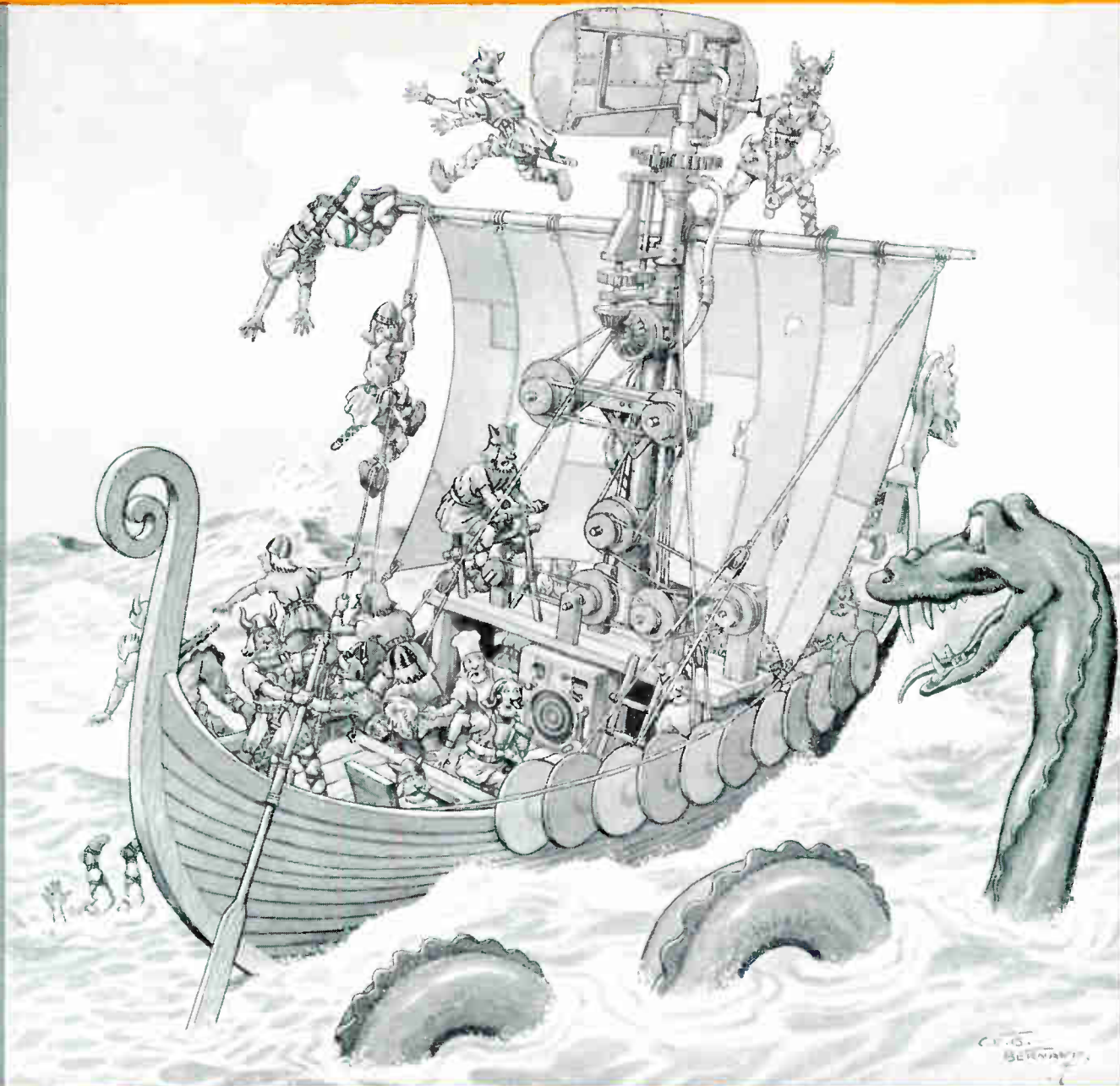
No eyes, but sees; no nose, but knows . . .

Tube B or not Tube B, that is the question!

Lief managed to answer the riddle, breaking the spell and instantly transforming the monster into a lovely princess. And so they were married and lived happily ever after.*

* The single word was "Bomac," of course. Lief knew "Tube B or not Tube B" must refer to Bomac tubes, heart of any radar system ("that which has no ears, but hears, etc.") Smart one, that Smorgasbord.

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