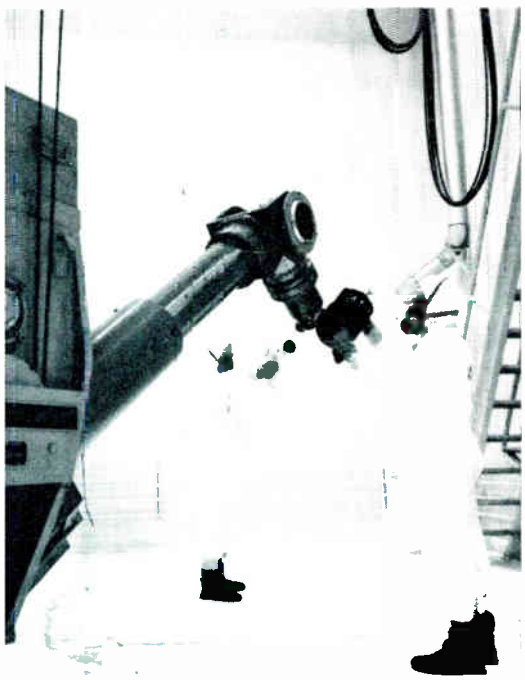
DECEMBER 10, 1957

electronics

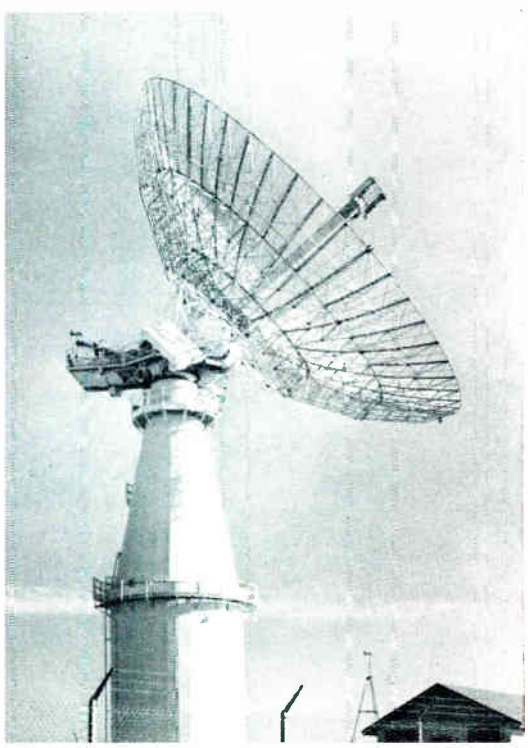
business edition

A McGRAW-HILL PUBLICATION • VOL. 30, NO. 12A • PRICE FIFTY CENTS



Atomic Planes By 1965?

Right now engineers are designing radiation-resistant components . . p 15



Missile Radar Probes Arctic

Northern lights may hold key to defense against ICBM . . . . . p 19

NEW—Raytheon Amplitron

Now—peak power 800 kw, bandwidths of 10% with efficiencies of 50-70% over entire band

QK520 Amplitron
Typical Operation (Pulsed)

Anode Voltage	40 kV
Anode Current	35 amps
Peak Power Output	800 kw
Average Power Output	1200 watts
Efficiency	55%
Operating Band (±1 db)	1225-1350 Mc
Peak Power Input	80 kw
Phase Stability with Anode Current	1°/amp

The Amplitron is a new type of tube capable of power amplification at microwave frequencies. Amplification is obtained over a broad range of frequencies without need of mechanical or electrical adjustments. The Amplitron is a derivative of the magnetron and retains many of its advantages—high operating efficiency, simple construction, small size, light weight, low operating voltage.

The Amplitron uses crossed electric and magnetic fields, a reentrant beam produced by a magnetron-type cathode, and a non-reentrant broadband circuit matched at either end to external circuits.

Variations in anode current or voltage have little effect upon the total phase shift. This results in very low phase pushing and excellent reproduction of the input spectrum even under pulse conditions with slow rise time and ripple. Because of low insertion loss, duplexing may be accomplished at the input rather than the output of the final rf amplifier.

A limited quantity of preliminary literature is now available. To be sure of your copy, write now.

RAYTHEON MANUFACTURING COMPANY

Microwave and Power Tube Operations, Section PT- 11
Waltham 54, Massachusetts

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electronics business edition

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ISSUE AT A GLANCE

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electronics

December, 10, 1957 Vol. 30, No. 12A

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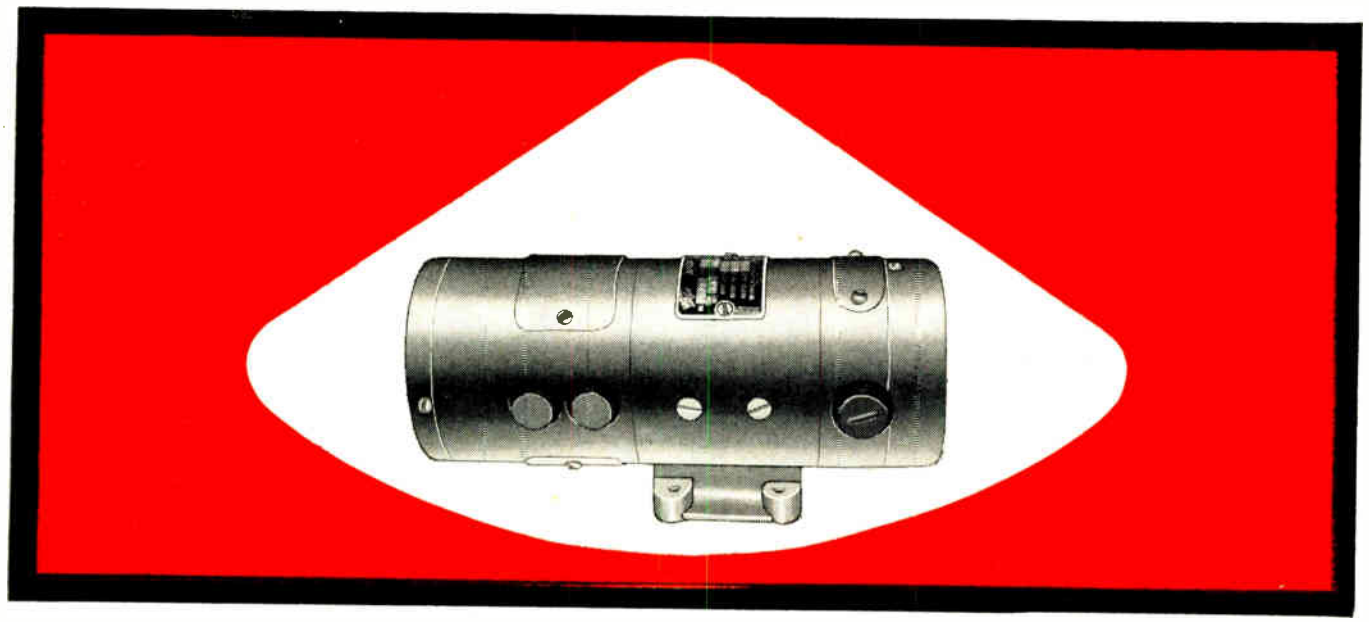
Member ABC and ABP

Case History from the files of the Wincharger Corporation

problem: SUPPLY A SMALLER AND LIGHTER POWER SUPPLY FOR HELICOPTER RADIO AUTOMATIC TUNING



When the Army adopted automatic tuning for helicopter transmitters, it was found that standard alternators and dynamotors—housed and mounted to resist shock and vibration—were too big and heavy for helicopter use.

Wincharger's Research and Development Group was handed the problem of developing a **smaller, lighter** power supply that would furnish the additional power needed to run the equipment—yet stand up under the rugged demands imposed on it.

After extensive study and testing, the Wincharger group integrated the AC power section into a conventional dynamotor. The result was a smaller, lighter **Alterdyne** that provided reliable power, withstood shock and vibration and proved completely satisfactory under actual flight conditions.

If your work requires special purpose power supplies, inverters, alternators, dynamotors, bring your problem to Wincharger's Research and Development Group.

WINCO®

ALTERDYNE BY WINCHARGER

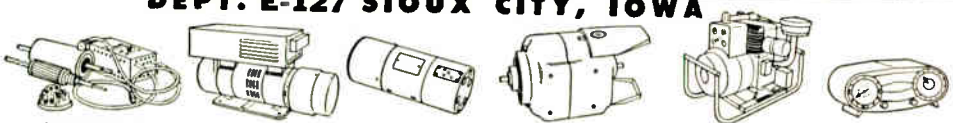
Specifications

Input — Normal 27.5 volts
Output No. 1 — 138 volts D.C. at 140 mils.
Output No. 2 — 310 volts D.C. at 30 mils.
Output No. 3 — 27 volts — 400 cycle AC at 300 mils.
Temperature Range — Minus 40° C to plus 85° C.
Altitude — 20,000 ft.
Duty — Continuous
Max. Weight — 72 oz.
Meets all requirements military specifications — MIL - D-24A

SPECIALISTS IN ELECTRONIC AND ROTARY ELECTRICAL DESIGN AND MANUFACTURE

WINCHARGER CORPORATION

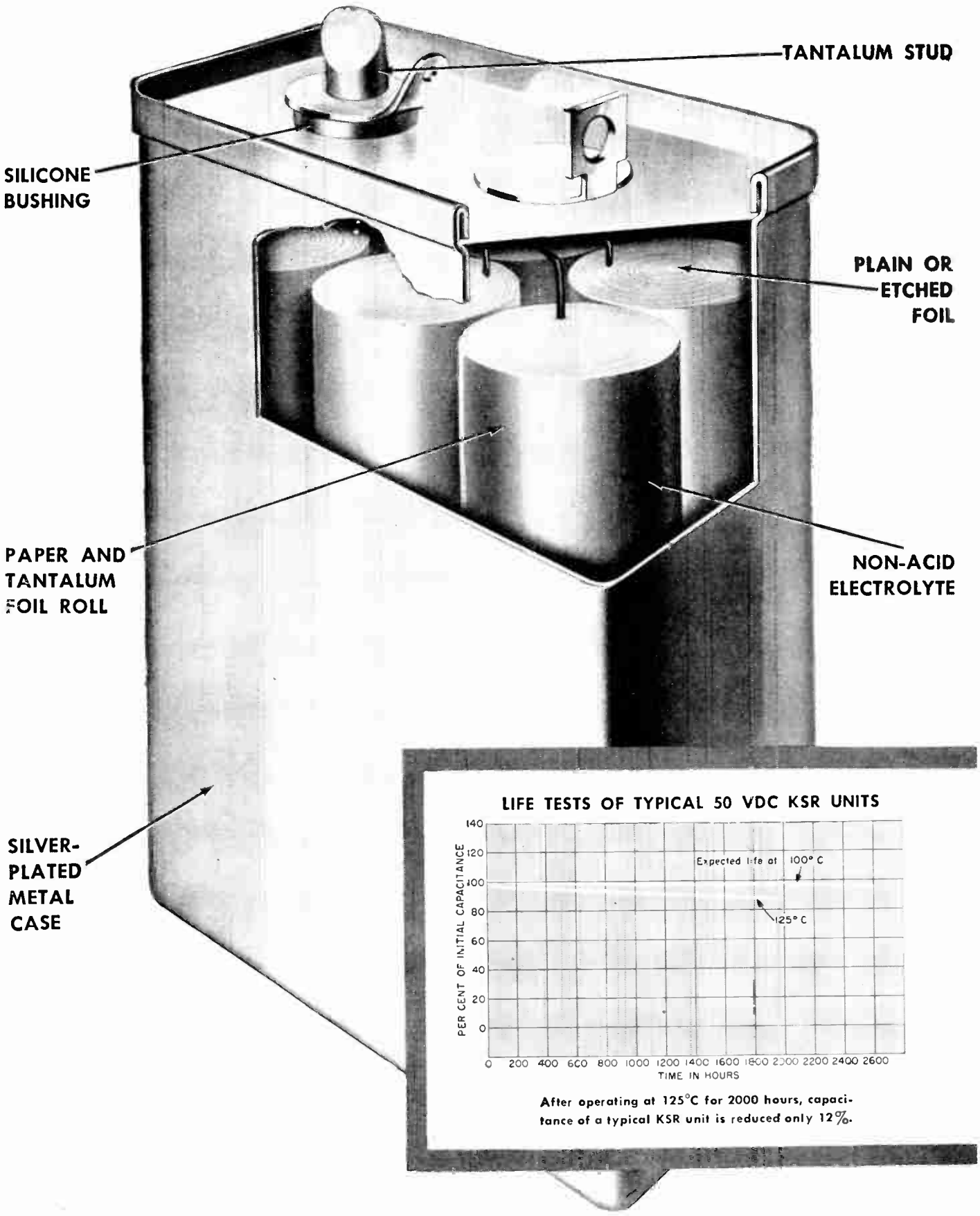
DEPT. E-127 SIOUX CITY, IOWA



ALTERNATORS INVERTERS DYNAMOTORS UNIVERSAL MOTORS ENGINE-GENERATORS RADIOS

A ZENITH *Subsidiary*

General Electric announces . . .



. . new KSR† Tantalytic* Capacitors

KING SIZE RECTANGULAR units offer thousands of microfarads in lighter, smaller cases

Now General Electric offers a completely new Tantalytic capacitor for use in computers, missiles, radar, and airborne electronic equipment—the King Size Rectangular Capacitor. This unit offers more joules per size, weight, and cost than any other tantalum capacitor available.

On a volt-microfarad basis, the new KSR's are 40% lighter, 30% smaller, and 40% less expensive than other 125°C rectangular capacitors. Compared with 125°C cylindrical designs, KSR's may be as much as 50% lighter, 30% smaller, and 15% lower in cost.

Like other General Electric Tantalytic capacitors, the KSR units offer "bulk capacitance," i.e., high volt-microfarads in an extremely small case. Now, one King Size Rectangular capacitor can often be used where several lower rated units were needed before. As a result of this bulk capacitance, costly connections are reduced and extra mounting brackets are eliminated.

† Trade-mark of General Electric Co.

In addition to the great size and weight advantages, the KSR capacitors offer these outstanding features:

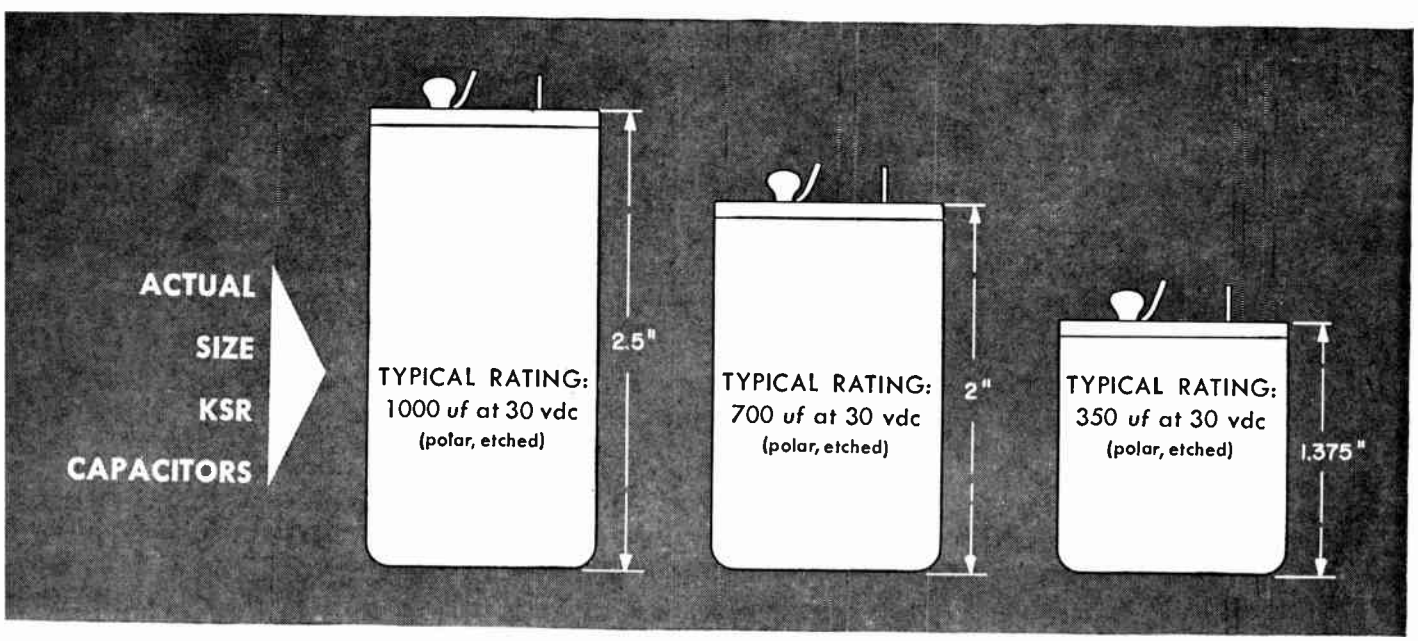
- **High reliability from −55°C to +125°C.**
- **Polar or non-polar construction; plain or etched foil.**
- **Long operating life at 125°C; extra long life at 85°C.**
- **Excellent shock and vibration characteristics.**
- **Non-acid electrolyte for long shelf life.**
- **Dual temperature and voltage ratings.**

KSR Tantalytic capacitors are now available in three case sizes: 1.375 inches, 2 inches, and 2.5 inches in height. All three have the same base size: 1.316 inches by .75 inch. For more information on these new capacitors or for assistance with your capacitor applications, contact your General Electric Apparatus Sales Office. Or write to General Electric Co., Section 449-1, Schenectady, N.Y.

* Registered trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC



glass-base laminates?

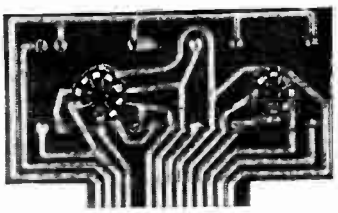
C-D-F DILECTO®
is the answer!

Teflon*, silicone, epoxy, melamine, and phenolic glass-fabric laminates. Polyester glass-mat laminates.

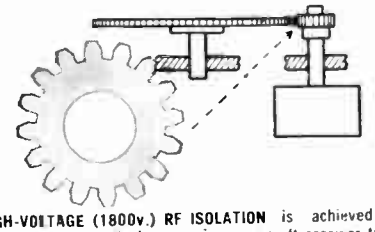
You can improve design, speed production, and save money by specifying one of the many C-D-F Dilecto grades. Whatever your application for these laminates — with fine- or medium-weave glass-cloth base — you'll find a better answer to your problem at C-D-F. (Melamine can also be made with glass-mat base.) And C-D-F offers modern machining and fabrication facilities to deliver production quantities of finished Dilecto parts to your specifications.

See our catalog in Sweet's Product Design File, where the phone number of your nearby C-D-F sales engineer is listed. For free trial samples of glass-base Dilecto, or of any other C-D-F plastics, mica, or fibre product, send us your print or your problem! Write for your free copy of C-D-F Technical Bulletin 64.

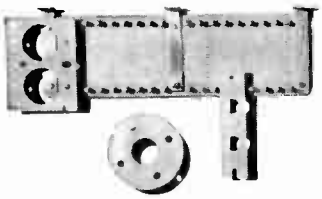
*DUPONT TRADEMARK FOR TETRAFLUOROETHYLENE RESIN



SPEED AUTOMATIC PRODUCTION of printed circuits with warp-resistant C-D-F metal-clad Teflon* and epoxy laminates. Other advantages: high bond strength of copper to laminate, superior blister-resistance in solder immersion.



HIGH-VOLTAGE (1800v.) RF ISOLATION is achieved by miniature C-D-F Dilecto gears in an aircraft receiver-transmitter switch. They also had to exhibit dimensional stability through a wide temperature range, resistance to fungus growth and thermal shock.



PRECISE MACHINING AND FABRICATION are standard benefits of Dilecto laminated plastics. These silicone glass-base parts (coil mountings, aircraft terminal board) were sawed, drilled, punched, and milled in production quantities by C-D-F and customer.

PROPERTIES OF SOME TYPICAL C-D-F DILECTO GLASS-BASE GRADES

Grade	Equivalent NEMA or ASTM grade	Flexural Strength Lengthwise (PSI)	Dissipation Factor at 10^{6} Cond. A	Dielectric Strength Parallel Step x step	Insulation Resistance Canc. C96/35/90	Arc Resistance (seconds)	Maximum Operating Temp. (°C.)
GB-112T (Teflon*)	None	14,000	0.0015	65	100,000	180+	250
GB-12S (Silicone)	G-7	28,000	0.002	60	100,000	180+	200
GB-28E (Epoxy)	G-10	70,000	0.019	65	75,000	130	150
GB-28EFR (Flame-Retardant Epoxy)	G-10	68,000	0.010	65	100,000	180	150
GB-28M (Melamine)	G-5	50,000	0.014	50	100	185	135
GB-261D (Phenalic)	G-1 and G-2	22,000	0.020	55	10,000	5	150
GM-PE (Polyester)	GPO-1	35,000	0.020	70	200	130	150

These are typical grades for typical applications. To meet special requirements, C-D-F makes many other Dilecto grades, one of which may serve your purpose better than any of these listed here. Consult the C-D-F Technical Department for expert assistance with your design problem involving laminated plastics products.

CDF

CONTINENTAL-DIAMOND FIBRE

A SUBSIDIARY OF THE Budd COMPANY • NEWARK 16, DELAWARE

Yields Lure Investors

Drop in stock market prices creates new opportunity for investors in electronic stocks

FALLING STOCK prices have created a new opportunity for investors in electronic stocks—to participate in tomorrow's growth while getting high dividend yields today.

Dividend yields (ratio of annual cash dividend payment to market price) of many electronic stocks now favorably compare with yields of soap, cigarette, chain store, utility and other high-yielding stocks.

Average yield of all stocks at mid-November was 4.4 percent. Yields on eight of sixteen dividend paying electronic stocks tabulated below equalled or exceeded this average. Seven of the firms were yielding five percent or more. One stock in the group was yielding more than eight percent.

This group is by no means typical of the electronics industry as most firms only pay stock dividends or no dividends at all. Others, like two shown in the table, still yield only nominal returns on current prices. Nevertheless, there are many others in the industry yielding as much or more as those used to illustrate this article.

Future price movements of high-yielding dividend paying electronic stocks are worth watching.

Market experts feel that increasing numbers of investors are being attracted to the high yields obtainable at today's low stock prices.

Company	Dividend Payments [1]	Price (At Mid-July)	Yield (At Mid-July)	Price (At Mid-November)	Yield (At Mid-November)
American Bosch Arma	1.00	21⅞	4.6	20	5.0
Bendix Aviation	2.40	56¾	4.2	47¾	5.0
Con. Electrodynamics	0.40	49⅞	0.8	26½	1.5
Cornell-Dubilier	1.20	21¼	5.1	14¾	8.1
Daystrom	1.20	44¼	2.7	33½	3.6
Hazeltine	1.40	39¼	3.6	34½	4.0
General Dynamics	2.00	59	3.4	55⅜	3.6
Hoffman Electronics	1.00	24	4.2	19⅛	5.2
IBM	2.40	353	0.7	239½	0.8
International Resistance	0.20	4⅞	4.1	4¾	4.2
Magnavox	1.50	42¼	3.5	31⅜	4.8
Mallory (PR)	1.40	43¾	3.2	28⅞	5.0
Motorola	1.50	48⅜	3.1	42½	3.5
RCA	1.50	37⅝	4.0	28⅝	5.2
Servomechanisms	0.40	10⅝	3.8	7⅝	5.2
Sperry Rand	0.80	25¼	3.2	18¾	4.3

[1] Cash dividends paid or expected in 1957

SHARES and PRICES

SILICON rectifier business is experiencing sharp growth because of increasing demand by industrial and military users for small-size components that can withstand high temperatures. General Instrument, one of the leading manufacturers, got started on this line two years ago because of its attractive prospects. General Transistor says that it will begin production of silicon rectifiers early in 1958. Beginning with this issue, Shares and Prices compares latest reported earnings with those of the same period in the preceding year. Previous practice had been to compare latest earnings with those of the full preceding year.

Typical Silicon Rectifier Manufacturers	Recent Price	Indicated Dividend Rate	Percent Yield	Earned Per Common Share 1957	Period	1956	Traded	1957 Price Range
General Electric	59	2.00	3.4	2.10	(9 mos)	1.85	NYSE	52⅜–72⅜
General Instrument	5	0.45	9.0	0.18	(6 mos)	0.03	NYSE	4 – 8⅛
General Transistor	19⅝	....	....	0.43	(6 mos)	0.43	ASE	8¾–30
Motorola	42½	1.50	3.5	2.76	(9 mos)	2.49	NYSE	35¾–51¾
Raytheon	18⅝	....	....	1.75	(6 mos)	[1]	NYSE	16⅜–23¾
Texas Instruments	22	....	....	0.29	(9 mos)	0.14	NYSE	15⅞–31½
Van Norman Industries	5⅛	0.20	3.9	....	(9 mos)	0.72	NYSE	5 –13½
Westinghouse Electric	57¾	2.00	3.5	2.83	(9 mos)	d–0.17	NYSE	52⅜–68⅝

[1] Not comparable because of change in reporting period

Most Firms Small

66.5% in electronics fit in U. S. small business class

MERGERS, acquisitions and internal growth have been building bigger electronic firms for many years.

But, ours today is still largely a small business industry, according to a survey by the Electronics Industries Association.

Two-thirds of EIA's electronic manufacturer members are small business by government procurement standards. For procurement set-aside purposes the government considers a company small if it employs less than 500 persons and is not dominant in its field.

Large companies, with more than 1,000 employees each, represent 25 percent of all firms in the industry. Smallest group of electronic firms is the medium-sized one which represents only 8.5 percent of the total.

Average number of employees in the small business group is 133. Average of the large firms exceeds 15,000, while average of the medium-sized is 700.

The survey also found that most electronic plants are small, even larger company ones. About 72 percent of plants operated by medium-sized firms and 43 percent of those operated by large firms had fewer than 500 employees.

To Uncle: RSVP

NOVEL PLAN for by-passing the money squeeze resulting from the Defense Department's policy of not paying its bills on time has been devised by Elton Barrett, president of C.G.S. Laboratories, Stamford, Conn.

Barrett recently sent the following telegram to the Collector of Internal Revenue:

"Money due us from Department of Defense being held up. Request ruling whether we can assign accounts receivable due from U.S. Government in payment of taxes due to U.S. Government."

Unfortunately, the tax collector has not replied.

One member of the industry doubts that he ever will. However, the member suggests that companies unable to borrow money from banks to tide them over may find that late payment of taxes is advantageous. The penalty for late payment, he points out, is only six percent. Bank money would cost as much or more.

MERGERS, ACQUISITIONS and FINANCE

• **Sheaffer Pen** purchases **Maico Company,** Minneapolis manufacturer of hearing aids and devices. Maico will operate as a Sheaffer subsidiary under the name of **Maico Electronics, Inc.**

• **Telecomputing** completes merger with **Wm. R. Whittaker Co.** Both firms are in the Los Angeles area. Principal products of Telecomputing, the surviving corporation, now include computing equipment, gyroscopes, missile components, nuclear test equipment, and aircraft and missile valves and controls.

• **National Credit Office** reports that first-half sales of 20 leading electronic component manufacturers increased six percent in 1957 while earnings gained 29 percent. Sales of the firms increased from $255.5 million in the first six months of 1956 to $271.9 million in the same period of 1957. Earnings expanded from $9.3 million to $12 million.

• **Perkin-Elmer,** Norwalk, Conn. sells 75,000 shares of common stock at $20 a share. About $500,000 of proceeds will be applied toward the cost of new plant facilities and $200,000 will go for cost of new equipment. Perkin-Elmer manufacturers scientific instruments for use in laboratory analysis and plant process control. It also makes optical systems and elements and electronic components.

• **American Nuclear Power Associates** formed by **Raytheon, Clark Bros.** division of **Dresser Operations, Griscom Russell** subsidiary of **General Precision, Rockland Light and Power** of Nyack, N. Y., and **Burns and Roe,** New York City architect-engineers. The group plans to create the initial design of a new high-temperature, high-performance nuclear power plant. The plant is a necessary forerunner to economically competitive nuclear power, the group claims. The power plant will be based on Raytheon's liquid metal fuel-gas cooled reactor concept.

• **Gabriel Company,** Cleveland, Ohio, reports that it is continuing efforts to acquire a medium-size company in the aircraft, electronics and missile hydraulic field on the West Coast. The effort is part of Gabriel's diversification program.

• **Frank Proctor & Associates** of New York City acquires majority interest in **Dumont Airplane & Marine Instruments,** Clearfield, Pa. A program of expansion for Dumont is planned with greater emphasis on consumer and industrial production. Dumont will also strengthen its position by a program of acquisitions of businesses in allied fields. One of its two divisions makes radio and tv capacitors. The other is active in sonar development and makes high-precision electronic devices. Frank Proctor is an industrial investment organization specializing in acquisitions.

TRANSISTORS HERE?

Management executives are asking themselves, and others, "can my business use transistors?" In order to arrive at a practical answer, a knowledge is necessary of what this latest electronic "miracle" does.

A transistor is a miniature semi-conductor which is extremely reliable and features extended life. These small rugged units are easy to store, and handle. Present complex circuits involving many conventional components can be reduced with the use of transistors, thus effecting substantial savings both in material and assembly time. Initial cost of transistors is lower than some comparable conventional components.

The replacement of vacuum tubes is thought of as the present function of transistors . . . but this is only one segment of the broad application possibilities.

The following list of applications, in diversified industries, is an indication of where transistors can be used:

GENERAL TRANSISTORIZED DEVICES

FUEL INJECTION SYSTEM IN AUTOMOBILES
ELECTRONIC-EYE BURGLAR ALARM
COMPLEX COMPUTERS
NEWLY DEVELOPED HOUSEHOLD APPLIANCES
IMPROVED DEVICES IN THE COMMUNICATION INDUSTRY
LOW POWER APPLICATIONS IN THE TOY INDUSTRY
DEVELOPMENTS IN THE TRANSPORTATION INDUSTRY
COMPLEX CIRCUITS OF CONTROL EQUIPMENT AND SYSTEMS IN THE PROCESSING INDUSTRIES

If you are administrative or technical management, you'll want to know the answer to make your business more profitable . . . write today for technical information to pass on to your engineers.

GENERAL TRANSISTOR
CORPORATION

"THE FASTEST GROWING NAME IN TRANSISTORS"

91-27 138TH PLACE
JAMAICA 35, NEW YORK

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WASHINGTON OUTLOOK

SENATE inquiry into the missile program, under Majority Leader Lyndon B. Johnson's direction, is giving scientific leaders the best sounding board they've ever had to air their views of how science should be put to work for national security.

The highly publicized testimony of men like Edward Teller and Vannevar Bush—calling for faster development schedules for missile projects, increased military research spending and action to bolster scientific education—will have an impact. It fits into Washington's new atmosphere in which the role of scientific research has been raised to a position never reached even during the gloomiest and darkest days of World War II.

Washington's new mood is already clear in the Pentagon's plan to boost spending for basic research in the physical sciences from roughly $85 million this year to almost double this in fiscal 1959, beginning next July 1. However, as this issue goes to press, the plan hasn't yet been spelled out in detail.

- **The military budget** which goes to Congress next month will not outline in full detail how the overall money increase is to be earmarked (See p 117).

  The big decisions will be made next fall, when the Pentagon's comptroller and the Budget Bureau dole out sums from the congressional fiscal 1959 appropriation to the military services for specific contract awards.

  Congress will vote money for general categories—such as research and development, aircraft and missile buying and the like. During the appropriations hearings, the Pentagon will give the overall picture. This will be based on preliminary decisions on matters such as future orders for Boeing B-52 heavy bombers, production schedules for Convair's new supersonic B-58 medium bomber and production plans for long-range ballistic missiles.

  One basic controversy is if or when should piloted aircraft be scrapped in favor of guided missiles? Meantime, the Defense Department is getting ready to push up operational target dates for ballistic missiles, increase SAC base dispersal, beef up radar warning lines and boost the salaries being paid to military technicians.

  One big rhubarb of interest to many companies and hundreds of executives in the electronics industry is whether the Air Force or Army should control planes and missiles over tactical combat areas.

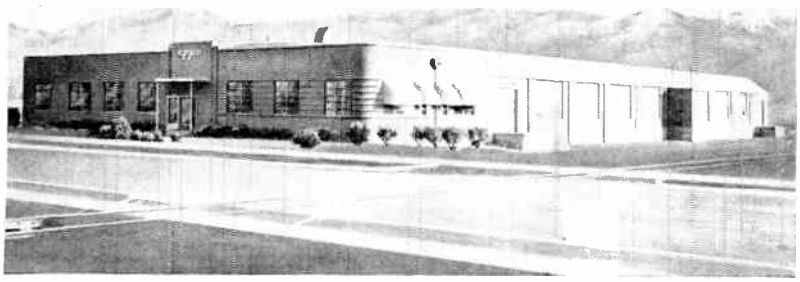
- **Latest twist** in the administration's post-*Sputnik* backtrack is the Pentagon's decision to (1) start volume production of an IRBM within the next 12 months and (2) start building an ICBM launching site at Francis E. Warren Air Force Base, near Cheyenne, Wyo.

  At press time, the Air Force's Thor IRBM was definitely set for volume production. There was talk, too, that the Army's competing Jupiter IRBM will also be pushed into production as a "back-up" project. (Ed. note: This has just been done.)

SYNCHRO NEWS

CLIFTON HEIGHTS, PA. DECEMBER 1957 Vol. 1 No. 1

CLIFTON PRECISION ANNOUNCES NEW WESTERN DIVISION



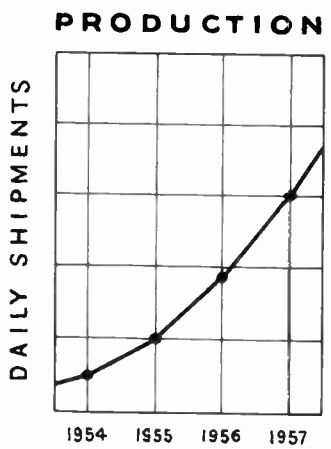
New Clifton Precision plant at Colorado Springs, Colorado

ONLY OUTSTANDING PERFORMANCE MAKES GROWTH LIKE THIS POSSIBLE

Today shipments of CPPC rotary components are running 4 times the rate of two and a half years ago (see chart).

The new facility will permit a further 100% increase in rate of shipments.

Only outstanding performance makes growth like this possible. CPPC synchros have provided highest accuracy and reliability in the least bulk and weight.



Colorado Springs Area Named

Production Capacity Doubled

Clifton Heights, Pa., November 4, 1957—Clifton Precision Products Co., Inc. today announced completion of arrangements for the purchase of a 33,000 sq. ft. plant at Colorado Springs, Colorado. The plant will approximately double the Company's capacity to produce synchros and electro-mechanical components for aircraft and missile instrumentation, guidance and control.

The new plant, which is situated on 13 acres of land at the foot of the Rocky Mountains, is presently being equipped and will be in production shortly.

Clifton Precision is a leading independent manufacturer of synchros, servo motors and all types of rotary components for airborne electronic equipment. The Company has specialized in sub miniature, high accuracy units.

EXECUTIVES IN THE NEWS

Fink: particular talent . . .

JUST TWELVE days after his 46th birthday (on Nov. 20), Donald Glen Fink was elected president of the Institute of Radio Engineers. Although he will not take office until January, he is already stepping up his activity with the professional fraternity.

Fink, who has been research director for Philco consumer products since 1952, was for many years identified with ELECTRONICS. He came to this magazine in 1934, a year after his graduation from MIT, and became its editor-in-chief in 1946. Associates think of him as a "fine engineer"—and an exceptionally articulate one.

Washington has made good use of his particular talent for both understanding technology and explaining it. He was an expert consultant on radar for the Secretary of War, worked on the Crossroads tests at Bikini. Later he served in an advisory capacity to the Departments of Defense and State, now sits on the Army Scientific Advisory Panel.

Pragmatist Fink thinks that it is in research—"the initial function," he calls it—that brains can make a larger contribution to a development effort than money. "I do not feel," he adds drily "that research is the end of the road." About the industry, the new IRE president is optimistic, thinks "we will have to be more selective in military work, put our money and manpower where it counts most."

Nine years ago, he married mathematician Alice Berry, whom he met in 1947 at the underwater sound labs in New London, Conn. They have one boy and two girls.

Fink reads a lot (Churchill's *History* being the most recent project), enjoys serious organ music, still keeps a schedule on ham station W3TVI, likes to swim. Up until recently he spent a lot of time writing: he's written 10 books, is still editor of its Proceedings.

COMMENT

Quality Hunt

If the gauntlet thrown down against statistical quality control ("Quality Hunt Gets Hot," Oct. 10, p 21) is really based on the indicated level of misunderstanding in the electronics industry, the "confusion among electronic buyers and sellers" must indeed be magnificent.

Someone does not like attribute

judgment applied to partial malfunction: this may be a sensible opinion in some cases. Nor is he in favor of an item standard which calls the good unit (e.g. one-time tube malfunction) a reject: few people are. But the solution: a sliding tolerance system! This appears to apply some elastic item standard for dimensions, electrical characteristics, etc.—perhaps something that can be stretched to accept anything coming off the line.

Acceptance Quality Levels and the accompanying sampling plans in MIL STD 105A are *not* item standards; they are lot quality standards for use in conjunction with attribute item standards where attribute inspection is applicable. Where it is not, there are lot quality standards available for application to inspection by variables or on a continuing line.

"Time to failure" and "acceptable malfunction rate" may each be a peculiarly valid measure of the acceptability of an electronic item. They will not avoid the fact, however, that acceptance of any quantity production must be on a lot basis, to which lot quality standards are inevitably applicable. This is as inescapable as the proverbial death and taxes.

H. H. Meeker, Jr.
U. S. Naval Ammunition Depot 66
c/o FPO San Francisco

Our article neither expressed nor implied that we were talking about item standards, and we're sorry Reader Meeker took us wrong. Sliding tolerances as described in our article would be unique only in that they would be mutually understood by both buyer and seller.

More Sputnik

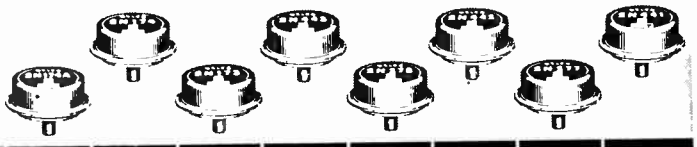
Re the first sound of *Sputnik* (Letters, Nov. 10, p 17) WERF was 'way behind in getting the sound. Here in Atlanta I picked up *Sputnik* at 8:15 p.m. EST on Oct. 4 (Friday), fed it directly over the phone to local WSB for taping and re-broadcast throughout the evening.

Can anyone top this?

Robert S. Duggan Jr.
Atlanta, Georgia

DELCO'S FAMILY OF HIGH POWER TRANSISTORS

Typical Characteristics at 25°C



	DT100	**2N174A	2N174	2N173	2N443	2N278	2N442	2N277	2N441
Maximum Collector Current	13	13	13	13	13	13	13	13	13 amps
Maximum Collector Voltage (Emitter Open)	100	80	80	60	60	50	50	40	40 volts
Saturation Voltage (13 amp.)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7 volts
Max. Square Wave Power Output at 400 ~ P-P*	400	310	310	225	225	180	180	135	135 watts
Max. Sine Wave Power Output at 400 ~ P-P*	180	140	140	100	100	80	80	60	60 watts
Power Dissipation (Stud Temperature 25°C)	70	70	70	70	55	55	55	55	55 watts
Thermal Gradient from Junction to Mounting Base	1.0°	1.0°	1.0°	1.0°	1.2°	1.2°	1.2°	1.2°	1.2° °C/watt
Nominal Base Current I_B (V_{EC} = —2 volts, I_C = —1.2 amp.)	-19	-19	-19	-13	-24	-13	-24	-13	-27 ma

*Adequate Heat Sink

** Designed to meet MIL-T-19500/13 (USAF) 18 JUNE 1957

Offer a wide range of performance characteristics to meet your switching, regulation or power supply requirements

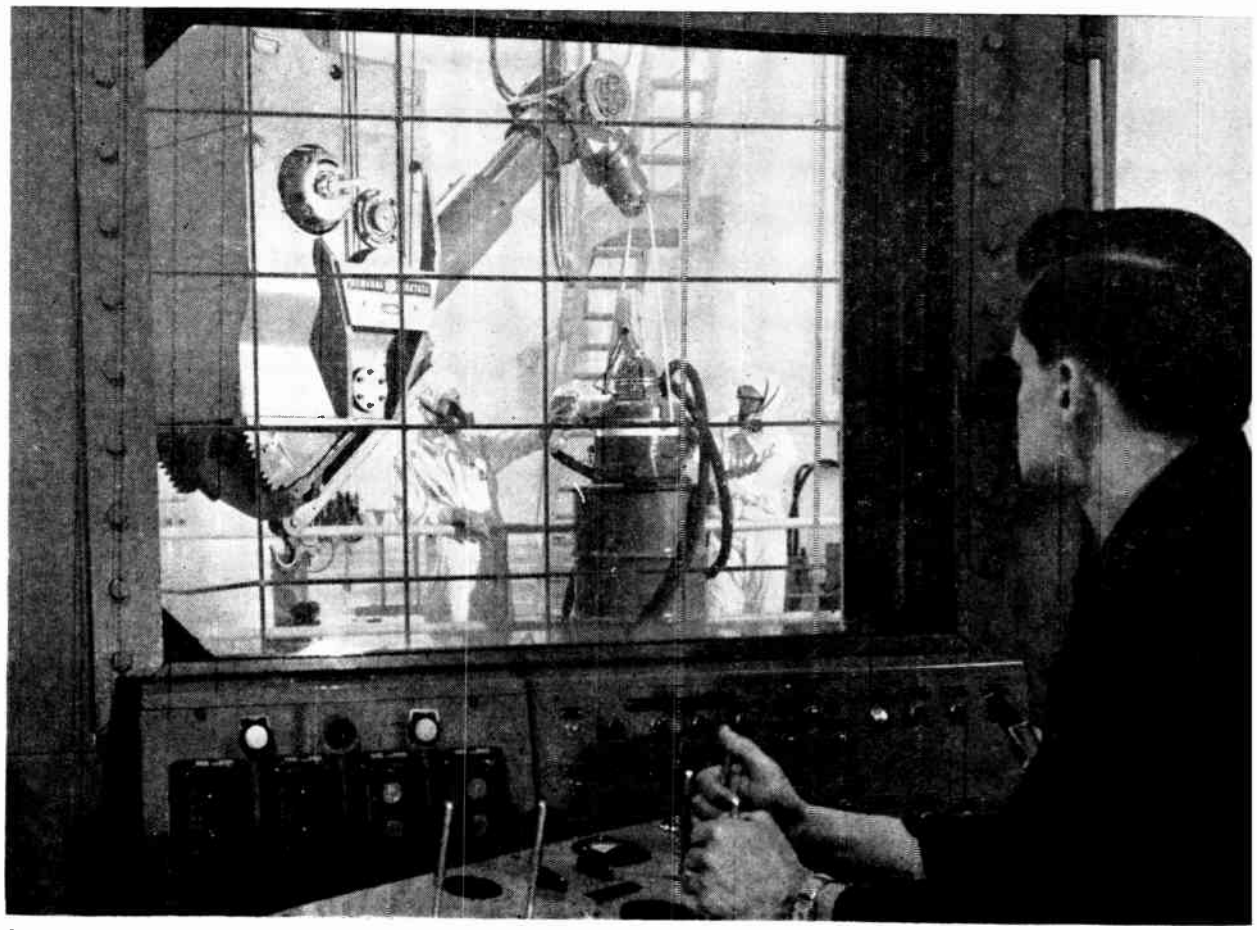
These nine Delco Radio alloy junction germanium PNP power transistors are now in volume production. They are characterized by high output power, high gain, and low distortion. And all are normalized to retain superior performance characteristics regardless of age.

Check the data chart above—see how they fit your particular requirements in current switching, regulation or power supply. Write for detailed information and engineering data. Delco Radio maintains offices in Newark, N. J. and Santa Monica, Calif. for your convenience.

DELCO RADIO
Division of General Motors
Kokomo, Indiana

electronics
business edition

DECEMBER 10, 1957



Giant master-slave manipulator at work in nuclear aircraft engine "hot shop" operated by GE for AEC. Radio and closed tv aid development work and 3-D color tv is planned

Atomic Planes in 1965?

"The Russians will follow their ICBM and satellite successes with the first nuclear aircraft, further harming our world political position . . . . . "

Congressman Melvin Price, Chairman, R&D Subcommittee, House Atomic Energy Committee

PROSPECTS of aircraft nuclear propulsion are bringing a new kind of technology to our industry. The big questions this week: when do we go into production and what do we produce?

Official sources say target dates are classified. *Aviation Week*, a McGraw-Hill publication, says that the Air Force has a schedule which calls for flight in the mid-1960's.

Total Air Force spending is reported to be $200 million a year, half of the fiscal 1958 request. The

Atomic Energy Commission spent $86.7 million on aircraft reactor development in fiscal 1957.

Recent events indicate the timetable may be speeded up. Department of Defense and AEC agreed to place their projects under a joint head, Maj. Gen. D. J. Keirn, of the Air Force. Newest indications are that the first atomic plane may be a modified jet plane. R&D under the present timetable called for a special new plane.

The military value of planes with vast ranges is well-recognized. Such ranges are advocated for strategic bombers and Naval patrol planes.

Some officials see great political urgency today. They fear the psychological and propaganda advantage Russia would gain by being first.

The US-USSR race is apparently close. AEC reported last fall that a turbojet laboratory engine was run on nuclear heat. Reports of Russian engine model tests were heard last spring.

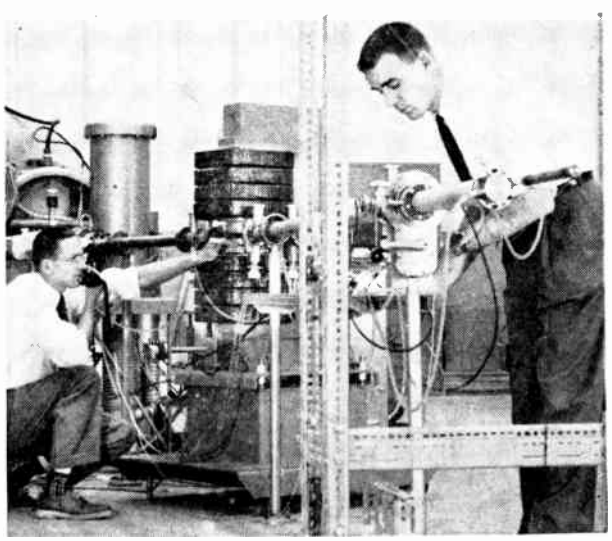
Congressman Melvin Price, R&D subcommittee chairman of Congress' atomic energy committee, made these points during a recent interview with ELECTRONICS:

He predicted the Russians would follow their ICBM and satellite successes with the first nuclear aircraft, further harming our world political position.

He criticized the limitation of funds and said that "the figure has been reduced since initial budget considerations this year."

Too many study committees, he says, are delaying progress. He thinks we should have two goals: get a plane up fast while still aiming ultimately at the best for later.

The fragments of unclassified information indicate that we have turned some important corners. Construction of full-scale ground facilities has begun and will be ready in two years.



Engineers use particle accelerator at Lockheed in study of radiation problems facing nuclear aircraft

AEC spending for aircraft reactor development and construction has pulled ahead of AEC's biggest outlays for naval reactors. Studies of nuclear rockets and ramjets have begun.

One ARDC officer says there has been no decision on what kind of plane to build (subsonic, supersonic, high or low-flying) and, hence, no "finalized schedule."

Specific electronic equipment design must also wait on that decision, he says, but there have been extensive studies and some development work in radiation tolerant components and systems. A number of reports on this work are being published.

Weight considerations will limit full radiation shielding to the crew quarters. A large proportion of the plane and its reactor and flight instrumentation will have a radiation environment.

Since no material is immune to radiation, people in charge of electronic development do not expect any great breakthrough in materials. "What we need," one jokes, "is a bucket of electrons to stop gamma rays."

The trick is to build components that will withstand radiation for a usable period, or components whose values change to a known and compensable degree under radiation.

A good rule of thumb is to test components first at 500 C and then in a reactor. GE has operated metal-ceramic circuits at 845 C, in radiation, for over 1,000 hours. Servomechanisms is using vacuum evaporation to make components of otherwise unworkable materials.

Other firms reported engaged in electronic research or development include Admiral, Cook Laboratories, Hughes, Magnetics, Motorola, RCA and Stromberg-Carlson; Convair, Lockheed, Boeing, North American on aircraft; GE, Pratt and Whitney on engines.

ARDC last May hired Battelle Memorial Institute to gather and collate all data on radiation effects relating to nuclear aircraft, for use of authorized agencies and contractors. Battelle will also advise on gaps and duplications in the R&D effort.

The first two in a series of semiannual symposiums on radiation effects, sponsored by ARDC and its contractors, were held this May and October. Navy, Army, authorized researchers were also among those in attendance.

Reactor control and remote repair guidance equipment will be added to standard aircraft instruments. Reliability, ARDC says, will be a greater problem in planes staying aloft many days. Spares may be essential in order to allow extensive maintenance in flight.

Military: The Chill Is Off

Last Friday's Vanguard catastrophe puts even more heat on this country's military missile and satellite development programs

Electronics share of annual military dollars is slated to exceed $4 billion, with speeded ballistic missile development underway

EXPLOSION and fire that destroyed Navy's satellite-carrying Vanguard rocket on its launching pad Friday will put the heat on missile and rocket developers for months to come.

Even a successful firing of the Army's Jupiter C rocket (see p. 42) would do little to restore national prestige already tarnished by two successful Soviet satellite launchings.

This much is for sure: The prolonged squeeze on defense expenditures is at an end. Plans for stepped up spending are the order of the day. For our industry the impact boils down to this:

Quantity production of inertial guidance systems, controls, and electronic ground-handling equipment for intermediate-range ballistic missiles will now be scheduled sooner and in larger volume than originally planned.

Development will now be speeded up for long-range radar for ballistic missile defense systems, anti-submarine detection devices, and electronic gear tied to the intercontinental ballistic missile projects.

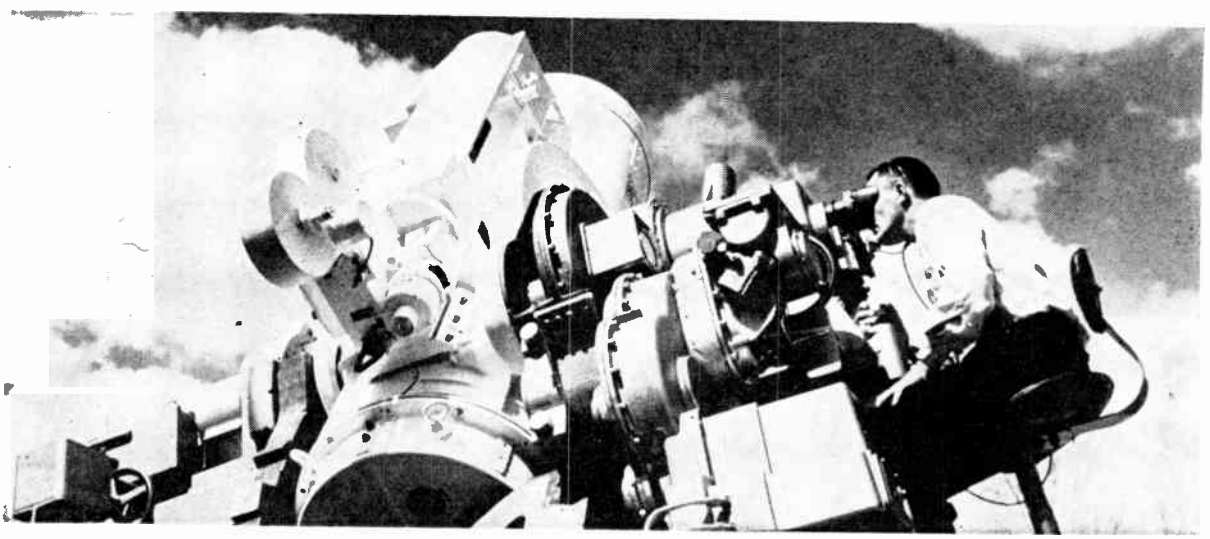
Applied research efforts will now be increased in such fields as electromagnetic propagation and detection, and data-processing and computing systems.

Until the turnaround, many Pentagon officials had been predicting a fairly stable rate of expenditures for military electronic equipment in the near future. The current level of deliveries is running at an annual rate between $3.5 billion and $4 billion, including aircraft and missile electronic systems and components.

Now the outlook is for a steadily rising rate of expenditures for electronics.

But the spending hikes will be exceedingly selective. Administration spokesmen emphasize that there'll be new production cuts or stretchouts to offset some of the increased spending. It's likely that some producers of electronic equipment for manned tactical and fighter-interceptor planes, ground communication gear, shorter-range radar, and the like will be hit.

In recent weeks, there's been an intensifying



Tubes Guide Missile Telescope

Electronically guided telescope at Melbourne, Fla. photographs missiles launched from AFMTC, Cape Canaveral, Fla. during the first several hundred miles of flight. Designed and built by Perkin-Elmer, the ROTI Mark 11 (Recording Optical Tracking Instrument) has a 500-in. focal length, weighs 8 tons.

Washington reaction to Sputnik: the unloosening of old budget restrictions of missiles and basic research, the move to pool weapon development in NATO, the appointment of MIT's James R. Killian as the President's special assistant to spearhead increased federal participation in scientific research, the overhaul of Pentagon missile management (see *Washington Outlook*, p. 10).

Meanwhile, the military budget for fiscal 1959 is shaping up. The Pentagon has abandoned all pretense of sticking to its overall $38 billion expenditure ceiling for fiscal year 1958, which comes to a close June 30, 1958.

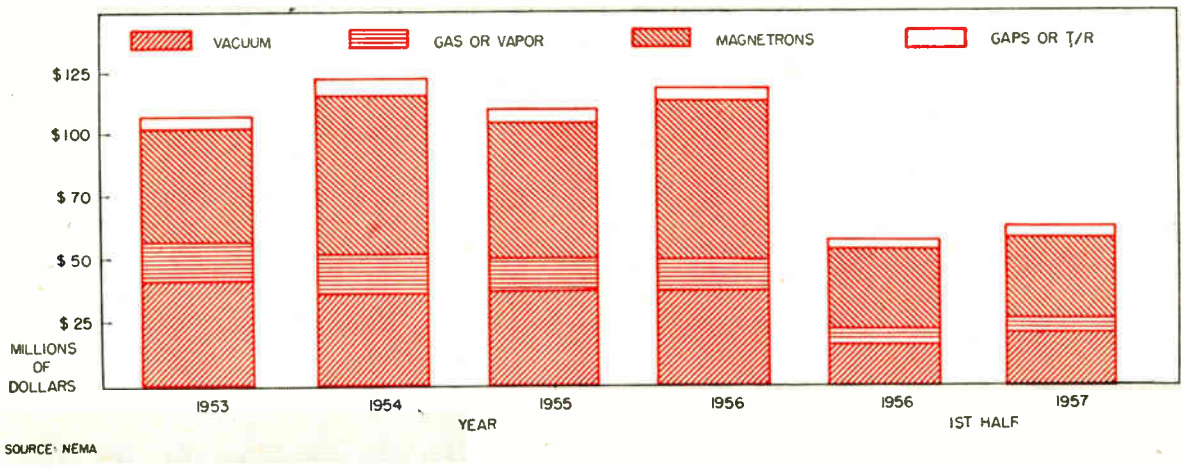
A $200 million military budget hike for January-June 1958 is in the works, taking more heat off major aircraft and missile projects, previously in line for new stretchouts. Some of this money will, of course, go to electronics firms.

Coming on top of the $400 million budget hike allowed for July-December 1957 spending, the latest figure for this year's overall defense expenditures now comes to $38.6 billion—$600 million over the administration's original ceiling but still some $2 billion over the spending level at the time the budget squeeze began earlier in the year.

As ELECTRONICS went to press, Pentagon consensus was that fiscal 1959 spending will total about $39 billion—only some $400 million over this year. But requests for new appropriations seemed headed for $40 billion, $2 billion over the administration's pre-Sputnik budget plans. Administration insiders predict annual spending boosts of about $1.5 billion over the next three years.

More of these defense dollars will go for electronic equipment and components. During October to next June, total value of military procurement contracts to be let will be about $14 billion—roughly the same amount awarded during all of fiscal 1957. In fiscal 1959, the value of new contract awards will rise substantially for the first time in two years.

PRODUCTION and SALES



Industrial Tube Sales Climb 11%

INDUSTRIAL tube sales in the first six months of 1957 were 11 percent ahead of the same period for 1956. Sales for the first half of this year were $63.0 million compared with $56.9 million for the first half of 1956, reports the National Electrical Manufacturers Association.

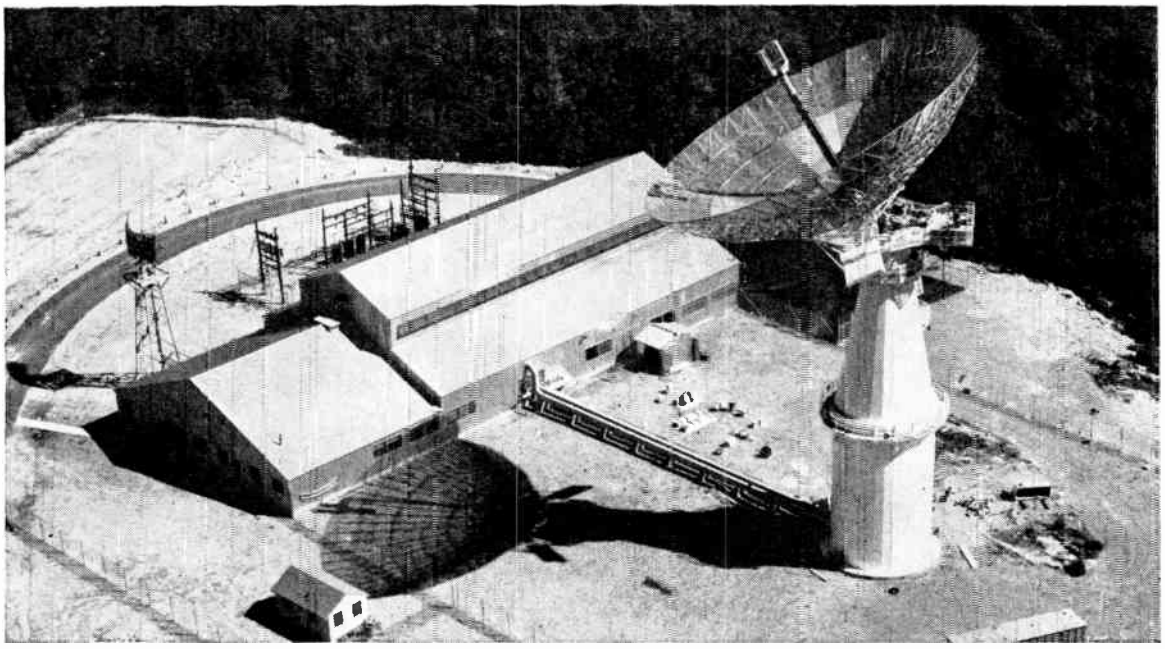
Magnetrons, with sales of $32.5 million, led tube type sales in the 1957 half. Second place went to vacuum tubes with sales of $21.4 million. Remainder was divided between gas or vapor types with sales of $6.1 million and gaps or T/R boxes with $3 million sales.

Relative sales positions of these four industrial tube types have not changed since 1953—the period charted. However, magnetron sales have become proportionately more important, while sales of vacuum and gas or vapor types have become relatively less important. There has been little change in percentage sales of gaps or T/R boxes.

Magnetrons accounted for 51 percent of all sales in the first half of 1957, up from 41 percent in 1953. Vacuum tubes' share of the total dropped from 38 to 34 percent, while gas or vapor types dropped from 15 to 10 percent.

Though industrial electronic sales have advanced from $600 million in 1953 to over $1 billion (estimated for 1957), industrial tube sales have failed to keep pace. The variance in the two growth rates reflects the trend toward smaller and less costly tubes.

Industrial tube sales increased by only 11 percent from 1953 to 1956, from $106.6 million to $117.7 million.



MIT's big dish may be our first line of defense against transpolar intercontinental ballistic missiles. But first, nature poses some knotty problems. That's why . . . . .

Missile Radar Probes Arctic

SECRETS of the northern lights are being unlocked these days so that an antimissile can effectively defend the North American continent.

Propagation of radio waves by the aurora borealis would seriously hamper detection and tracking of missiles coming over the North Pole, just as electronic disturbances crippled NATO communications for 48 hours in the Norwegian Sea area.

To study this problem, and the radio effect of meteors, MIT's Lincoln Laboratory has in operation a "very large, high-powered long-range radar" on Millstone Hill, which is situated 35 miles northwest of Boston.

The Millstone radar is the first step in a joint project of the U. S. Air Force and the Defense Research Board of Canada for ballistic missile defense of North America. A twin radar installation is planned for the Prince Albert area of Saskatchewan in western Canada.

Designed as a research tool, first big job of the Millstone facility was tracking of Sputnik I and II at remote distances.

The radar will also be used in the Navy's project Vanguard IGY satellite program.

Technical details of the Millstone installation are shrouded by the Air Force, but it is clear that this is "more and better" than DEW or any other radar device now operated by the U. S.

Specially designed klystron tubes, 11 feet high, provide the transmitting power. This indicates that Millstone probably radiates not less than one megawatt peak pulse power, 100,000 watts average.

Range? The Air Force says "long range." Period. Comments a Lincoln Lab official: "It's not in the nature of 150 miles. It's a big one." One guess on extreme range is something over 1,000 miles.

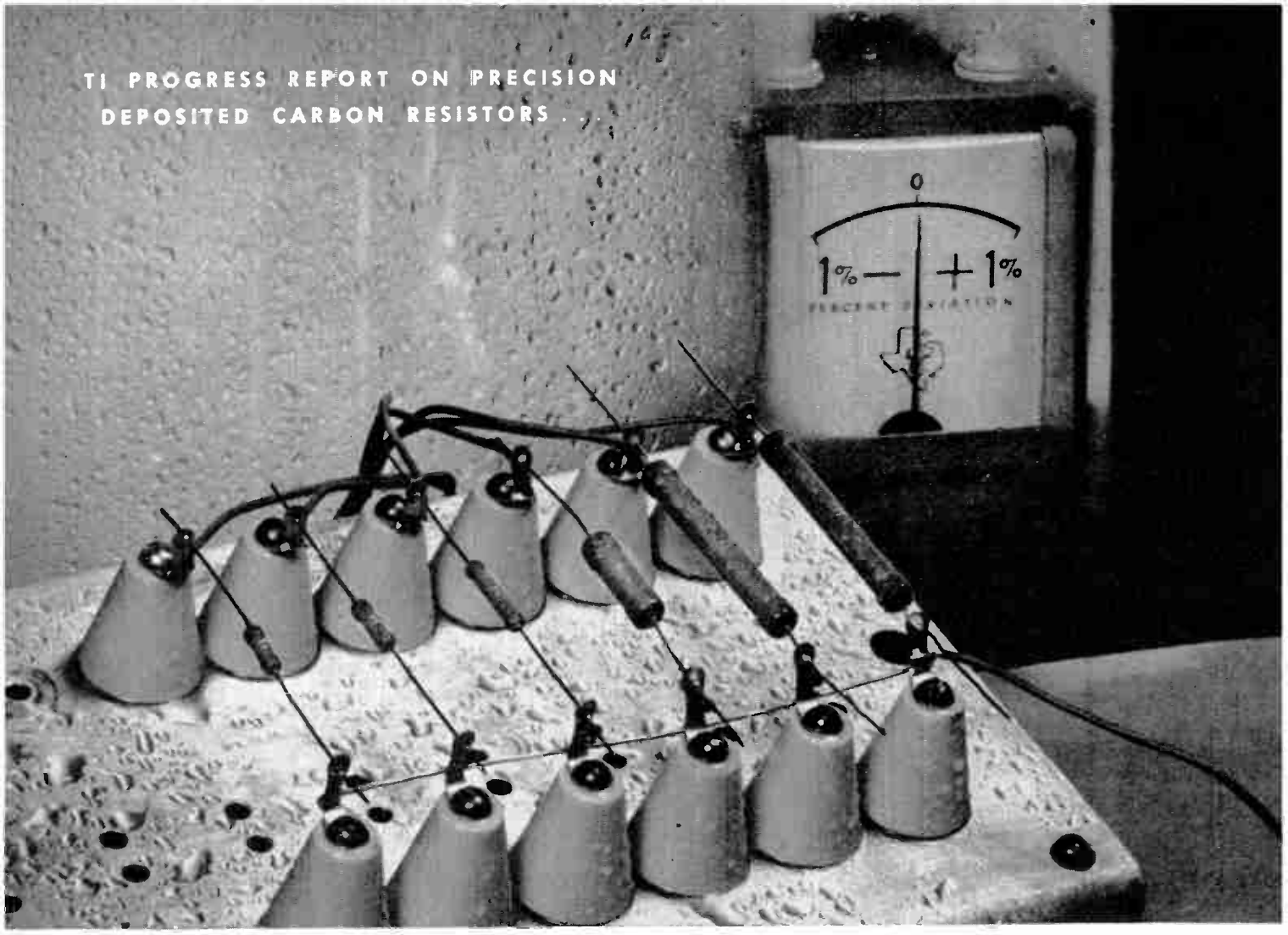
Both the Air Force and Lincoln Lab brush off queries about pulse width, repetition rate and peak pulse power.

Close study of the picture released to the public gives hints that the pulse width is two milliseconds, that the radar uses a monopulse system for continuous tracking. Size and shape of waveguide indicate a frequency of around 150 megacycles.

Signal-to-noise ratio is not revealed. Lincoln Lab says new tools and techniques were developed in the design of the radar and its associated gear.

A special transistorized digital computer was designed and built by Lincoln to process the radar return signals on a real-time basis at very high speeds. Such equipment would be essential in antimissile operations. A tape printer records these radar returns at thousands of characters per second.

The antenna system consists of a parabolic reflector, 84 feet in diameter, mounted on a concrete and steel tower 90 feet high. The rotating portion of the antenna structure weighs 90 tons. With a horizontal rotating capability of 360 degrees and a vertical elevating capability of 90 degrees, the antenna can sweep the sky.



TI MIL-Line Precision Resistors

HOLD TOLERANCE...EVEN WHEN DRIPPING WET!

Soaking wet, dried out, or 'shook up,' TI MIL-Line deposited carbon resistors still far exceed MIL-R 10509B. They emerge from one acceptance test after another – by major electronics manufacturers – with performance records that have not been equalled. *It's the seal that makes the difference* . . . an exclusive Texas Instruments process that snugly wraps these precision resistors in tough jackets of a special coating with high dielectric strength.

For ease in design, production and maintenance . . . for improving the reliability and saleability of your products, the moisture resistance of TI deposited carbon MIL-Line resistors is just *one* field-proven factor. You also get a choice of 1, 2, or 5% tolerances . . . high stability over wide temperature ranges and under full load . . . low negative temperature coefficients . . . negligible voltage coefficient and noise levels . . . long shelf-life . . . wide selection of sizes and resistance values . . . reasonable prices . . . and, if desired, reel-type packaging for automation.

Here is a typical TI reel pack designed to speed production. TI precision deposited carbon resistors are mass produced and packaged in five sizes from ½ watt to 2 watts with resistance values from 25 ohms to 30 megohms.

For complete data, write for Bulletin DL-C 539.

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE DALLAS 9, TEXAS

NINE-MONTH ROUNDUP:

Sales and Profits Show Rise

1. For 30 of 36 firms: sales are running ahead of a year ago
2. Six of 'em sport sales and profit gains of over 25 percent
3. Five others breathe easier by going from red to black

DESPITE defense contract stretchouts and cutbacks in the third quarter of 1957, operating reports of most electronic firms are showing sales and profits improvement over the preceding nine-month period.

Nine-month sales increased over last year for 30 of 36 companies checked this week. Earnings improvement was less general. But 25 of the 36 reporting firms registered gains.

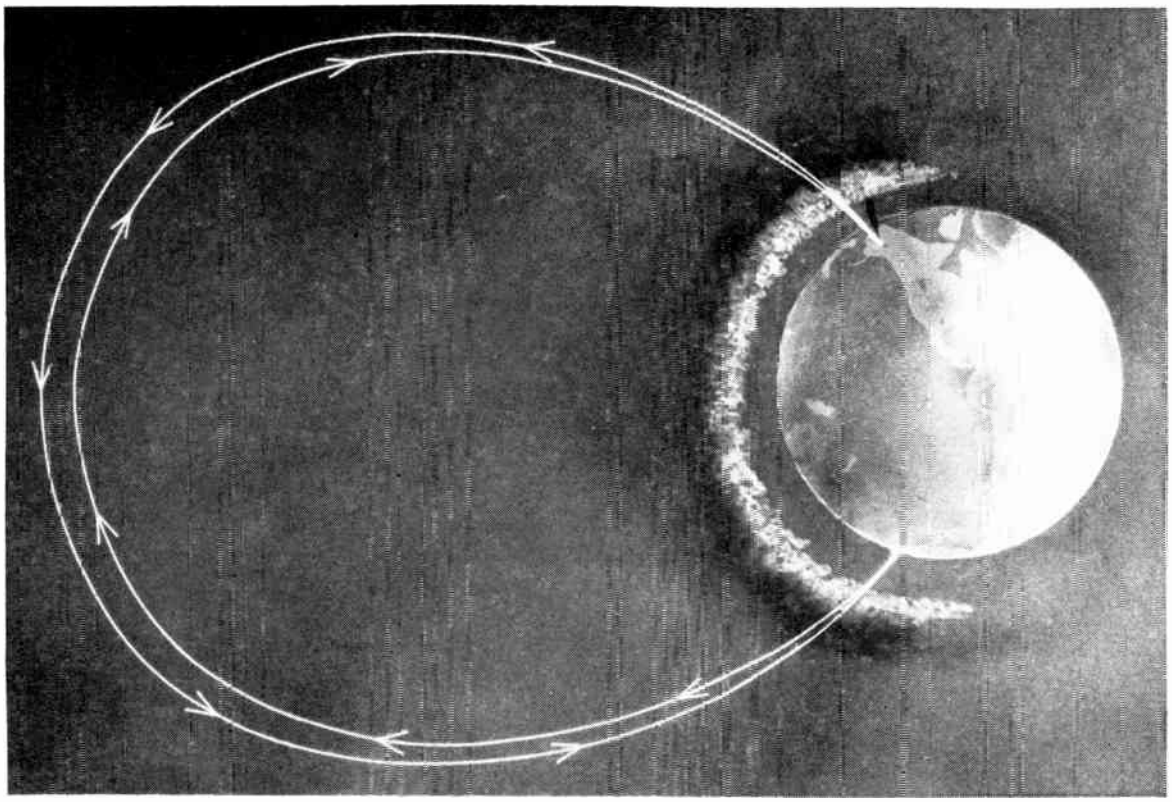
Five firms—Rheem, Sparton, Standard Coil, Webcor and Westinghouse Electric—converted 1956 nine-month deficits into profits in the 1957 period.

Big sales and profits increases were racked up by six firms. Gabriel, General Dynamics, General Precision, Haveg Industries, IBM, and Texas Instruments all enjoyed sales and profit gains of more than 25 percent in the 1957 period.

Six others—American Bosch, Arma, Amphenol, Clevite, International Resistance and Zenith—boosted earnings by more than 25 percent. But their sales increases were smaller.

The effect of stretchouts, cutbacks, and defense contracts varied considerably. Some, like Clevite and Consolidated Electrodynamics, said their nine-month profits were materially cut by stretchouts.

	9 mos. Sales (Thousands of Dollars)		Percent	9 mos. Earnings (Thousands of Dollars)		Percent
	1957	1956	Change	1957	1956	Change
Admiral	126,126	134,204	− 6	573	1,792	− 68
American Bosch Arma	101,089	86,730	+17	4,287	3,385	+ 27
Amphenol	23,388	18,970	+23	1,335	875	+ 53
Barry Controls	3,486	3,385	+ 3	144	170	− 15
Burroughs	204,861	190,451	+ 5	6,688	8,957	− 25
Clevite	57,071	53,790	+ 6	3,553	2,630	+ 35
Con. Electrodynamics	22,423	16,284	+38	583	878	− 34
Du Mont (Allen B.)	30,151	34,490	−13	d-978	d-924	−...
Gabriel	17,285	13,546	+28	660	175	+277
General Bronze	18,992	18,921	+ 0.4	603	630	− 4
General Dynamics	1,133,182	715,506	+58	32,090	23,016	+ 39
General Electric	3,169,276	2,962,780	+ 7	182,988	160,727	+ 14
General Precision	138,627	109,703	+26	3,617	1,768	+105
Haveg Industries	3,750	2,733	+37	186	64	+182
Hoffman Electronics	31,119	34,241	− 9	1,214	1,101	+ 10
IBM	704,407	513,174	+37	62,386	49,234	+ 27
Int'l Resistance	13,000	13,657	− 5	531	408	+ 30
McGraw-Edison	198,304	187,954	+ 6	11,642	12,384	− 5
Minnesota Mining	274,225	235,949	+16	29,415	26,986	+ 9
Motorola	166,023	162,689	+ 2	5,350	4,818	+ 11
Philco	270,246	254,322	+ 6	3,112	1,071	+191
RCA	853,667	812,524	+ 5	28,320	27,893	+ 2
Rheem Mfg	147,562	126,451	+17	2,187	d-2,289	+...
Robertshaw-Fulton	55,229	53,418	+ 3	3,445	3,229	+ 7
Servomechanisms	15,461	12,298	+26	253	482	− 48
Sparton	6,847	6,669	+ 3	57	d-3	+...
Standard Coil	41,846	44,117	− 5	258	d-1,565	+...
Stavid Engineering	6,935	5,443	+27	162	132	+ 23
Stewart Warner	86,692	89,017	− 3	4,557	4,650	− 2
Sylvania	251,884	246,153	+ 2	8,642	11,545	− 25
Texas Instruments	48,114	29,853	+61	2,672	1,506	+ 77
Tung-Sol Electric	46,513	39,147	+19	2,221	2,061	+ 8
Webcor	28,548	20,269	+29	1,107	d-216	+...
Westinghouse Air Brake	186,010	165,082	+13	9,967	9,223	+ 7
Westinghouse Electric	1,477,273	1,015,814	+45	49,102	d-1,399	+...
Zenith	111,134	100,568	+11	4,885	3,891	+ 26



Whistlers pierce ionosphere. Do they mean . . .

New Radio Propagation Mode?

- **Ionized solar gases and earth's magnetic field provide natural radio signals called "whistlers" with a pathway through space**
- **IGY whistler experiments point towards a new way of radio communication that will be unaffected by ionospheric storms**

THERE ARE signs this week that IGY scientists investigating natural radio signals called "whistlers" may hand us a new, reliable, long-distance method of point-to-point radio communications.

By following the paths which guide whistlers on round trips through outer space, radio signals could avoid magnetic storms in the ionosphere.

Whistlers were first detected 40 years ago and linked to lightning discharges 30 years ago. But until 6 years ago, no basic understanding existed.

L. R. O. Storey postulated in 1952, at Cambridge University, that whistlers follow the earth's lines of magnetic force through ionized gases in the exosphere.

At that time there was no real proof that there is sufficient atmospheric density to support magneto-ionic ducts above the 250-mile ionospheric altitude range.

Subsequent investigations have borne out Storey's theories. Here is what is now known:

Ionized gases from the sun are formed into magneto-ionic ducts extending 25,000-30,000 miles up.

These ducts run from a magnetic coordinate in one hemisphere to the comparable coordinate in the other hemisphere.

Whistlers bounce from hemisphere to hemisphere along one or more ducts at frequencies of 1,000 to 30,000 cycles. They are received simultaneously at points over 1,000 miles apart.

Whistler-mode propagation went beyond theory for the first time this summer when Stanford University successfully carried out a radio experiment.

A special pulse signal was sent from NSS (15.5 kc) at Annapolis to Cape Horn through the ionosphere and the exosphere. Both signals were received.

The signals over the 20,000-mile whistler path

took 0.7 second longer and were 10-30 decibels weaker, but the variations in amplitude appeared systematic.

"There is reason to believe that whistler-mode signals from NSS may equal or exceed the direct wave in strength at points further south (of Cape Horn)," ELECTRONICS **was recently told by R. I. Helliwell, of Stanford Radio Propagation Laboratory.**

"If this turns out to be true," Helliwell feels, "the new mode would have distinct communication possibility." New recording stations are now in the process of being readied at points in Argentina, Chile and Antarctica.

These experiments are part of a broad investigation into whistlers as part of the IGY program in ionospheric physics. Overall results, authorities feel, will be of value to the established radio communications systems.

Whistlers provide a probe into the exosphere. Hence, they furnish data on matter in space, solar storms, magnetic storms and fields and weather causes.

One result of the IGY program may be a map of the magnetic influences surrounding the earth—a road map for future communications.

There are 30 whistler stations in the IGY program. Stanford and Dartmouth College are each administering about a dozen for the U.S. National Committee for IGY and cooperating countries.

Analyzing whistler spectrum

Helliwell is directing "Whistlers West" and Millett G. Morgan, of Dartmouth, is directing "Whistlers East". Both schools have pre-IGY backgrounds in whistlers.

Whistlers can be received over telephone lines or a large antenna and an ordinary audio amplifier. IGY stations use a loop antenna and specially-designed wideband equipment to achieve analytical sensitivity.

Each station makes recordings at coordinated times to allow world-wide comparison of signals. During IGY's 18 months, over 3,000 miles of tape will be used.

TECHNICAL DIGEST

• **Shipboard tv** receivers serve as low-cost radar in indicator system covered by Italian Patent 539264. Small vessels entering harbor tune tv set to a shore-based tv transmitter which is continuously broadcasting pattern of associated search radar covering harbor. Pilot can thus watch movement of pip representing own ship as he maneuvers into port.

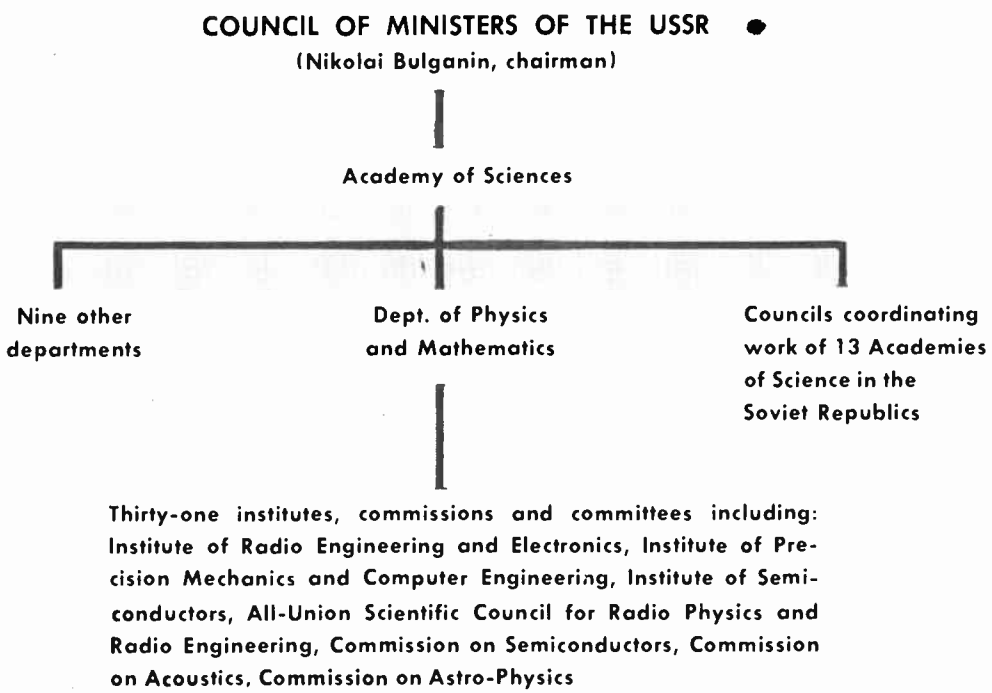
• **Synthetic stereophonic** sound effects are achieved with two different versions of single audio signal. One version is applied to both ears in phase; other is fed to both ears in antiphase after delay of 50 to 150 milliseconds, in technique developed by H. Lauridsen of Danish National Broadcasting System. Experiments at Bell Labs indicate that frequency domain can also be split between two ears in comb-filter fashion, using 16 filters each passing about 200 cps. Alternate filters then feed each ear.

• **Aluminum-uranium-aluminum** coating on cathode of multiplier phototube converts it to neutron detector suitable for control of power reactors. Research by Westinghouse for AEC shows promising performance where appreciable neutron fluxes must be measured in presence of intense gamma radiation. The three neutron-emissive coatings are evaporated onto inner surface of cathode face.

• **Ultrasonic back-scattering** effects permit identification of metallurgical structure, including single crystals, alloy phase changes, slip bands and ghost lines. Equipment used by RCA resembles that for ultrasonic flaw detection, with frequencies ranging from 1 to 90 mc, but pulse width is narrowed to less than 9 cycles to give high resolution. Peaks of A-scan presentation then show scattering effects at each metallurgical substructure.

• **Corrugated metallic plate** covered with resistance card serves as new attenuator element when inserted in rectangular waveguide. Axial component of electric field is produced on surface of corrugation, where it acts on resistance film baked on thin mica to give desired power loss. Theory was verified at 4,000 mc by Tokyo Institute of Technology.

• **Cylindrical pellets** of parallel glass fibers, each about ¼ in. in diameter and half an inch long, increase precision of injection molding and at same time add 50 F to heat distortion, double the tensile strength and boost impact strength six-fold. Each Fiberfil Corp. pellet contains around 20,000 monofilaments of glass, light enough to float in an air like dust.



Compact, direct setup gives an idea of . . .

What's Doing In Russia

- **Soviet Academy of Sciences is revealed as "Manhattan"-type setup capable of electronic "crash" programs according to command decrees**

- **Russian lag in design technique being overcome by systematic study of translations and abstractions of Western technical literature**

THE SOVIET UNION has established its own "Manhattan"-type project organization on a permanent basis. It includes not only atomic energy and rocketry but also electronics, it was learned this week.

The organization itself is well known; it's the Soviet Academy of Science. What is not so well known is the manner in which the top Soviet command uses the Academy to carry out "crash" scientific programs.

For example, the electronic equipment for Russia's *Sputniks* was developed by the Academy, completely independent of the Ministry of Radio Industry and the Ministry of Communications which embrace electronics as it is known here. This was told to ELECTRONICS by an authoritative Soviet source.

The source says all new, highly secret projects are developed at the Academy. There they are free from "strait-jacket" dictation by various industrial ministries.

An electronics project leader at the Academy has the best laboratory equipment available. He can, on very short notice, obtain reinforcements for his development team by calling for the immediate transfer of engineers from other organizations.

Missile and propaganda requirements, and the Russian longing for world scientific recognition, must have recently accelerated electronics progress. What they are doing in the way of secret applied research at the Academy must be assumed to bear a relation to their high caliber fundamental work.

On the other hand, it seems safe to conclude that the Soviets are not equally advanced in all fields. As with the *Sputniks*, they are emphasizing and, perhaps, de-emphasizing by decree from the high command. This also explains the recent Russian

strides in building high energy particle accelerators.

Until this year the Soviet delegation to the International Electrotechnical Commission showed little interest for the work of the electronics committees of the IEC, those pertaining to electron tubes, semiconductor devices and components for electronic equipment.

In 1955 and 1956 not one Russian delegate attended meetings of these technical committees. But at the Zurich sessions two months ago, the Soviets surprised everyone and sent a delegation of 10 electronics engineers.

For many years civilian electronics development in Russia was neglected in favor of heavy industry. More recently, Khrushchev has speeded up building of telecommunications and television networks through separate ministries having their own labs.

Beyond this new interest in electronics from the civilian point of view is not just technological seepage from the Academy of Sciences and from researchers in other laboratories. The Russians have cleverly and thoroughly picked the brains of Western scientists via translations of their technical articles, whether in the journals of scientific societies or of U. S. firms.

Several Russian laboratories have groups of from 5-10 engineers whose job is the collection, translation and abstraction of the world's literature in that field in which the laboratory specializes.

In addition, some 1,500 persons are reportedly employed in keeping up a universal scientific abstracting service, Referativnyi Zhurnal. Abstracts are in Russian, cross-indexed in other languages including Chinese.

The Ministry of the Radio Industry is the nerve center for much of Russia's electronics. It combines central administration with centralized applications laboratories.

Applications laboratories of the ministry develop prototype designs for the industry. A Soviet source gives this example: Prototypes of the latest tv receiver model with externally adjustable differentiating circuit for the video signal are finished.

The prototype designs will then be sent to numerous factories scattered all over the USSR. The local industry authority is then free to choose those designs best suited to the needs of the area, and to modify designs to suit its production program.

In Moscow the Ministry is charged with issuing standard specifications for all factories. In practice this means cheap, rapid production runs of simple units and expensive, slow runs on new, complicated units requiring considerable re-tooling. Result: an old 11-in. tv set costs 700 rubles, while a new 21-in. set costs 2,400 rubles ($270).

According to the Soviet source, 1957 transistor production will total about 20 million, including an undisclosed number of new types with an alpha cut-off frequency of 100 mc.

He gives these other 1957 production estimates: more than 50 million tubes, about 4 million radio receivers, and about 1 million tv sets.

Many European engineers who saw Soviet electronic equipment in 1955 agreed that its technical design was 10 years behind European standards. However, it was noted that the product did stand up to the conditions it was designed for.

Since then contact with world technical literature has advanced design quality. The Ministry of the Radio Industry has just completed the prototype design for a completely transistorized tv set.

Last month the Russians announced manufacture of the first experimental color tv sets in Leningrad. The sets have 20 by 15-in. screen, 27 tubes and can receive black-and-white.

Production of a hearing aid using semiconductor triodes, weighing 129 grams and powered by a miniature battery good for 100 hours of use, has begun.

Giant strides in computer development and production have been made this year by the Soviet Union, according to information reaching New York. Russia is said to have had between 30 and 40 large general purpose BESM digital computers in operation as of last March.

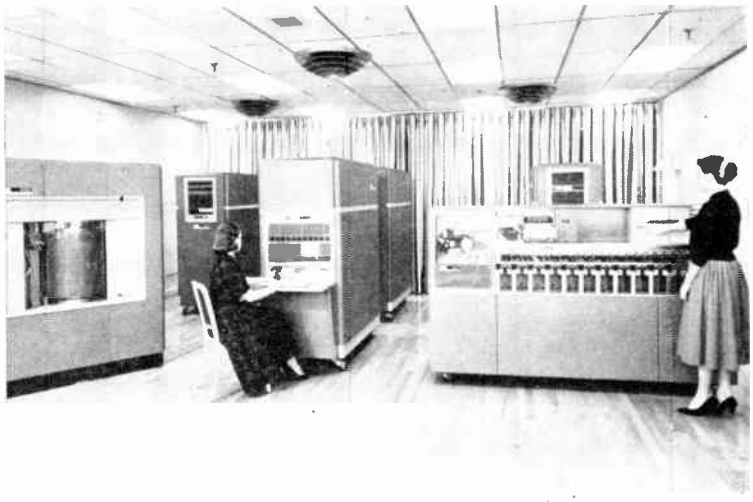
The BESM is used primarily for research and design problems, presumably including missiles, rockets and jet aircraft. Developed in 1951 at the Ukrainian Academy of Science, the original version had 7,200 tubes.

Later on, semiconductor advances allowed substitution of tubes by germanium diodes, leaving a total of 3,000 tubes. A mechanical printing device is used as output but its speed is unknown.

The computer has parallel operation and a floating decimal point. Other basic characteristics are somewhat obscure because Russian computer terminology is different from ours. They give a "speed" of 50 operations per second; "operating memory" of 31 active digits and 40 instructions; "passive" memory of 31 digits and 63 instructions; "internal memory" of 2,000 indications on the magnetic drum.

Probably the newest Russian computer known to U. S. commercial sources is the M2. This is described as having a memory of parallel design with a capacity of "512 double figures."

In the M2 impulses are stored on screens of oscillographic tubes. It's described as having an arithmetical unit of parallel action with four static trigger registers. Construction is said to permit operation with both fixed and floating points.



Assorted paper checks are magnetically-recorded at check-inscriber unit (left), only operation needed to ready them for automatic sorting, listing, etc., done by high-speed check-processing units (right)

Electronic Banks Take Shape

• One firm slips wraps off complete computer system for processing random-sized paper checks

• System with immediate memory recall uses magnetically-inscribed checks, services 40,000 accounts

The wraps are now off an experimental electronic bank-deposit system—and it does more than show commercial bankers how to keep good banker's hours.

The system is operating at IBM's Product Development Laboratory in Poughkeepsie, N. Y.

Rising bank-operating costs, personnel shortages and labor-turnover problems are met head-on with high-speed computers that will perform complete demand deposit accounting functions. The machines are fed ordinary paper or card checks of varying widths, lengths and thicknesses.

Checks are not punched, but are code-inscribed with magnetic ink. And one high-speed account-recording operation is all that is necessary to prepare the check for automatic sorting, listing, posting and totaling operations.

The IBM electronic bank is a completely-workable laboratory test model that has been developed only to gain valuable bank-systems experience. IBM has no plans for marketing the existing equipment. However, the company does plan to market a version that will substitute Arabic characters printed with magnetic ink for the code-sensing method used in the present system.

Customer information will be printed on the checks to conform with definite standards recommended by the American Bankers Association. And this printing will be placed on the checks so as to not interfere with the simultaneous processing of punch-card checks.

Batches of incoming paper and card checks are forwarded to an operator at the check-inscriber unit, an IBM 630. On the operator's control panel, batch numbers and dates are preset for repeat positions on every check. The operator records each check amount on a keyboard and the check is whisked into the inscriber where the value is automatically recorded on the check face in magnetic ink.

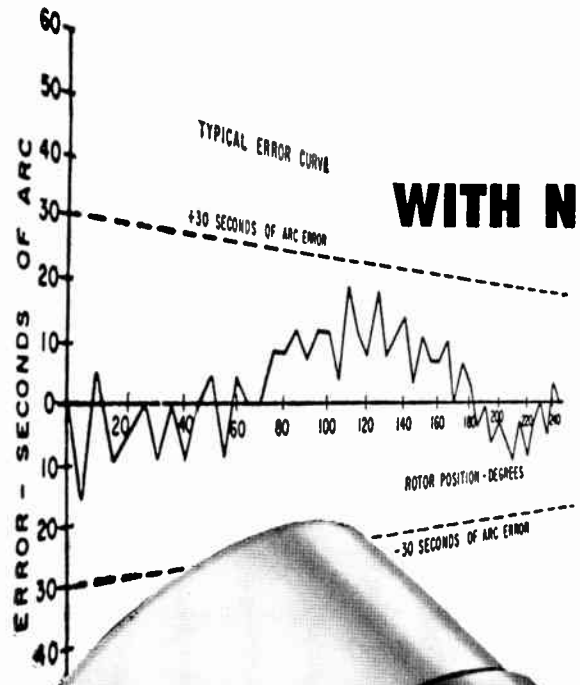
An average operator can inscribe 1,600 to 1,800 checks per hour. Check totals are recorded automatically on adding machine tape for balancing to previously established controls.

Magnetically-inscribed checks, now containing all the information needed for posting to the customers' accounts, are sorted, read and recorded on a register which balances all checks.

Read-write access arms of a juke-box like disk memory IBM RAMAC (random access method of accounting and control) seek and find information stored for 40,000 accounts. RAMAC immediately posts current transactions, detects overdrafts, stop payments or hold, and any other required information.

SYNCHROS

WITH NEW STANDARDS OF ACCURACY



KEARFOTT

NEW SIZE 25 SYNCHRO is accurate to 0.5 minutes of arc. It requires no external compensating devices. Available as transmitters, control transformers, differentials and resolvers.

SIZE 23 "PANCAKE" SYNCHROS are suitable for gimbal mounting and are accurate to 2.5 minutes of arc.

SIZE 11 SYNCHROS for 4 wire systems offer accuracy of 3.0 minutes of arc. Standard 3 wire Synchros available with 5, 7 and 10 minute maximum errors.

ACTUAL SIZE

SIZE 25
MAXIMUM ERROR
30 SECONDS FROM E. Z.

SIZE 11

SIZE 23

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KEARFOTT SYSTEMS INCLUDE: Directional Gyro Compass Systems, Three Gyro Stable Platform Systems and Inertial Navigational Systems.

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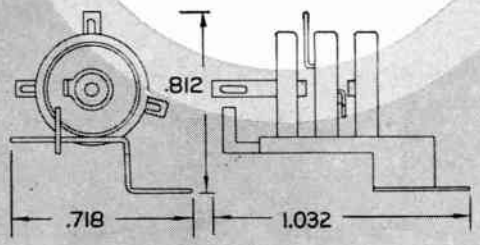
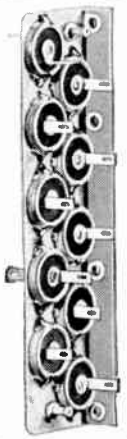
for your miniaturized equipment...

SANGAMO pre-mounted Button® Capacitor Assemblies

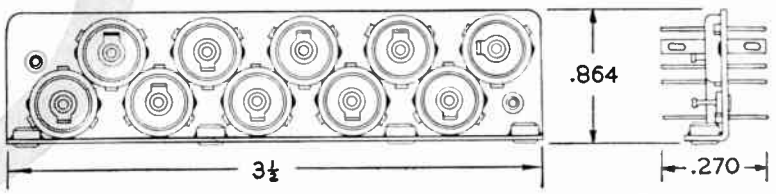
TYPE N46



simplify circuits... save space... solve mounting problems!



TYPE N51



Sangamo Multi-section Button Assemblies are silvered mica button capacitors, pre-mounted in silver-plated non-ferrous brackets. They are easy and inexpensive to mount in miniaturized equipment where many buttons must be installed in a small space. These multiple assemblies supply their own common circuitry—retain the low inductive design advantages of conventional button mica capacitors—are ideal for use in VHF and UHF circuitry.

Two types and dimensions of assemblies in the Sangamo series are shown above. Any suitable combination of buttons may be selected for mounting. All Sangamo button type mica capacitors used in these assemblies conform to military specification MIL-C-10950B.

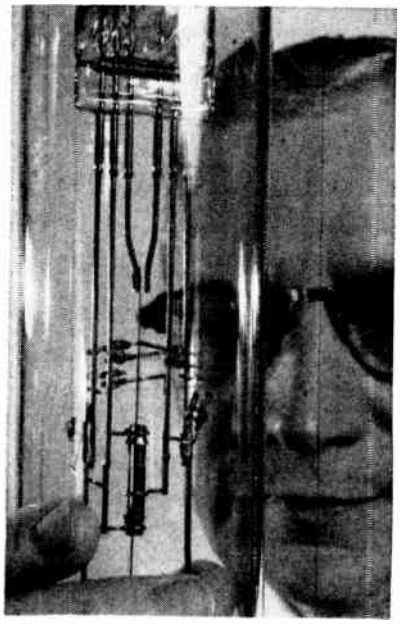
Write for complete information and prices.

SANGAMO *Electric Company*
SPRINGFIELD, ILLINOIS

SC57-12

Tubes Convert Heat

Thermionic converter gets better than 8% efficiency—eight times that of conventional thermocouples—with higher efficiencies coming



Wire emitter supplies electrons to collector through ionized gas

RECENTLY unveiled GE device called the thermionic converter changes heat directly into electrical energy without the use of rotating machinery. Although this has been done for some time with thermocouples and thermogalvanic cells, the promise in the announcement lies in the converter's better than eight-percent efficiency. Efficiency of conventional thermocouples is usually less than one percent.

Thermocouples using a junction of two different kinds of metal produce small electrical currents when heated. A difference between thermocouples and the thermionic converter is that the metals in the converter are separated by an ionized gas at low pressure.

The two electroes in the tube are held at high though different temperatures, the emitter at 2,500 F and the collector at 1,250 F. The separation helps limit the transfer of heat between electrodes. According to V. C. Wilson of GE, the positively charged ionized gas reduces the space charge around the emitter, greatly increasing efficiency.

Hopes are that the thermionic converter ultimately may change 30 percent of heat energy into electrical energy. This compares to the 40-percent efficiency of the steam-turbine generator.

If the intense heat developed in guided missiles could be used in converters for powering guidance and telemetering equipment, the heat problem might be turned to good use.

Other possibilities include using the heat of fusion from nuclear reactions or solar energy to operate converters.

Probably closer to realization is the use of thermionic converters for small amounts of power in remote areas. The Russians, for example, use thermocouple devices for kerosene-operated radios. Efficiency of these generators is believed to be only 3 percent.

Open-circuit output of the thermionic converter is from 2 to 3 volts, but this drops with load. The final device may produce about 2 volts per cell, but cells can be connected in series to produce higher voltages.

Missile Progress Good—Air Force

SPOKESMEN for the USAF missile program had some encouraging news for the electronics industry last month.

Key points in Midwest talks by top officials dealt with both scientific and fiscal matters:

1. The U.S. has solved all the fundamental scientific problems in producing long range ballastic missiles. This "may well be more than the Soviet Union has achieved."

2. The USAF spent $556 million on its missiles in fiscal 1955, and proposes to spend five times as much during fiscal 1959.

First statement was made by Simon Ramo, chief scientist for the Air Force ballistic missiles project. He talked before the Ninth IRE Mid-America Electronics Convention in Kansas City. The second statement came from General Thomas D. White, Air Force chief of staff, whose comments were read by Lt. Gen. Emmett O'Donnell at the Executive Club in Chicago.

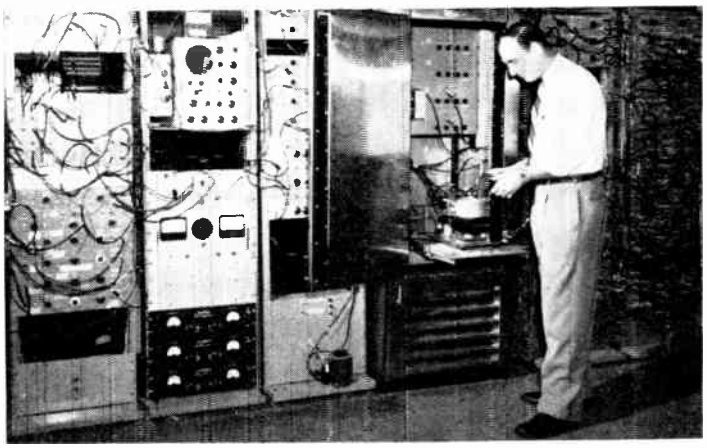
"In fiscal 1955," Gen. White said, "missiles took about 12% of our procurement funds, a total of $556 million. We estimate that by fiscal 1960, we will be investing as much in missile systems as in manned aircraft systems. This will mean a program in excess of $2.5 billion on missile systems in fiscal 1959 (beginning July 1, 1958)."

Ramo's remarks put the problems of *Sputnik* and the ICBM into healthy perspective. "Nothing that has occurred is particularly pertinent in the development of an intercontinental ballistic missile," he stated. All it takes to put a satellite into an orbit is "to put it up high enough and push it sideways," he said, adding "it's a lot easier to miss the earth than to hit it."

Ramo thinks that the primary problem in ICBM technology is getting the 300,000 parts that go into the missile to work together reliably. "We need more testing of components," he warned. "Guidance is much more important than thrust."

He compared our missile program with the USSR's, pointing out that the Russians may have an ICBM but haven't demonstrated it. "We are engaged in full-scale testing on a crash basis," he said. "The U. S. has had a series of 10 successful (ICBM) flights with all data coming in as planned. We have gone into production operation" with Thor, Atlas and Titan. "We are on schedule with the Air Force program. When we lick the reliability problem we won't have another step to take."

Ramo added a kudo: "Without electronics, there would be no choice but to go through hundreds of tests taking years; with it, we are making progress."



New core tester is ready as . . .

Ferrites Sell $15 Million

Market has trebled since 1950. Tv deflection yokes and flyback cores take $7-$8 million. New uses include microwave, antennas, magnets

Ferrites, a fast-growing ceramic family first fostered by tv, is now busily expanding footholds in radio, microwave, computers, magnets and telephones.

Until a few years ago, tv parts—primarily deflection yokes and flyback cores—accounted for almost the entire ferrite output. Now, tv takes only half.

Chris Snyder, General Ceramics v-p, gives this picture of market growth: pre-1950, $50,000 a year; 1950, $5 million, and 1957, $15 million.

The 1950 spurt followed tv needs for a material with more oomph than iron. GC shipped 1,000 pounds in January, 1950, and 10 tons the following December. Snyder says other ferrite firms did as well.

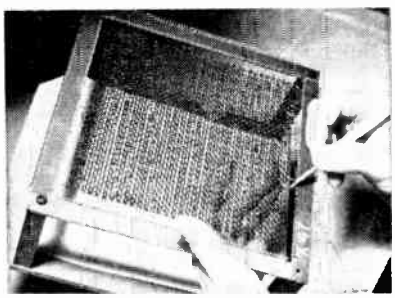
Tv ferrite sales have been edging upward and color tv will someday provide another spurt, since heavier parts will be required for color television deflection yokes and cores.

Its 1952 core sales were negligible, rose to $300,000 in 1955 and are $1.5 million this year. Prices have dropped from 50 cents to 3.5 cents a core, wired memories are down from $1.25 to 12 cents a core and will probably drop to five or six cents in a few years.

Among other products going places are microwave ferrites, tuner parts, antenna cores, recording heads. Memory materials are moving into shift registers, delay and storage devices and counters besides computers.

The trend to higher frequencies and semiconductors is carrying low-loss ferrites along. With few gaps, ferrites cover the field from 10 kc to 500 mc.

Low-frequency, high-power applications are a weak spot. Researchers are seeking a method of manufacturing ferrites with narrow



Computer memory frame uses 4,096 ferrite cores

resonance line widths—ferrite materials which simulate single-crystal resonance.

High Q antenna cores have succeeded air loops in 50 to 60 percent of home radios, may replace tv antennas and were recently introduced in aircraft and mobile radios.

Major use in carrier frequency equipment is believed imminent, depending on improvements in temperature stability. Telephone companies are actively developing ferrites transformers, filters and delay lines.

Ferrites now get about $1 million of the $45 million market for permanent magnets.

Magnetic Fields Between Planets

RECENT STUDIES now available prove that magnetic fields exist in the space between planets, and that some cosmic rays do come from the sun. A University of Chicago physicist reports these facts, says ELECTRONICS' Midwestern Editor.

John A. Simpson, professor at the Enrico Fermi Institute for Nuclear Studies, told a campus meeting of industrial sponsors that studies were made of a giant solar flare that occurred 20 months ago. He said that solar outbursts, such as that of February 23, 1956, release in 20 minutes the energy of a billion of the largest known hydrogen bombs.

This energy is partly in the form of nuclear particles traveling at close to the speed of light. Ranging in energy from one to 40 billion electron volts, these particles are stored for as long as 15 hours in extensive, but weak, magnetic fields occupying a large portion of interplanetary space.

Measurements taken at various university stations throughout the world and during balloon flights from the campus show that these huge fields act as a leaky bucket. Within minutes after a large flare, the intensity of cosmic radiation to outside of the solar system is high. As the field "empties," the leak lessens. After many hours just a "trickle" of cosmic rays are shooting away to other parts of the universe.

IRBM: New Role, New $

Missile's going to NATO means more production, a lift for launching site support gear makers

RECENT responsibility placed on the intermediate range ballistic missile—to counter the Soviet's ICBM threat by moving IRBM's within striking distance of the USSR—throws the spotlight this week on a large and specific segment of the electronics industry.

First effect will be bigger business for primes, subs and vendors for accelerated development of the three IRBM's now in the mill: USAF's Thor (Douglas is prime contractor; A.C. Spark Plug and BTL handle guidance), Army's Jupiter (Chrysler is prime; Ford Instrument, guidance) and Navy's Polaris (Lockheed is prime; GE and MIT, guidance).

Defense spending for fiscal year 1959 will rise $1 billion to $2 billion. Defense Secretary McElroy made this statement the same day he announced that IRBM's would be installed in NATO missile sites by mid-1959.

What the actual increase will be when appropriations are made, and where the money will then be spent, depends on more specific planning plus the changing technological scene. If it were learned, for example, that the Soviets have become capable of knocking out simultaneously our NATO bases this might alter the IRBM's projected role.

One immediate result of placing our strategic hopes on the IRBM has been to spare both Thor and Jupiter. Ex-Secretary Wilson's pre-*Sputnik* committee's task of determining which of the two ballistic missiles to abandon has been shelved in favor of continuing both.

Besides increased business from stepped-up missile development and production, electronic gear to support and protect the NATO launching sites—whether they are on already-existing SAC bases or behind European barns—will have to be substantial. Search radar, radio command, electronic countermeasures, counter countermeasures, communications, test equipment, etc. will all be required.

Regarding the sites, one DOD spokesman told Electronics that SAC bases would probably be used. This philosophy, of course, assumes that aircraft will be phased out as missiles come in.

More likely, however, is that the launching sites will not be positioned on well-known and well-photographed SAC airstrips. Separate sites, interspersed among camouflaged dummies, will probably be the system employed.

MILITARY ELECTRONICS

• **Army will launch** a cylindrical satellite, built by Jet Propulsion Labs and weighing about two pounds less than Vanguard's sphere, "between now and March," says Army Gen. J. B. Medaris.

Ford Instrument's guidance system for the three-stage-rocket carrying vehicle, Jupiter C, will not be modified for its new job. Medaris believes there is a 90 percent chance of a successful orbiting on the first try. Jupiter C has already been fired three times.

• **Navy indicates** that Vanguard time table may be speeded up (as predicted in Electronics, Oct. 20). Hope hangs on obtaining sufficient data from fewer than the four test-sphere firings originally planned to prepare the way for the six full-scale satellites. If one test-sphere launching provides enough data, the first 20-in satellite might be orbiting next month.

• **Temperature data** from both inside and outside Vanguard's first small test sphere will be telemetered back to Earth due to a physical phenomenon that was momentarily forgotten while the sphere was being designed. A change in transmitter's ambient temperature causes a frequency change which, if accurately calibrated, can be translated into actual temperature (accurate within 5 degrees within the 0 to 60 degrees C range; less accurate outside this range).

Although both transmitters are located inside the sphere, the frequency determining quartz crystal for one transmitter is outside the sphere's skin. Frequency change from its 108.03 mc transmission will provide outside temperature data. The other transmitter, inside the sphere, operating at 108.00 mc, will give the temperature inside the satellite.

CONTRACTS AWARDED

Federal Telephone and Radio division of IT&T will sell $11.4 million worth of VORTAC, short-range navigation system, equipment to the Civil Aeronautics Administration. This is the first major step in CAA's 6-year VORTAC program, which calls for more than 1,230 ground stations and expenditures of $314,000,000 by 1965. Target date for VORTAC to go into operation is July 1, 1959.

Hamilton Watch's Hathaway Instrument division gets a $2.25 million contract with Hughes for quantity production of airborne signal data recorder equipment for testing Falcon, air-to-air missile.

Cal-Tronics gets $200,000 contract with Arma for design, engineering and development of eight digital computer test set units for

work with Arma's Titan project. Cal-Tronics is also working on an airborne-supplies unit to launch air-to-air missiles for North American.

Autonetics division of North American will supply Republic with monopulse radar for installation in an advanced version of the F-105.

RCA will provide CAA with 10 high frequency receiver systems totaling $245,773.

Tung-Sol Electric gets $435,000 contract with Dayton AF Depot for beam power amplifiers.

A.C. Spark Plug wins $1,477,619 contract with AMC for amplifier and gyro assemblies applicable to aircraft systems.

W. A. Apple Mfg. sells radar reflective targets to Aviation Supply Office, Philadelphia, for $785,151.

Benrus Watch has contracts with Navy and CAA totaling close to $1 million for production of 400-cycle power supplies for guided missile launchers, vhf receivers and precision electronic test equipment.

Olympic Radio and Television division of Siegler gets a $1,306,000 contract with BuShips for production of uhf radio direction finding equipment.

Lavoie Labs gets $474,181 contract with BuAer for production of airborne radar beacons (DPN-17) for drones.

Lear sells Master Attitude Reference System (MARS) equipment for installation in KC-135, B-52, T-38 and F-101 to AMC under $5,414,160 contract.

Stromberg-Carlson division of General Dynamics wins $3,740,000 contract with the Navy for production of test equipment for TACAN.

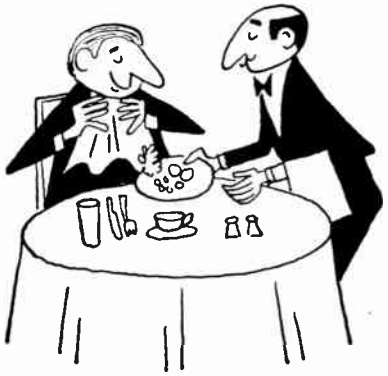
El-Tronics sells radio receivers, AN/URR-35, to BuShips for $355,925.

"But I don't have time to read!"

24 HOURS IN A DAY ... 8 hours to sleep. 16 hours for everything else. "So why is it," we keep asking ourselves, "that some men spend many more minutes reading this fine magazine than other men? And why is it that the men who spend the least time with it invariably insist they're too busy to read?" In any event, here's how you can become the master of time, and not its servant. To wit:

GET UP EARLIER ... Put a new half-hour into your day. Use it to read. While you're shaving. Or at breakfast. Or catch an earlier train. Read that article you may have spotted right in this issue a few seconds ago. "I must be sure to read that," you said. Bet you won't -- unless you create the time to do it.

WRITE SHORTER LETTERS ... less involved memoes, unwindier reports. Brevity is business' biggest bargain. Cut your dictating time in half. And it's contagious. Pretty soon, other people will make their replies shorter and sweeter. So you save twice as many minutes for your favorite business publication.

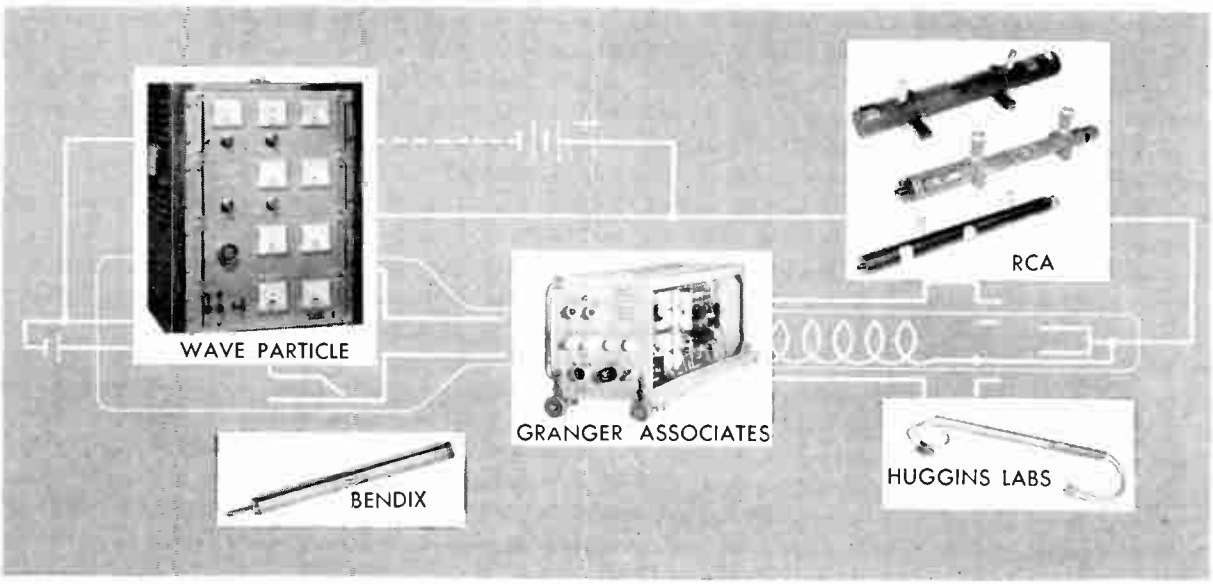


EAT LESS FOR LUNCH ... You put away fewer groceries in a 1-hour lunch than a 2-hour lunch. You feel lots better. Costs less, too. And look at the time you gain! Invest it in reading. Expose yourself to the current experience of men with similar problems and common goals. Know what's going on. Be an "authority".

BE A CONFERENCE "CLOCK-WATCHER" ... Be Succinct. Then sit down. The boss will bless you. If you're in a meeting-happy company, campaign for faster, fewer meetings. Everybody gets more done . . . but you're the big time winner. Explore some of the great things you may have missed in these pages. Find out what's going on in other functions and phases of your industry.

LOOK AHEAD, READ AHEAD, GET AHEAD ... today. Little future for "stand-patters". Be alert. Be informed. Management's watching you. Stimulate your brain cells. Upgrade your viewpoint. And do it on your own terms... as many reading minutes as you like, when and where you want to apply them. For the more time you invest reading your favorite McGraw-Hill business publication, the more time you save to do a better job, to see more of your family, to enjoy life.

TWT's Move Into Spotlight



New Tubes, Supplies Appear

TRAVELING-WAVE tubes, an amplifier using one, a backward-wave oscillator and a power supply for operating twt's are featured in this week's new products. Three light-weight traveling-wave tubes are announced by **RCA** (41) that have been designed for cascade operation in military airborne radar and counter-measures systems. X-band traveling-wave tube amplifiers offered by **Granger Associates** (42) are packaged with an integral regulated power supply.

Backward-wave oscillators announced by **Bendix** (43) for the frequency range from 49,000 to 59,000 mc are intended for multichannel telephone and tv systems using circular waveguide, short-range radar and highly directive communications equipment. Uhf broadband traveling-wave tubes announced by **Huggins Labs** (44) for operation from 500 to 1,000 mc have a minimum power output of 10 dbm. Power supplies offered by **Wave Particle** (45) are said to operate most low-level and intermediate-level twt's.

A line of rack-mounting power supplies offered by **Beta Electric** (46) have outputs ranging from one to 50 kv at 2 to 50 ma. . . . Synchronous motors with inputs up to 140 volt-amperes can be operated from 12-volt d-c sources with a transistorized inverter developed by **Mandrel Industries** (47) to deliver 50 or 60-cps modified square waves.

Controlled magnetic type microphones that are ½ inch square and less than ¼ inch thick are announced by **Shure Brothers** (48) for manufacturers of hearing aids, tape recorders and dictating equipment. . . . **Lear** (49) announces a series of pressure switches for controlling airborne radar pressurizing sets by operating directly in the pump motor electrical circuit.

Relay testers offered by **Anaheim Electronics** (50) permit checking standard relays, polarized relays and choppers for pull-in and drop-out voltage and current, closing time, dwell time, contact bounce, coil resistance. . . . Signal generators developed by **Southwestern Industrial Electronics** (51) deliver sine and square waves for frequency determination, servo analysis, low-frequency phase-shift measurements.

Mechanical amplifier-clutches have been announced by **Digitronics** (52) to control large amounts of torque from small controlling torques for use in automatic control systems and data-processing equipment. . . . Plastic pump and motor units are available from **Jabsco Pump** (53) for use by the electronics industry for handling ferric chloride in the manufacture of printed circuits.

An electronic pilot relay offered

For more information use READER SERVICE CARD

by **Haledy Electronics** (54) uses a cold-cathode tube and responds to 2 microamperes current. . . . Removable type inserts permit quick change of imprint variables on a marking machine announced by **Markem Machine** (55) for such electronic components as transistors, capacitors, solenoids.

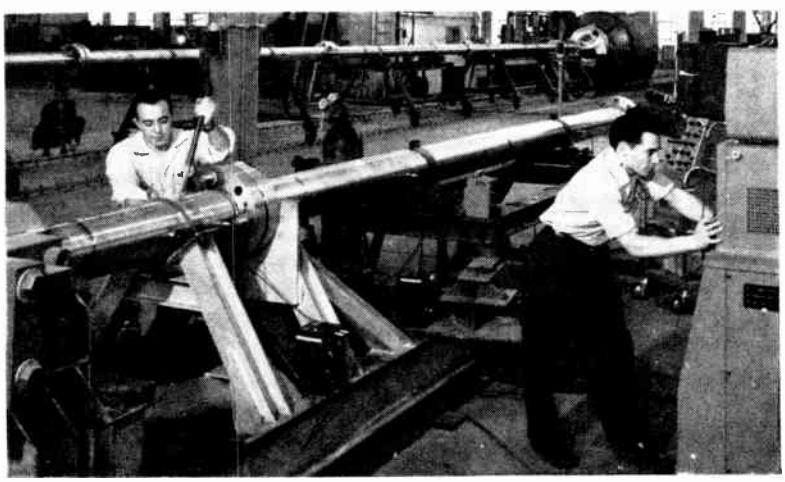
Glaser-Steers (56) announces four-speed high-fidelity turntables with automatic record changers. . . . Optical image movement is used to eliminate both target and photo cathode burn-in of image orthicon tubes in a tube life extender announced by **Visual Electronics** (57). . . . Trimmer potentiometers with resistances from one to 125,000 ohms are available from **Con-Elco** (58) in cylindrical cases 1¼ inches long and ¾ inch in diameter.

Beckman's (59) Model 1133 analog computer comprises six control consoles that operate singly or as one large computer with each console having 3600-hole patchboards and capable of controlling more than 100 amplifiers, 200 servo-set potentiometers and proportional numbers of nonlinear equipment. . . . Plug-in precision resistors are announced by **Aerovox** (60) for building analog computers.

Slow neutron survey meters being marketed by **American Tradair** (61) are equipped with tube electrometer circuits with negative feedback for rapid meter response, good zero stability and a linear scale. . . . Immediate 36-channel records are provided by an oscillograph announced by **Minneapolis-Honeywell** (62) that features tape speeds from 0.1 to 160 inches per second and frequency response of 3,000 cps.

D-c tachometer generators offered by **Lyndon Aircraft** (63) operate up to 7,500 rpm delivering 45 volts per 1,000 rpm. . . .Radar interference blankers developed by **Empire Devices** (64) eliminate or greatly reduce the effect of main bang from nearby radars in standard and MTI radar receivers.

Gulton Industries (65) is adding a British-developed microwave absorbing material to its product line that is said to have a frequency range from 2,500 to 70,000 mc. . . . Mica paper available in thicknesses from 0.002 to 0.01 inch from **Spruce Pine Mica** (66) is



Prelude to the ICBM

High speed instrumentation and recorders, right, are used with shock tubes in ICBM research. Shock waves attain speeds of 18,000 mph and temperature of 15,000 F. Photo shows scene at a GE missiles materials laboratory

fully impregnated and cured with silicone resin.

A one-tube pulsed oscillator is used in an ultrasonic generator offered by **Branson Ultrasonics** (67) for cleaning and degreasing applications. . . . Antenna radiation-pattern measurement towers 22½ feet high are designed by **Blaine Electronetics** (68), using no metal and capable of rotating weighty scale model missiles, aircraft and antennas.

Pulse generators are announced by **Rutherford Electronics** (69) with repetition rates from 1 cps to 10 mc and pulse widths from 0.02 to 12.5 microseconds. . . . Continuously variable delay lines offered by **Digitronics** (70) for 0.06 to 0.1 microsecond and 3.3 to 5 microseconds can be added to larger fixed delays as required.

Communications systems called Voiceplex are announced by **Kahn Research** (71) to permit two voice channels to operate in the frequency range normally required for one. . . . Aircraft antenna lightning arrestors, produced by **Dale Products** (72) to protect radio equipment, are over at 10,000 volts peak at 30,000 ft for the first stroke.

A new model of the 260 volt-ohm-milliammeter is announced by **Simpson Electric** (73) featuring a reversal switch to eliminate lead reversal, increased a-c sensitivity to 5,000 ohms per volt and printed circuits. . . . Transistorized power supplies used in **Motorola's** (74) two-way railroad radios eliminate the vibrator.

Laboratory d-c power supplies designed by **Western Apparatus** (75) for use with transistor circuits feature overload protection that limits current to within 20 percent of the selected value even with short circuits. . . . An angular oscillating table developed by **Geniseo** (76) for evaluating gyros and accelerometers is said to generate a precise sinusoidal function.

The type ECC85/6AQ8 tube, a high-mu, high-transconductance

twin triode, has been designed by **Amperex** (77) for use in a-m and f-m receivers as a grounded-grid or grounded-cathode r-f amplifier and as a self-oscillating frequency converter or cascode amplifier. . . . **Philips** (78) announces an electron microscope for industrial processing, research, medicine and pathology that is said to have resolving power better than 50 angstroms.

A speed deviation recorder announced by **GE** (79) for industrial applications provides an indication of deviation in percent by comparing a d-c tachometer generator output to a stable, adjustable d-c reference. . . . Improved stability and accuracy are claimed for **Waters'** (80) new model nitrogen gas analyzer by using r-f energy to excite the gas.

Diplexers announced by **Hycon Eastern** (81) to feed signals from 2 to 100-watt transmitters into a single missile antenna system are fixed-tuned between 215-250 mc.

New Product Makers

41: RCA, 30 Rockefeller Plaza, New York 20, N. Y.
42: Granger Associates, 966 Commercial St., Palo Alto, Calif.
43: Bendix, Eatontown, N. J.
44: Huggins Labs, 711 Hamilton Ave., Menlo Park, Calif.
45: Wave Particle, P. O. Box 252, Menlo Park, Calif.
46: Beta Electric, 333 E. 103 St., New York 29, N. Y.
47: Mandrel Industries, 5134 Glenmont Dr., Houston, Tex.
48: Shure Brothers, 222 Hartrey Ave., Evanston, Ill.
49: Lear, Abbe Rd., Elyria, Ohio
50: Anaheim Electronics, 109 S. Illinois St., Anaheim, Calif.
51: Southwestern Industrial Electronics, 2831 Post Oak Rd., Houston 19, Tex.
52: Digitronics, Albertson Ave., Albertson, N. Y.
53: Jahsco Pump, 2031 N. Lincoln St., Burbank, Calif.
54: Haledy Electronics, 57 William St., New York, N. Y.
55: Markem Machine, Keene 82, N. H.
56: Glaser-Steers, 20 Main St., Belleville 9, N. J.
57: Visual Electronics, 342 W. 10 St., New York 18, N. Y.
58: Con-Elco, 1711 S. Mountain Ave., Monrovia, Calif.
59: Beckman/Berkeley, 2200 Wright Ave., Richmond 3, Calif.
60: Aerovox, 1100 Chestnut St., Burbank, Calif.
61: American Tradair, 34-01 30 St., Long Island City 6, N. Y.
62: Minneapolis-Honeywell, Denver, Colo.
63: Lyndon Aircraft, 140-37 Clifford St., Newark, N. J.
64: Empire Devices, Amsterdam, N. Y.
65: Gulton Industries, 212 Durham Ave., Metuchen, N. J.
66: Spruce Pine Mica, Spruce Pine, N. C.
67: Branson Ultrasonics, 40 Brown House Rd., Stamford, Conn.
68: Blaine Electronetics, 14757 Keswick St., Van Nuys, Calif.
69: Rutherford Electronetics, 8944 Lindblade St., Culver City, Calif.
70: Digitronics, Albertson Ave., Albertson, N. Y.
71: Kahn Research, 22 Pine St., Freeport, N. Y.
72: Dale Products, Box 136, Columbus, Nebraska
73: Simpson Electric, 5200 18 W. Kinzie St., Chicago 44, Ill.
74: Motorola, 1501 W. Augusta Blvd., Chicago 51, Ill.
75: Western Apparatus, 2001 Greenleaf St., Evanston, Ill.
76: Genisco, 2233 Federal Ave., Los Angeles 64, Calif.
77: Amperex, 230 Duffy Ave., Hicksville, N. Y.
78: Philips, 750 S. Fulton Ave., Mount Vernon, N. Y.
79: GE Instrument Dept., West Lynn, Mass.
80: Waters Corp., 102 1 Ave., Northwest, Rochester, Minn.
81: Hycon Eastern, 75 Cambridge Pkwy., Cambridge 42, Mass.

School Tv Eyes New Horizons

Teacher shortage whets interest in educational tv as aid in technology race with Russia

THIS WEEK the broadcast industry is weighing a challenge posed by President Eisenhower in his recent Oklahoma City talk.

Speaking of Russia's technological challenge, Eisenhower said training scientists was important "above and beyond all other immediate tasks." With a scarcity of teachers, it now looks as if school tv may get new horizons.

The 28 stations now on the air cost about $500,000 each, spend about $250,000 a year. Public and private money pays bills. Closed circuits are in wide use, and some commercial programming for students is available. Space for 224 more school stations is still open.

As to whether science can be taught by tv, D. C. Stewart, assistant director of the Joint Council on Educational Television, says science is as suited to tv as any other subject. He points out that in St. Louis, Washington University's KETC teaches the entire freshman math course. Resulting grades equal those of conventionally taught students.

Pittsburgh educational station WQED transmits 162 high school physics lectures by Harvey White, University of California professor. No significant change in grades is noted.

Chicago's WTTG broadcasts an entire junior college course. Anyone may tune in for credits by paying fees and passing examinations.

A complete freshman college course is broadcast by WTVS, Detroit. Grades are "significantly higher" than average. Older students with stronger educational motives are credited for this.

The number of educational tv stations has grown since the first two went on the air in 1953. In 1954 seven stations began broadcasts, followed in 1955 by nine, and in 1956 by four more. This year another six went on the air. They may be joined by others in early 1958.

Opinions vary, but F. L. Fitzpatrick, head of the science department of Columbia University's Teachers College, feels that school tv has a definite place in education's future. He believes, however, that effectiveness and limitations remain to be defined. His school plans a survey comparing science education by experts over tv with teaching by nonspecialists in person.

Howard Fehr, head of the college's mathematics department says lack of two-way communication deprives students of classroom mind-to-mind contact. "Mere presentation of material," he says, "must not be mistaken for training in thinking."

Both men value tv as a visual aid, but feel we don't yet know enough. They doubt its value in graduate work.

FCC Actions

• Allows National Broadcasting Company to deliver tv programs to stations of Canadian Broadcasting Corporation whether or not programs are network, and whether or not they pass through NBC's regular facilities.

• Grants license to educational tv foundation WTVS, Detroit, bringing total educational stations either in operation or under construction to over thirty-five.

• Permits Western Union to increase message telegraph rates between U.S. and British Guiana, Bermuda, and Turks Island.

• Changes Alaska rules to make King Salmon rather than Naknek location of Alaska Communications System facilities.

• Authorizes construction of base station and auxiliary station to service 100 mobile units in 152-162 mc band by Pacific Telegraph and Telephone Company.

• Approves request from AT&T for new point-to-point microwave relay system bypassing Kansas City, Mo. Link will go from Worden, Kans. to Dover, Mo. through La Cygne, Kans.

• Announces that Coast Guard will no longer monitor 2670-kc distress frequency, but will instead have some of its personnel watch 2182 kc.

STATION MOVES and PLANS

WFIL-FM, Philadelphia, moves transmitter to same site as WFIL-TV, plans to reduce antenna height to 780 feet.

WANN, Annapolis, Md., obtains permission to increase power from one to ten kw and install directional daytime antenna.

KPFA, Berkeley, Cal., asks deletion of channel 233 from nearby Salinas to avoid risk of interference.

BPET, Aubuquerque, N. Mex., plans noncommercial operation on channel 5 with 4,100-ft antenna.

KHVH-TV, Honolulu, Hawaii, control passes from Henry J. Kaiser

and Hal Lewis to Kaiser-Burns Development Corp.

WDVM, Pokomoke City, Ind., increases power from 500 watts to one kw.

WSKI, Montpelier, Vt., license goes to Green Mountain Broadcasting Co. whose president D. Endman has interests in WERO, Owego, N. Y., and WTKO in Ithaca, N. Y.

WOPA-FM, Oak Park, Ill., changes from Class A to B, goes from 102.3 mc at one kw to 102.7 mc at ten kw erp.

WROM-TV, Chattanooga, Tenn., control goes to Martin Theaters of Georgia, Inc.

KTRX, Kennewick, Wash., shifts from channel 25 to 31 and changes proposed transmitter location and type.

XETV, Tijuana, Mexico, is marked for receipt of special transmissions from American Broadcasting Co. and Paramount Theaters Inc.

KOOK-TV, Billings, Mont., seeks private intercity relay for off-the-air pickup of KID-TV, Idaho Falls, Idaho.

WCAW, Charleston, W. Va., asks frequency change from 1400 to 680 kc.

WMHE-FM, Toledo, Ohio, obtains subsidiary communications authorization to furnish background music on multiplex basis.

WNAC-TV, Boston, plans antenna move to 1242 ft above sea level, transmitter moved to Needham, Mass., a community situated nearby.

WJMR-TV, New Orleans, slated for CP hearing on change to channel 12.

KLON, Long Beach, Cal., applies for modification of non-commercial f-m CP for extension of completion date.

PC Users Face Puzzle

Printed circuits—make or buy them? Firms weigh costs, production problems against advantages of in-plant supply

As uses of printed wiring and circuits spread, end equipment manufacturers are now trying to decide whether to buy from a vendor or make their own boards.

There seems to be general agreement that cost considerations favor the vendor today. Printed wiring and circuit manufacture is in a shaking down period and a buyers' market exists.

One components manufacturer who invested over $150,000 in production facilities recently decided to give it up. His board production was running at full capacity and yet losing money.

"Prices will have to go up 50 percent," he claims, "before it will be profitable. We haven't made prime costs for 12 months and now are not even covering materials. Too much competition."

Radio and tv manufacturers, major users of mass-produced printed wiring, began making their own about five years ago because vendors could not supply their demands. The vendors' capacity has since caught up, according to one source.

Vendors take the natural position that printed wiring should be bought just as other components are purchased—from specialists.

Photocircuits says the savings which might be considered a part of in-plant production are illusory. Minimum capital investment, it feels, would be $100,000. Equipment expenditures would be matched by costs of training personnel, space costs, overhead, inventory and waste disposal.

The manufacturer would also be faced with getting a return on his investment, handling peak loads, quality and cost control. The danger of technical obsolescence—such as molding or plating replacing etching as a preferred method—is also cited.

Some firms, however, do find it expedient to make their own printed wiring, weighing the costs involved against engineering convenience or their own specialized requirements.

C G Electronics began producing its own circuitry because, the firm says, outside sources able to meet its specification (for subminiature equipment) were difficult to find. C G has since become a vendor to other equipment makers.

General Precision Laboratories both buys and makes its boards, a policy that is periodically reviewed. Now, GPL makes prototype boards to save engineering delays, but purchases volume quantities to save money.

Our Missile Role Grows

In 7 out of 10 of the Army's major missile systems today, the prime contractor is a member of the electronics industry.

The missile proper, less guidance, is in most cases in the hands of an aircraft manufacturer. But the long-standing relationship of prime and sub has been reversed—and the electronics industry has moved into the foreground.

"Missile system management is not just a plum dropped into the lap of the electronic industry," cautions Martin Schilling, project management chief in Redstone Arsenal's R&D Division.

"It is an added responsibility. Perfection in electronics must match the dynamic movement of missile development."

Electronic sub-systems play a major role to such an extent that their developers should be entrusted with the overall system responsibility, the Army decided.

"This situation places quite a responsibility on these new prime contractors," Schilling told NEREM (Northeast Electronics Research & Engineering meeting) in Boston.

New electronic designs must be reduced to military gear that will operate under normal—i.e., severe—military environment and can also be maintained under these conditions.

"The prime contractors have to bring within a few years their new equipment to a so-far unheard of level of maturity. Reliability levels that must be accomplished are very high in such large aggregations of electronic equipment as modern guided weapons systems possess. This is a drastic departure from designing tv sets for living room conditions," the onetime German rocket pioneer pointed out.

The project manager plays a vital role.

Schilling sees him as "a broad planner and, at the same time, "a gnat picker pouncing on tiny details which may have an effect on the project, out of all proportion to the size of the detail."

James Davis, assistant to the president of the Vertol Aircraft Corp., told NEREM that a good weapons system management requires a vertical structure, with synchronizing authority in the hands of the project manager. "A massive outpouring of money is not a substitute for proper management," he declared.

"Systems engineering is a must," added Charles Stee of the Navy's BuShips.

NEREM speakers and exhibits heightened the emphasis on basic research.

Ivan A. Getting, Raytheon vice president for engineering and research, decried the tendency of government in the past decade to depreciate science and technology. He said it has been disastrous to industry and to men and institutions engaged in vital, continuous research.

Science and technology, he warned, "are not commodities."

More than 4000 visitors saw NEREM take a giant step in the 1957 show. Dominating the exhibits were research and engineering devices, displayed by 125 national and New England firms.

Iowa: Low-Cost Help

Up to 60,000 females await jobs in industry. Wage rates below those in other electronic areas. Now 74 Iowa firms in our field

MENTION IOWA and electronics these days and most industry members think of one firm, Collins Radio in Cedar Rapids.

True, Collins is Iowa's largest electronic firm, by far. Its Iowa activities use 800,000-plus square feet of factory and lab space, account for the bulk of its $124 million annual sales volume, and require most of its 9,000-odd employees.

But, Collins is only part of the Iowa electronics story, reports the Iowa Development Commission from the state capital at Des Moines.

Since 1931, when Arthur Collins introduced Iowa to electronics, the number of electronic firms has grown considerably. Today, Iowa boasts of 74 firms in electronics and related work.

Products manufactured by these firms include communication and navigation systems, radio tubes, tv antennas and towers, microphones and speakers, switches, resistors, capacitors, coils, cabinets and cases.

Electronic firms that have come to Iowa or added new branch plants in the last two years include: Micro Switch at Independence, International Resistance at Burlington, Bourns Labs at Ames, Collins Radio at Anamosa, Dunlap Electronics at Burlington, and Holiday Manufacturing at Washington.

In coming years many more electronics companies are expected by the Cornhusker state, particularly assembly operations and component manufacturers.

The big attraction Iowa is counting on to draw more electronic firms is its plentiful supply of low cost, female help. According to a recent survey, 60,000 females can be expected to enter the labor force if job opportunities become available.

In many of the smaller communities the wage rate for unskilled help is $1.20 for females and $1.40 for males. These rates are 30 cents an hour less than many other electronic centers, claims the commission. (A firm with 300 employees could realize a labor saving of $187,000 a year.)

Some firms can add to labor savings the economies on transportation costs, possible in Iowa because of the state's central location. An eastern manufacturer of electronics products serving a national market might benefit substantially.

Other advantages for electronic manufacturers claimed by Iowa advocates are: high level of education and inherent mechanical aptitude of residents, two state universities producing engineering graduates, and proximity to sources of electronic supplies.

Friendliness of Iowa people is an advantage that stands out in comments about Iowa by heads of companies that have moved to the state.

Typical comment is that of William M. Gilmore, president of Micro Switch Company. He says:

"The friendly atmosphere in Iowa is an advantage in many ways. The state's laws reflect this friendly attitude. It has resulted in our acquiring a friendly work force."

Who'll Raise the Moon?

WORK on the Vanguard project is being stepped up. Ultimately, the six satellites planned by the U. S. as part of their contribution in the International Geophysical Year may be hurled into space by either the Martin Vanguard rocket or by the Army's Jupiter C. The big question this week: who'll get there first?

Army plans a cylindrical satellite instead of the sphere to be used in Vanguard. Its satellite will weigh 20 lbs, like the Naval Research Laboratory's, and will do about the same job. Jupiter C will be modified to use more than three power stages. Otherwise, the launching vehicle will closely resemble present Jupiter C.

Details of the Vanguard vehicle's construction illustrate some of the recent advances in rocket technology. The material used for the protective nosecone is molded asbestos phenolic with a titanium tip to protect the magnesium-skinned goldplated satellite. The third-stage bottle as well as second-stage skin are made of magnesium-thorium alloy.

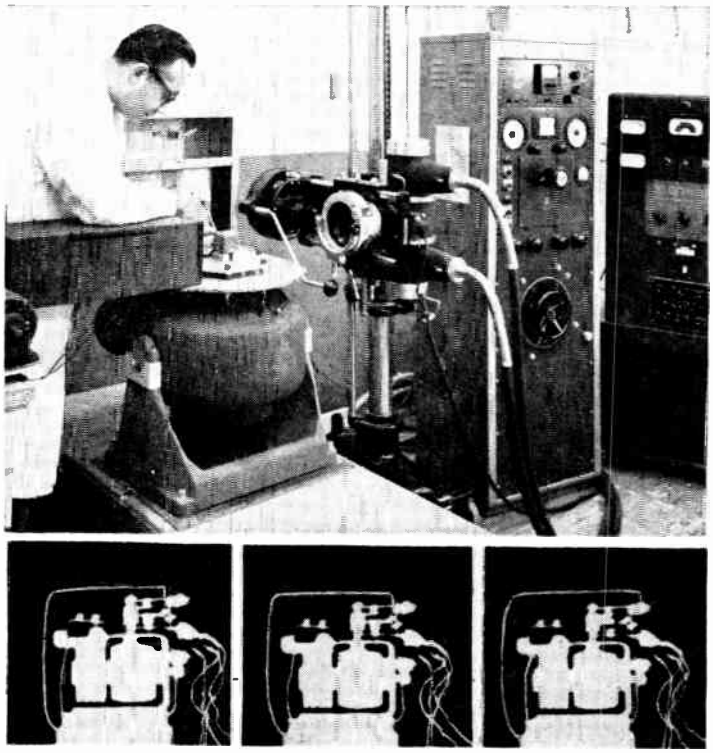
Second-stage integral tankage is made of stainless steel, first-stage tankage of aluminum, and the tail-can of magnesium.

Propellant for the Vanguard first stage is kerosene with liquid oxygen, the same combination thought to have been used for Sputnik II. White fuming nitric acid and unsymmetrical dimethyl-hydrazine will propel the second stage, and the third stage will use a solid propellant.

A three-axis gyro reference will be used with a magnetic amplifier autopilot to balance the finless Vanguard rocket on its tail as it goes aloft. The guidance systems include a pitch programmer and program timer which will be preset to nose the vehicle over when it reaches the right altitude. The program can be overruled from the ground. Integrating accelerometers will provide distance and position data, and a coasting-time computer will fire the second and third stages.

Six explosive bolts will shuck the first stage loose when its job has been completed. The mechanism for the second stage separation is somewhat more complex: a rocket-powered turntable will spin the third stage to give it orbital stability while it parts from the second stage. Then retro rockets will slow down the second stage, letting the cone coast clear. Finally a delay fuse will ignite the third stage propellant.

The nosecone is segmented, will open like a seed pod to eject the satellite after the orbit is established.



X-ray movies 'open' sealed relay as men . . .

See Inside Gear Parts

Motion picture, x-ray combination allows design engineers to peek into sealed components during stress tests

DESIGN ENGINEERS, particularly those concerned with missile and aircraft components and assemblies, can now see inside the parts during tests for shock, vibration and acceleration reliability.

The technique is one borrowed from medicine, x-ray motion pictures. Such a test set-up, called Cine-Radiography, is in use at Rototest Laboratories, Lynwood, Calif.

The west coast firm has already used the set-up during life, vibration and performance tests of airborne relays, switches, motors, miniature tubes, tuners, timers, potentiometers and potted transformers.

It is being used mainly in studying components which contain moving parts not visible because of sealing, enclosures or intricacy, or components which contain parts not supposed to move.

In a typical amplifier tube, for example, vibration testing may reveal that grid-to-cathode shorts cause a majority of failures. X-ray motion pictures will show the movement of grids and cathodes at various levels of vibration.

The engineer gets a picture of part deterioration and failure as it occurs. Once the cause and area of failure are established, minute sections can be x-rayed, using controlled penetration and laminography to focus on the critical point.

An electronic and electromechanical synchronizing system keeps the motion picture shutter in phase with the x-ray pulses. Speeds of 20, 30, 60 and 120 frames per second are now used and higher speeds are considered feasible.

Advances being explored include increased power for higher speed and greater flexibility, stereoscopic methods, correlation with closed tv and other test equipment, and

China Goes Electronic

USSR-aided tube plant ends a year of production as Soviet-style Academy pushes research

CHINA, which built its first incandescent lamp factory only 20 years ago, today is leap-frogging into electronics with Soviet assistance.

An electron tube plant, Red China's first step into the electronics age, completed its first year of operation a few weeks ago, according to an article in "Radio Services," an English-language Indian magazine.

The author was by-lined as Wu Hsi-Chiu, who studied at MIT and is now an associate research fellow with the Institute of Semi-Conductors of the Chinese Academy of Sciences.

Wu says Russian engineers helped design the Peiping plant where "all the workrooms, like the chemical and assembly shops, are constructed for rigid control of humidity, temperature and cleanliness. . . Many of the small parts are washed by supersonic wave vibrations. . . Tubes are rolling off semi-automatic lines and some of the processes are entirely automatic."

The tube plant is also a training ground for electronics technicians. Last year it took in more than 500 engineering undergraduates for practical training, reports Wu. He adds that 238 electronics engineers were graduated this year from Chinese universities, with almost twice that number expected next year.

The Peiping plant is said to have the capacity to provide "all of the ordinary radio tubes China needs now and for many years to come." Wu says a plan to extend telephone service in 7-12 years to all townships and large cooperative farms will take many millions of tubes—9 million alone for the gear in 760,000 co-ops.

But Wu states that the plant's "greater significance lies in its ability to produce a wide variety of tubes for some of the most complicated electronics equipment." The Central People's Broadcasting System, he says, uses the first 120-kw shortwave transmitter made in Communist China.

"The first home-produced remote-control device was put into operation in July 1956 on a long-distance power transformer, and China is now ready for further production of devices like it," Wu reports.

He says four institutes carry on electronics research under the Chinese Academy of Sciences: the Institute of Electronics, the Institute of Computing Machines, the Institute of Automation and the Institute of Semi-Conductors.

DEVELOPMENTS ABROAD

• **Soviet** scientists are putting great effort into solar battery development, which like an earth satellite captures the public's imagination and could provide impressive propaganda. The Kiev Radio reported recently that a Russian research center is developing a solar battery with a life span of 100 million years. This was stated by Prof. Ivan Nikitych Fransevich of the Ukrainian Academy of Science's Scientific Research Institute of Metal Ceramics and Specialized Alloys. Power of the battery was said to be sufficient for a 200-telephone exchange.

• **Finland's** Valtion Sahkopaja (State Electrical Engineering Works) has developed transistorized metal detectors to provide sawmills with protection against tramp metal in logs. Large industrial model can work in a log pond, operates on mutual inductance bridge principle, and has automatic balancing circuit. Portable 3-kilogram model operates from batteries in the handle, depends on mutual movement between the search coil and metal to be detected.

• **Britain's** National Physical Laboratory has just published a new edition of its pamphlet describing MSF—the standard frequency transmission from the U. K. These radio transmissions, on the air almost continuously from the Rugby Post Office Station, enable anyone needing precise frequency to check his apparatus against a standard which is known to one part in ten thousand million. MSF frequencies are now based on the resonant frequency of the caesium atom.

EXPORTS and IMPORTS

In Paris it is learned that technical agreements between U. S. and French firms on nuclear matters are cropping up after months of rumors, with electronics involved in the first important deal so far. An agreement for exchange of technical information and aid in the nuclear field has been signed by the big French electronics firm, Thomson-Houston; Alsthom, a T-H associate, and the General Electric Co. Both T-H and Alsthom are involved in contract work for the French Atomic Energy Commission.

Venezuela's Ministry of Communications announces that next year construction will start on a $45-million microwave telecommunications system. Bids were submitted by U. S. and European firms early this year. Contract award has not

yet been announced. The nationwide network, scheduled for completion in 1960, will provide long distance telephone facilities within Venezuela and with other countries.

Japan expects to start exporting television sets to Europe for the first time. Tokyo Shibaura Electric is negotiating with Eloff Hanson, a Swedish trading company, for export of 2,500 17-in. sets annually to Sweden, possibly beginning in February.

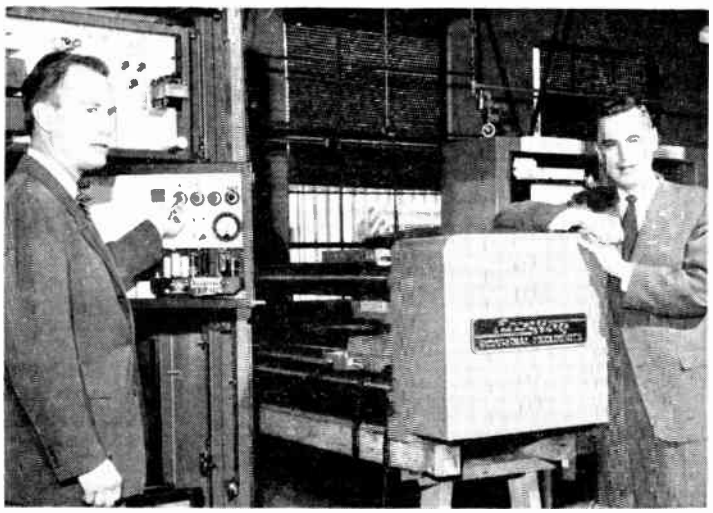
Australia's computer business is still expanding rapidly, with several orders currently being negotiated with overseas manufacturers' reps. Large-scale government orders are expected soon.

Dominican Republic and Puerto Rico last month were linked by a 238-mi. tropospheric scatter bridge. Six two-way telephone channels are provided. IT&T's Federal Telecommunications Laboratories designed the equipment while the International Standard Electric Corp. supplied it to Radio Corp. of Puerto Rico, another IT&T company, and Compania Dominicana de Telefonos C. por A., a General Telephone Co. subsidiary.

In West Germany officials of Allgemeine Deutsche Philips Industrie GmbH, opened the new Philips central laboratory in Hamburg-Stellingen last month. The new electronics laboratory was said to be in line with the research decentralization policy of Philips. Eight more laboratories and an office building will follow in 5-10 years.

New Zealand's Civil Aviation Administration has placed a $1 million order for the supply and installation of Marconi radar equipment with an Australian firm, Amalgamated Wireless (Australasia) Ltd. The radar surveillance gear is for the new Rongotai airport near Wellington and the RNZAF base at Ohakea. Rongotai equipment uses radio link from scanner on 1,650 ft hill to control center because of the risk of cable fracture in the earthquake area.

PLANTS AND PEOPLE



Nucleonics Firm Grows

INDUSTRIAL Nucleonics Corp., 7-year-old Columbus, O., maker of control systems, is shooting for a $200-million sales figure in 1975. Firm's 20-year plan figures on riding the crest of burgeoning market in industrial controls.

I-N racked up $5 million in sales last year, will come close to doubling that figure this year. Its principal product is the Accu-Ray, now widely used by tiremakers, tobacco companies and plate-rolling mills as a measurement and control device.

The Ohio firm was organized by brothers W. E. and Roy Chope (picture) and George Foster after World War II. It started production in May, 1950, specializing in industrial applications of the atom. Right now the Chopes are beginning to spread out. First move is a $1-million plant now going up on a 16-acre site in Columbus. Ultimately I-N plans to consolidate all operations on the site and adjacent land now under option. Company is now scattered around town in ten buildings.

Bullish sentiment on the part of president W. E. Chope—"we're gambling on a sure thing," he says—is fueled by current government statistics. Population growth figures show that in 1975, 30 percent more workers will have to produce 70 percent more goods and services just to maintain our present living standards.

"The answer," Chope says, "is greater industrial efficiency."

Besides current applications, I-N is working its control systems into the textile, food-processing, petroleum and chemical industries. The firm is now building smaller instruments to measure corrosion in boilers, control the height of soup in cans and the density of ice cream during processing. Other units can determine if a dredging operation is efficiently removing the sand and silt from the bottom of a lake or stream.

Also in the works is a quality and inventory control system that can report daily or hourly to management. Tentative cost of the system is between $1.5 and $2 million.

In recent organizational realignment, I-N set up eight operating divisions, gave each division manager complete autonomy. Expansion plans include setting up production companies in England and Holland. These will probably go into operation within a year.

Controls Co. Expands

CONTROLS Company of America will build a 50,000-sq ft light manufacturing plant in North Manchester, Ind. Operations now housed in Controls' Spring Valley, Ill., facilities will move to the new plant.

Building will go up on a 10-acre site donated by the city. Construction started late last month, with occupancy scheduled for January.

The one-story structure will employ some 300 people in the manufacture of timers and switches. Spring Valley plant will be sold, president Louis Putze says.

Bakelite: New Chief, Plant

BAKELITE Co. gets a new president and a new plant in moves recently announced by parent Union Carbide Corp.

R. K. Turner moves up to the top slot in the plastics firm. Turner started with Carbide's research department in 1924, moved up in its Chemicals Company's ranks, became Bakelite's vice president in 1952. He succeeds George C. Miller, who moves over to take charge of Union Carbide Realty Co.

Carbide will put up its ninth Bakelite polyester plant in Whiting, Ind. The high-pressure plant will be completed early in 1959, will be able to produce 72 million pounds of polyester resins annually.

Dalmo Forms Hydraulics Unit

DALMO Victor is setting up a new hydraulics division responsible for design and production of electro-hydraulic servo valves and associated gear.

Electronic expert R. J. Stahl moves out of the office of assistant to Dalmo Victor president to take over as manager of the new division. Stahl joined D-V in 1953, quitting the post of chief engineer at Color Television Inc, San Carlos, Calif. Both Dalmo and Color are now divisions of Textron Inc.

Sylvania Merges Parts, Ceramics

CERAMIC manufacturing operations of Sylvania Electric Products are now merged with the firm's parts division. Sylvania has production

facilities in Mineola, N. Y., which produce small ceramic components for electron tubes and connectors.

Division general manager Merle Kremer says that these facilities will be expanded for manufacture of precision ceramic parts and vacuum-tight ceramic-to-metal composites.

Sylvania has been doing its own ceramics development and manufacture for ten years.

R-W Chooses 3 New V-P's

THREE of Ramo-Wooldridge's top researchers move into vice presidencies. The three new officers are Ruben F. Mettler, Burton F. Miller and Milton E. Mohr.

Mettler, program director for the Thor IRBM, has been with R-W since 1955, is now associate director of the firm's guided missiles research division. Miller has been director of the communications division since 1954, once worked on the electronic systems for plants of the Manhattan (A-bomb) Engineering District. Mohr has been director of R-W's control systems division since 1954, took over the Boston division last April.

Philco Builds R&D Center

PHILCO Corporation is building a new electronics research and development center in Palo Alto, Calif., as part of its western development laboratories.

The 50,000-sq ft lab is scheduled for occupancy next February, will cost upwards of $1 million. It will operate as part of Philco's government and industrial division.

General manager of the western development laboratories is Oscar T. Simpson, onetime executive engineer of the firm's research division.

The new facility makes room for a scientific and administrative staff of some 250 people, can be quickly expanded to 250,000 sq ft if additional space is needed. It replaces temporary laboratories in nearby Redwood City.

Aerojet Expands Reactor Output

AEROJET—General Nucleonics is buying two acres of land and placing an option on 389 more acres surrounding its San Ramon, Calif., manufacturing facility.

Land will be used for expansion of AGN's production and design facilities for portable nuclear reactors. A. T. Biehl is technical director, and Robert Mainhardt is general manager, of the San Ramon operations.

AGN moved into the present facility about a year ago, has since "mass produced" and placed into operation a total of ten portable low-power reactors.

Executive Moves

PRESIDENT Lester A. Wells of Engineering & Research Corp., Riverdale, Md., goes to Washington to become exec v-p of Thieblot Aircraft division of Vitro Corp. of America.

Dale V. Cropsey, assistant to Elgin National Watch's president, becomes v-p for the firm's electronics and abrasives divisions.

Longtime Graybar Electric manager John Reine becomes a v-p of the firm.

Boston's Epsco Inc. gets a new v-p and treasurer as fiscal expert Robert G. Clark moves up from an officer's post at New York's Empire Trust Co.

BUSINESS MEETINGS

Dec. 18-19: Electronic Industries Association (ex-RETMA) Conference on maintainability, University of Southern California, Los Angeles.

Jan. 6-8: Symposium of reliability and quality control, Hotel Statler, Washington

Reps Sell Foreign Goods

ELECTRONICS imports, $20 million last year, will be appreciably more when this year's figures are added up. Hefty portions of the growing American market for foreign-made goods are sold by manufacturers' reps.

Electron tubes of L. M. Ericsson Corp. of Sweden are channeled into this country by New York sales agency **State Labs Inc.** The agency recently set up a network of thirteen reps to cover the country from Alaska to Florida.

American Geloso Electronics, North American sales division of Societa per Azioni Geloso, Milan, now has thirteen reps selling its line of miniature tape recorders from Cuba to the Pacific Northwest.

In San Francisco, **S. F. Salisbury** takes on the products of Transistor Devices Inc., serving California from Fresno north.

Dressen-Barnes Corp.'s line of power supplies is now sold in the Delta states and Texas by Dallas rep firm **Southwest Electronics Industries,** and in heart-of-America by **Engineering Services Co.,** Kansas City, Mo.

Instrument products of North Atlantic Industries Inc. are now sold in metropolitan New York by **B. B. Taylor,** Rockville Center, N. Y., and in overseas markets by **Electronic Manufacturers Export Co.,** Plainview, N. Y.

Atlanta rep **Grady Duckett** takes on the hi-fi products of Fairchild Recording Equipment Co. for the southeast.

San Francisco rep **F. W. Moulthrop** now handles receivers and components of the National Company in northern California and Nevada.

INDEX TO ADVERTISERS

•

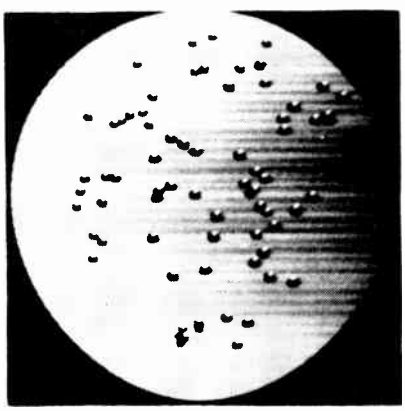
CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

In Our Dec. 1 Engineering Edition, Don't Miss . . .

• **Transistor Relays.** Electronic relays for remote control devices operate electromechanical relays requiring 2 or 3 watts, but consume only a few microamperes when idling. Circuits for both continuous-audio-tone and pulsed-video control signals are described by D. W. R. McKinley of the National Research Council.

• **Filter Design.** Butterworth and Tchebycheff filters with prescribed steady-state insertion-loss characteristics can be designed with the universal design data developed by Donald R. J. White when at ACF Industries. The design of bandpass prototypes shows how lumped-element configurations operating from about 300 cps to about 500 mc can be achieved.

• **Particle Counter.** A moving target indicator which spots and counts bacteria colonies randomly distributed over a flat surface has been designed at DuMont Labs.



Bacteria colonies are counted by moving target indicator

The system, according to Messrs. Mansberg, Yamagami and Berkley, has wide-range application in medical laboratories. Spot signals from particles less than 100 microns in diameter are received from a cathode ray tube and stored in a 1,000 sec delay line. A video circuit compensates for spot-to-background density and an anticoincidence circuit determines the right count.

• **Resisting Radiation.** Robert L. Riddle of Haller, Raymond and Brown suggests the control to some degree of the degrading effects of irradiation upon transistors by the use of negative feedback. Using this technique, a transistor amplifier and single transistor were exposed to radiation from a nuclear reactor. Test results were favorable. Radiation effects on coaxial cable showed no noticeable change in r-f transmission characteristics.

• **Computer Transcription.** Transistor circuits consisting of two-input resistor gates, flip-flops and other delay circuits are combined in plug-in assemblies to provide logical and driving operations for card puncher that produces business machine cards at the rate of 150 a minute. Each card, says James Palmer and Charles Propster, Jr. of RCA, is checked by reading completed card and comparing its output with original input information.

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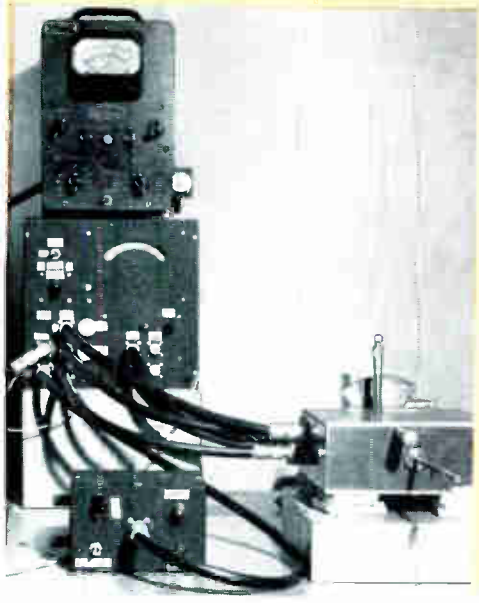
Jack-of-All-Trades

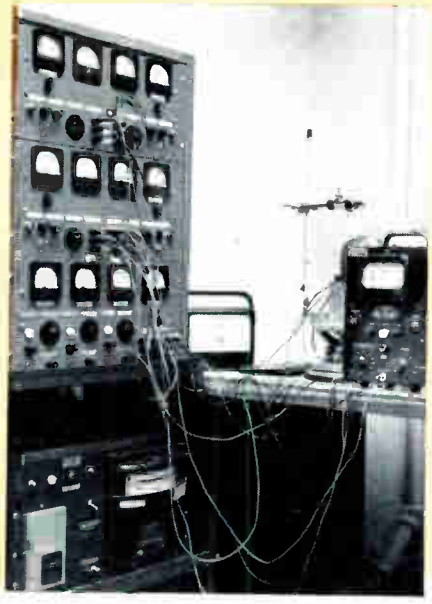
Type 1230-A D-C Amplifier and Electrometer

If your requirements call for the measurement of minute currents and voltages, or high resistances, you'll like the new General Radio D-C Amplifier and Electrometer. Its ability to measure currents down to 10^{-14} amps., voltages as small as 1 mv, and resistances up to 10^{13} ohms directly and with good stability makes it a laboratory *jack-of-all-trades*. The Electrometer can be easily converted from a high-impedance voltmeter to a low-impedance ammeter. This simplifies measuring circuits greatly, and is a definite advantage when low-voltage, well-shielded connections are required. At Minneapolis-Honeywell's Research Center in Hopkins, Minnesota, scientists have found the Electrometer indispensable for a wide variety of uses. These include:



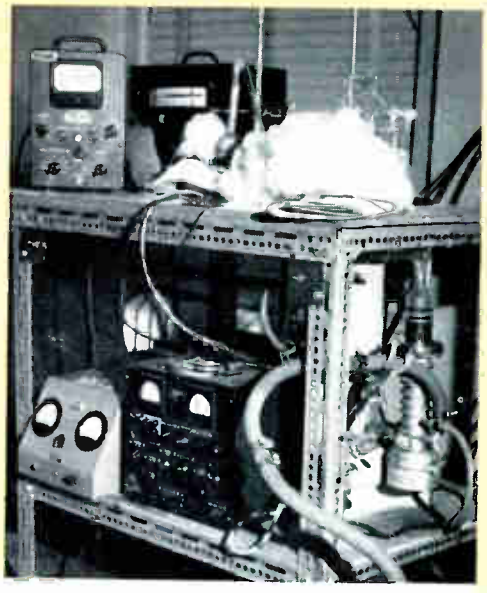
Low-Voltage Measurements

In investigating effects produced by optical irradiation of semiconductor materials, the Electrometer is used to measure open-circuit photo voltage, short-circuit photo current, and the voltage-current characteristic at the metal-to-semiconductor contact.



Low-Current Measurements

Electrometer measures low-magnitude ion currents in a miniature mass spectrometer. Here, an omegatron-type mass spectrometer is used for the analysis of gases at low pressures.



High-Resistance Measurements

Electrometer's high-resistance ranges permit accurate measurements of insulation resistance between electrical leads entering vacuum systems or cryrostats and the measurement of resistivity of pressed powders (10^{12} ohms or more).

Specifications

Voltage Ranges: ±30 mv, 100 mv, 300 mv, 1 v, 3 v, and 10 v; dc, full scale. Accuracy is ±4% of full scale on 30 mv range, ±2% on all other ranges.

Current Ranges: ± 300 milli-micromicroamperes d-c (3×10^{-13} amp) full scale to ± 1 milliampere full scale in twenty ranges (two per decade). Full-scale accuracy is ±3% to ±10% depending on multiplier position.

Drift: Less than 2 mv per hour after one-hour warmup.

Resistance Ranges: 300 kilohms to 30 megamegohms ($3 \times 10^{13}\ \Omega$) in 16 ranges. Accuracy is ± 3% to ±10% depending on multiplier and on meter deflection. With external 600 v battery in place of the internal 9 v source, resistance range can be extended to read $1.2 \times 10^{17}\ \Omega$ at smallest meter division.

Write For Complete Information

Input Resistance: Determined by setting of resistance standards (ohms multiplier) switch: 10^4, 10^5, 10^6, 10^7, 10^8, 10^9, 10^{10} and $10^{11}\ \Omega$; also "zero" and "infinity" positions. At "infinity" position, it is approximately 10^{14} ohms.

Output: Voltage, current, and resistance are indicated on a panel meter. Terminals provided for use with graphic recorders having resistances up to 1500 Ω.

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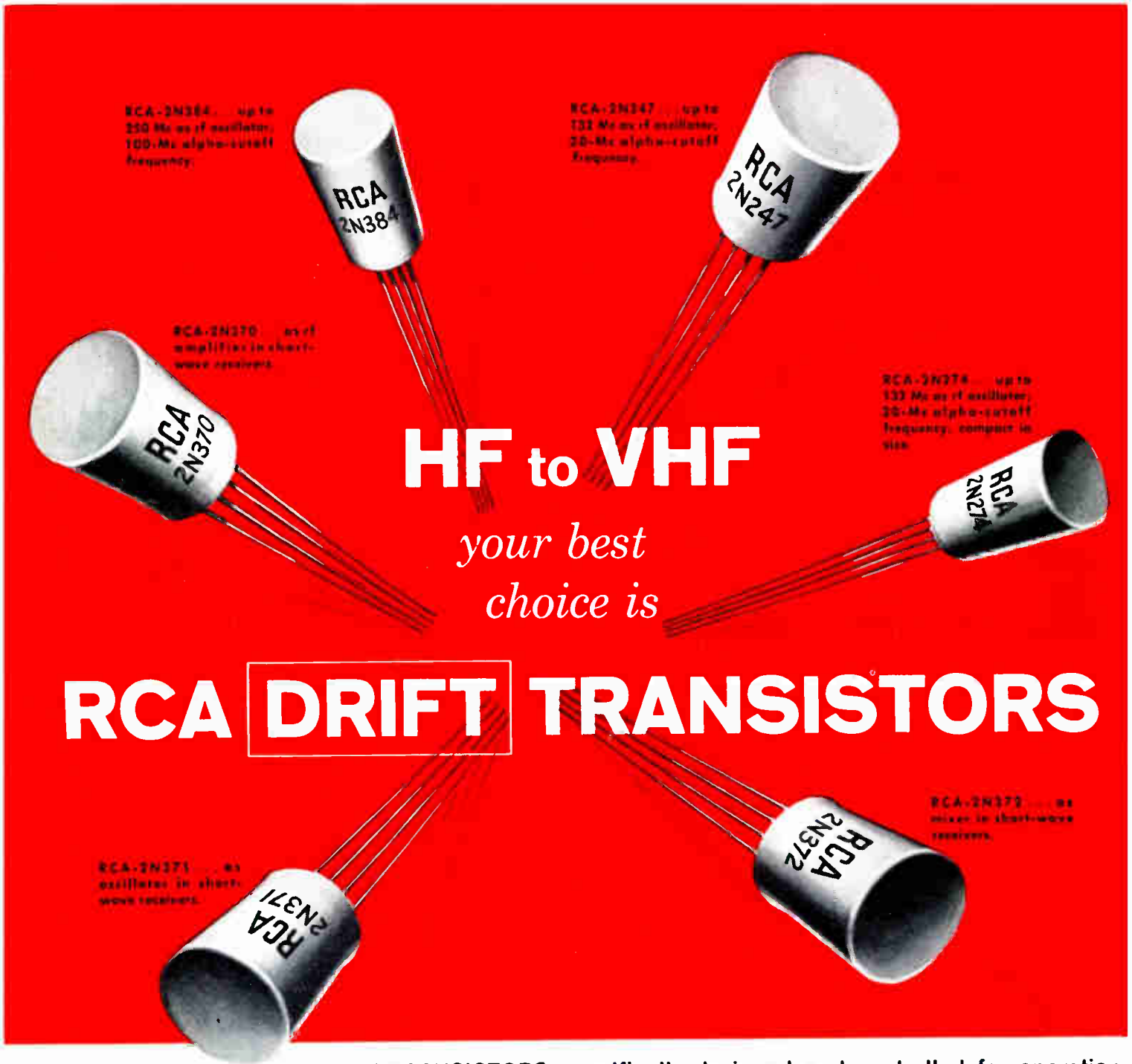

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