Sherman Mills Fairchild
April 7, 1896 - March 28, 1971

All who were associated with him, in business or in person, must be deeply saddened by the death of Sherman Fairchild. He will be missed not only in the companies he headed, but in the world of science and industry. For over 50 years, he was a major force in American technology, matched by few pioneers in our busy business history. He founded and nurtured Fairchild Camera through its early years to a position of industrial and technological significance. The company is an embodiment of his ideals and he was profoundly committed to its continuity and success. We keenly feel his loss but must be grateful for the good fortune of his leadership over so many years.

C. Lester Hogan
President and Chief Executive Officer
Fairchild Camera & Instrument Corporation

Sherman Mills Fairchild - The Man

Sherman Mills Fairchild was once described as a cross between "a rich Edison" and "a modern Leonardo da Vinci" – rich Edison because of his inventiveness and inherited wealth – da Vinci because of his rare combination of artistic and engineering talents. But perhaps the most accurate label applied to him was stated by another pioneer in aviation: "Fairchild was something of an enigma, a good deal of a genius, and very much a teacher!"


"Fairchild was something of an enigma, a good deal of a genius and very much a teacher."

Fairchild goes on the NY Stock Exchange.

Many major magazines provided other apt descriptions. One referred to him as "somebody from another time. He was an incurable tinkerer, a tireless dabbler in the mechanical arts, a lone wolf in these days of research teams and group efforts, a man fascinated with everything from space platforms to cellophone tape." A news magazine referred to him as "the epitome of the new scientist-businessman-inventor who is the driving force behind the success of the growth and glamor stocks."

Fairchild would not accept the word "impossible." Why not invent matches that won't blow out in the wind, or car locks that won't rip your coat, or pill bottles that won't spill open in your pocket? His early experiments resemble something out of Tom Swift. For example, he designed and built a small dam that worked so well that it flooded out a section of state highway. Fortunately, he didn't give up the ship with that one failure.

He had a method – to drive himself and others to newer and more useful answers, to stimulate by doubt, and to use the question mark as a springboard to progress. He challenged almost every idea – whether it involved an aerial survey or production of a stereo cartridge. And he went at it with the typical "Fairchild style" – extreme enthusiasm and efficiency.

One of Fairchild's secretaries once remarked to a magazine writer that he sent out 200 requests a week for product information. She told of how he became a connoisseur of dictaphones, typewriters, colored pencils, fruit-picking machines and potato sorters. He had become a self-taught expert on office procedure, who not only designed his own filing systems but worked on ideas for office partitions. She also recalled when he telephoned all over New York to find a particular kind of sticky cellophane label because he had heard it came off the roll easier; and how he had once spent two months looking for a typewriter with a type face small enough to type the pages of his pocket calendar.

He was also a "gadgeteer." His basement was filled with the products of his hours of tinkering. He would proudly display a phonograph arm that slides in a slot instead of being fixed to a pivot; a scheme for putting all the mailing addresses in the U.S. in code so that mail can be handled by data processing machines; an automated process for color film developing; a movie projector that serves as its own screen, like a television set, the film would be in a clip and would never have to be rewound.

Fairchild's gadgets even covered his townhouse in New York City. For instance, his living room was actually a sound studio with auxiliary controls hidden in the coffee tables, an acoustically balanced teakwood floor and a fully equipped control room that came into view when shutters were folded back. Another innovation was a $17 motor, salvaged from a junkshop, and rigged up to raise

It all started with a camera.

His dress and manner were informal—almost casual.

and lower the louvered windows which fronted the house. Instead of stairs he installed ramps in his townhouse modeled after those found in Grand Central Station.

When Fairchild got restless, he retreated to his country estate. An avid tennis player, he designed and built his own recreation hall complete with an indoor tennis court. This unique windowless hurricane-proof building enabled him to play all year round. Among his frequent weekend guests were tennis stars from all over the world.

Despite his wealth and history of personal illness, he worked long hours – nights and weekends – he refused to take vacations. A characteristic weekly schedule would include such items as

- A trip to L.A. to explain to MGM executives how his Front Projector system could be applied to commercial moviemaking.
- A talk with Edward G. Uhl, president of Fairchild-Hiller, about a new product line.
- A discussion with IBM Chairman Thomas Watson, Jr. regarding recent business activity.
- A taping session in his N.Y. townhouse featuring Hubie Blake, the 85-year-old jazz pianist. He often held taping sessions at his house with well-known musicians.
- A movie test of a new color film, in his living room, which had photographic lights and electronic strobes in the wall fixtures.

Fairchild was one of the most important businessmen in America, yet unlike any ordinary executive – his dress and manner were informal – almost casual. He had no platoon of secretaries, no plush offices or a let's-get-down-to-business attitude. He didn't need these executive tools to run his businesses.

Even Fairchild's closest friends found him a difficult person to sum up. To many he had given the impression of being aloof, yet those who knew him would admit that he gave unendingly of himself and his knowledge.

An old friend once described Fairchild: "I think he's half child, half genius. He's forever up in the clouds, but maybe that's where the big things are done. He's often unrealistic, but that could be his real talent. He just doesn't think like other people. He even looks at death as just another problem to take down to his workshop. Do you know what he said to me one day? He was talking about the future. 'If I die,' he said. Have you ever heard of anything like it? 'If I die . . . ' "

The Early Genius

Fairchild at 17 with a Graflex camera.

Aerial photo of Manhattan in 1921.

Fairchild Camera product line in the late 1940's.

Fairchild's first cabin plane, the FA-1A (Fair-Cabin) built in 1926.

Commander Byrd began his Antarctic Expedition with a FC 2 W 2 in 1928.

The Early Genius

Sherman Fairchild was born with a silver question mark in his mouth. April 7, 1896 marked the beginning of a life hinged on the question "Why?" By his continuing struggle to provide an answer for every "why," he set a life style for himself which was to leave an indelible mark on science, industry, technology and people.

It didn't take long for Fairchild's curiosity to get the best of him. In 1912, this inquisitive teenager completely dismantled a $10,000 Locomobile (a gift from his father) to see "what made it tick." He emerged from the garage several hours later, covered with oil and grease, to inform his father that "this overgrown flivver only has four bearings on the crankshaft!"

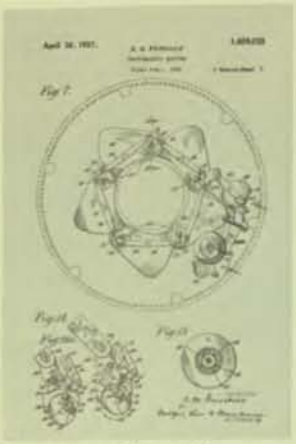
The same passion for exact detail led Fairchild to study a camera which challenged him with its limitations. Working on the theory that there is nothing that can't be improved, he synchronized the shutter with a blast of flash powder and took the first night action shot of a boxing match—which came to a dead halt until the boxers got the "spots" out of their eyes.

The camera caused Fairchild's career. After he left Harvard in 1916 due to illness, the young man of 20 perfected the design of the revolutionary shutter for aerial cameras. Two years later, the military became interested in the aerial camera but refused to build it. So, he rented a loft in the garment district of New York and began to manufacture the shutter and camera himself. He delivered the two aerial cameras covered by the order in 1919 at a loss of $30,000. Not easily discouraged, he immediately began to design a better aerial camera which, one year later, won substantial orders from the Navy and Signal Corps. The loft factory was abandoned and Fairchild Aerial Camera Corporation was established on February 11, 1920 in New York.

When World War I ended, Fairchild had to find a commercial use for his camera and Fairchild Aerial Surveys was incorporated as a sheer necessity. Through experimentation, he developed the aerial camera into an exact tool of engineering—a means of recording and measuring quickly the ground data which surveyors on foot required weeks or months to gather. He stood alone in this concept of the aerial camera as an engineering tool, and thus had to "sell" it at his own expense by mapping a number of large cities. In 1922, the New York Times carried a headline which aroused public interest—"New York City Mapped in 69 Minutes by New Type of Camera Perfected by Sherman Fairchild." Eventually, a worldwide aerial surveying business developed.

Fairchild was not satisfied with the existing aircraft, here or abroad, because they were not suited to the needs of aerial surveying. He founded the Fairchild Aviation Corporation in 1924 to build a plane exactly right for aerial surveying. On June 14, 1926, the Fairchild FC-1 made its public debut—it also made history. The FC-1 scored three firsts—an enclosed cabin; folding wings to reduce hangar storage space; and both wing slots and flaps for greater stability and landing/takeoff safety. This was just the beginning of Fairchild's aviation firsts—many more followed.

A year later, the Fairchild FC-2 made history with two more innovations—hydraulic brakes and hydraulic landing gear. In 1933, he scored again with the Fairchild C-31—the first airplane in the world to be designed expressly for carrying cargo. This design can still be found in practically all cargo aircraft today. Fairchild's own C-119, the "flying boxcar," was the backbone of Air Force cargo and paratroop operations during the 1950's.



First of over 30 patents.

Sherman Fairchild (standing right) loads his aerial camera aboard one of the early biplanes.

Fairchild had a "keen sense sense of humor."

"Get the right man and let him do it." Sherman Fairchild with Dr. C. Lester Hogan, president and chief executive of Fairchild Camera and Instrument Corporation.

Fairchild was constantly motivating others.

Fairchild demonstrating aerial camera in 1923.

All of these Fairchild breakthroughs have been stamped with the seal of a "U.S. Patent" (he had over 30 patents to his credit). These early achievements fortified his faith in his concepts and justified the career which he had embarked on as a teenager. "My whole life," he said, "has been spent in finding new and better ways to do things." His interest in technology was unceasing—his friends described him as "Prometheus chained to his rock."

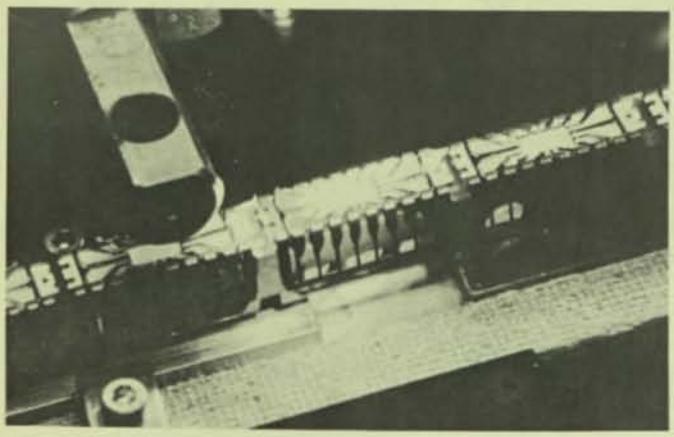
This particular "Prometheus" organized and filed his life, career and finances alphabetically for the sake of order and clarity. He would readily give you an example such as "P" for photography; "T" for tennis; or "E" for eats. "Sherman," an associate once said, "is like a chest of drawers. He's got a drawer for everything and no one has looked in them all." Using Fairchild's "alphabet system," we will attempt to share with you his hobbies, ventures, philosophies and idiosyncrasies.

Aim in Life—"finding new and better ways to do things."
Bachelor—"I've never really had time to marry."
Conrac Corporation—he helped launch this industrial and aircraft equipment maker.
Darkroom—constructed in his country estate and "more advanced than any professional photographer's in New York."
Entrepreneur—newspapers, magazines, friends and competitors always portrayed him as such.
Fairchild-Hiller Corporation—airplane and engine manufacturing subsidiary which he formed during the depression.
George W. Fairchild—Congressman, founder of IBM and Sherman's father—he fostered his son's interest in mechanics.
Howard Hughes—close friend, tough competitor, and member of the same club of industrial genius.
International Business Machines (IBM)—he was a director, major stockholder and member of the executive committee.
Journals, technical and trade—he read 250 each month.
Keen Sense of Humor—when asked by an interviewer how much money he had, Sherman replied "I really don't know—a magazine said I had $80 million."
Lifeblood of his activity—people who might stimulate an idea.
Mail— an eight-inch stack of ideas daily, each of which merited Sherman Fairchild's personal attention and reply.
Novel Ideas—the Fairchild Forum, "the one system that allows you to talk simultaneously for the sake of argument", the first professional tape deck and the first recording of sound on aluminum disks.
Organizer—he packaged Fairchild Recording and three other photo-audio companies into what he jokingly called a "mini-mini conglomerate."
Pan American World Airways—he was a director and stockholder.
Quoted on his basic philosophy of management—"get the right man and let him run it."
Research—a word he couldn't resist.
Stereo Cartridge—he produced the first commercially successful one.
Tablecloth—his favorite place to draw diagrams while entertaining experts in a lavish restaurant.
Unrelenting—his method was to drive himself and others to newer and more useful answers.
Vacation—he didn't know the meaning of the word.
Workshop—his basement was a "gadgeteer's paradise" where he designed a bobsled which "ditched" him in the snow (he sported a plaster cast for several weeks).
Mister "X"—to his associates he was a man of mystery.
Yachts, polo ponies, private planes and chauffeurs were taboo—"I believe in living simply."
Zealous—one way to describe a man who would work 14-16 hours a day, often including weekends.

Fairchild Camera and Instrument Corporation

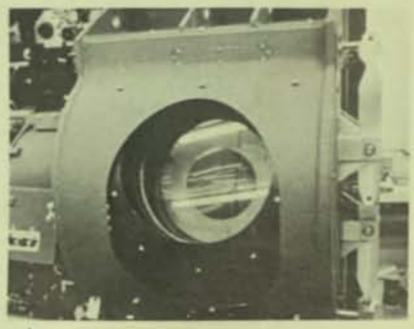
1919 to 1971 reflects more than half a century of industrial genius and scientific exploration – from the first manufacturing venture in a New York loft to the Fairchild Camera & Instrument Corporation as it is today.

Sherman Fairchild dealt in new ideas and created companies to develop product lines to satisfy the world's demand for new and better technology. Fairchild's cameras served the world in 1919 – today the divisions of the present Corporation shape the future of our universal society.

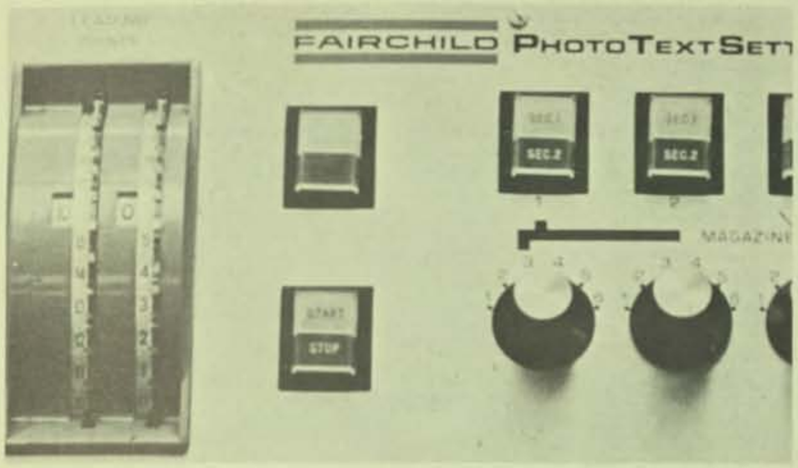


◀ **Fairchild Semiconductor**, headquartered in Mountain View, California, manufactures a wide variety of silicon Planar transistors, diodes, integrated circuits and complex arrays, including power transistors, small signal devices, LSI, MSI, CCSL, MOS, TTL, hybrids and memories.

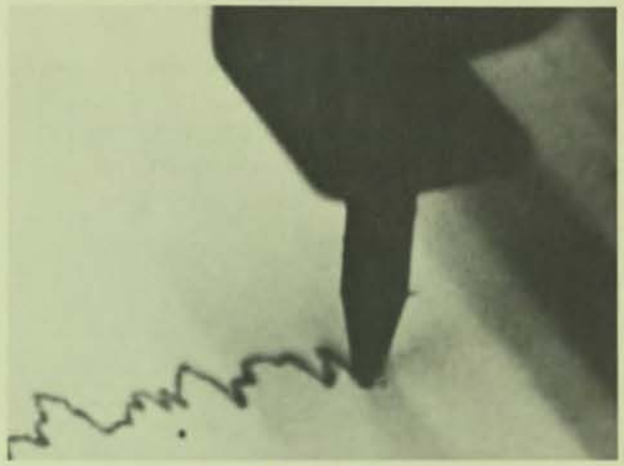
Systems Technology is involved in the development, manufacture and marketing of semiconductor test systems. The division is headquartered in Sunnyvale, California. ▶



▲ **Space and Defense Systems** manufactures precision aerial reconnaissance cameras and systems as well as electronic data conversion systems, precision lenses, advanced film processing equipment, and ordnance devices. This Fairchild division is headquartered in Syosset, New York.



Graphic Equipment, Plainview, New York, manufactures typesetting systems for automatic linecasting. These include electronic keyboards, typesetting computers, and phototextsetters.



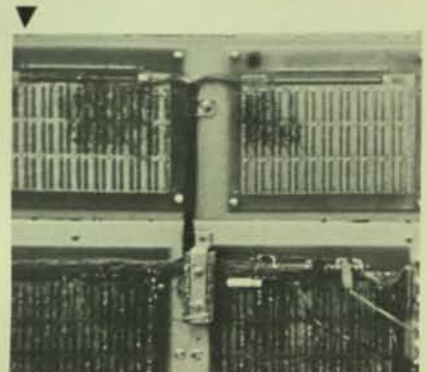
Electro-Metrics, located in Amsterdam, New York, manufactures a line of radio frequency interference analyzers and spectrum surveillance equipment, tunable rejection filters, RF and Microwave components, and other devices.

Microwave and Optoelectronics, located in Palo Alto, California, is expanding Fairchild's efforts in solid-state microwave devices, components and subsystems, complex optical arrays, optoelectronic photo sensors, emitters and devices; and solid-state displays and detectors.

DuMont Electron Tubes, Clifton, New Jersey, is an industry leader in the design and production of display devices which include cathode ray tubes, direct-view storage tubes, photomultiplier tubes and power tubes.

The Company's **Research and Development** laboratory, located in Palo Alto, California, is responsible for innovation — making possible the improvement of existing products and creation of new ones. R&D is playing a major part in the company's interchange of technologies among all divisions.

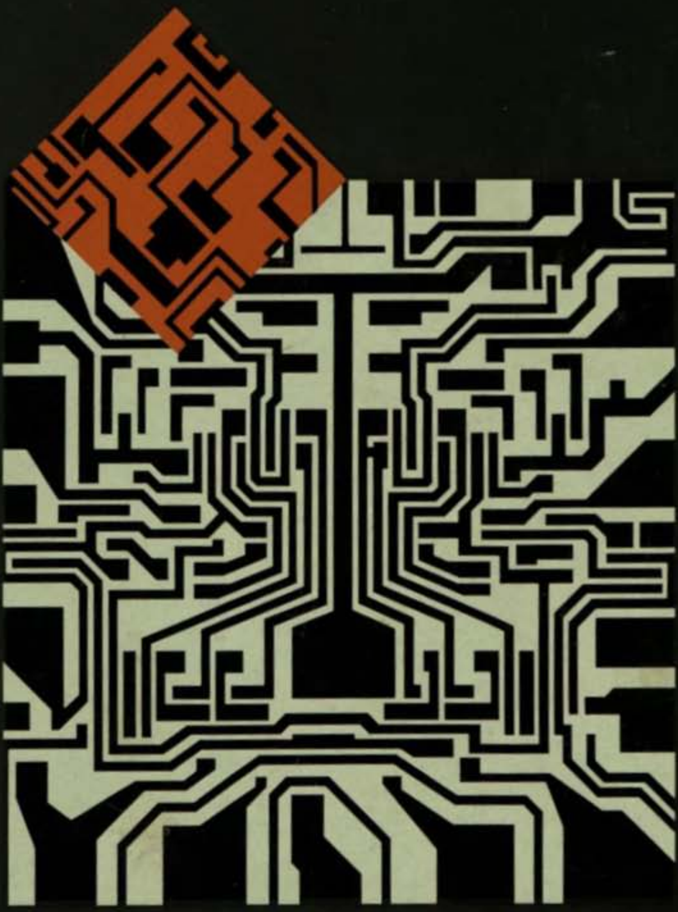
The Industrial Products division, Commack, New York, has a range of products including cockpit voice recorders, flight data recorders, music and announcement systems for aircraft, and front and rear-screen projectors.

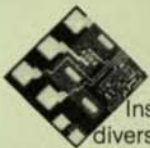


FAIRCHILD

CAMERA AND INSTRUMENT
CORPORATION

Facts About Fairchild





Fairchild Camera and Instrument Corporation is a diversified international company which develops, manufactures and markets electronic components, systems and end products for the consumer, commercial, industrial and government markets. The company ranks as the third largest U.S. supplier of semiconductor devices.

Fairchild solid state components—including integrated circuits, discrete devices and hybrid products—employ virtually every major semiconductor technology in use by the electronics industry. They are applied extensively by computer, aerospace, communications and automotive companies, in industrial processing and by users and makers of consumer electronic products. Microprocessors and related equipment serve industrial and consumer electronics markets.

Test systems for semiconductor components, memories and circuit board assemblies, which evolved from Fairchild's development of evaluation systems for its own use, are sold to both semiconductor and digital equipment manufacturers.

The Test Systems Group operates a world wide sales, service and software training and support network to serve its customers.

Fairchild digital watches, clocks and programmable home television games are sold through department and specialty stores worldwide.

The military services and other government agencies are major customers for Fairchild's space and defense systems, including aerial reconnaissance and surveillance systems, CCD cameras, communications jammers and data converters. Audiovisual and aviation products are also marketed to government, industrial and educational customers.

Headquartered in Mountain View, California, the company has plants in five states and six foreign nations, and a worldwide sales and distribution network. Fairchild Camera common stock is listed and traded on the New York and London Stock Exchanges and traded on the Pacific and Midwest Stock Exchanges.

Fairchild was founded by the late Sherman Mills Fairchild, noted industrialist and scientist, who was Board Chairman when he died in 1971 at the age of 74. He founded a number of other companies, including Fairchild Industries and Conrac Corporation, and for many years was a director of IBM.

His first independent business endeavor took place in New York in 1920 with the formation of the Fairchild Aerial Camera Company, from which Fairchild Camera and Instrument Corporation evolved. In its early years, the company was primarily a supplier of aerial cameras and other aviation equipment, developments based on Mr. Fairchild's inventions. These included the between-the-lens camera shutter, the closed-cabin airplane, the folding wing airplane and hydraulically-operated aircraft brakes and landing gear.

In 1936, his business enterprises had grown to the point that he separated the aircraft and engine manufacturing activities into a new company, now known as Fairchild Industries. The aerial camera and electronics segment of the business continued as a separate operating entity, and was renamed Fairchild Camera and Instrument Corporation in 1944.

Products evolving primarily from the original camera manufacturing operations have made Fairchild a major U.S. government supplier. Products manufactured in New York for the military services include aerial and surface surveillance and photographic systems and frequency monitoring equipment. Many government aircraft and commercial airlines carry Fairchild flight recording and weight and balance systems. The company also manufactures a range of audio-visual products used in industry, schools and retail stores.

The single most significant diversification move for Fairchild occurred in the late 1950's. The company had sponsored a small group of young scientists in California in the development of a new process for the manufacture of transistors.

These devices had touched off a revolution in the electronics industry, but no successful manufacturing method had been developed that could meet the requirements of the more demanding user. The goal of the Fairchild scientists was to develop, mass produce and market semiconductor components that would meet the most stringent specifications.

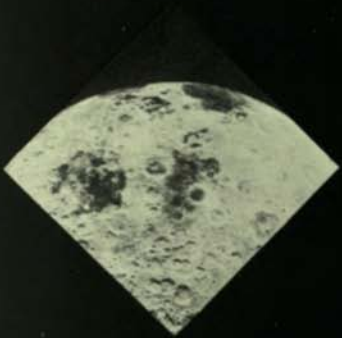
They reached it in 1959 with the introduction of the Planar* process material. Today, Planar technology is the fundamental process for producing transistors and integrated circuits, and is still regarded as the most significant achievement in the semiconductor technology since the invention of the transistor.

Facing page:

1. The moon's surface as recorded through the Fairchild Lunar Mapper aerial camera.

2. Sherman Fairchild loads one of his early cameras for a flight.

*Planar is a patented process of Fairchild Camera and Instrument Corporation.



During the 1960's, Fairchild built multimillion dollar plants in the United States and the Far East to serve the burgeoning semiconductor activities. The company quickly established itself as one of the world's major suppliers of semiconductor devices.

Semiconductor technology expanded so rapidly throughout the 1960's that circuit density (the number of transistors and other elements in a given size "chip" of silicon) doubled every year or two. This soon led to the standard designations of SSI (small scale integration), MSI (medium scale integration) and more recently to LSI and VLSI (large and very large scale integration). At the same time new circuit structure technologies were introduced in a bewildering variety of designations. Processes including Planar, Isoplanar, Isoplanar II and I³L™* are just a few of the leading Fairchild innovations.

Since 1960, circuit density manufacture has progressed from the ability to fabricate four to eight transistors on a single chip to today's microprocessors. The densest of these circuits contains more than a quarter of a million circuit elements on a single chip, and function as a complete computer central processing unit. In semiconductor memories, density has grown from 256-bit memories in 1970 to 65,000-bit memories today. Predictions are that memory chips of 250,000-bit capacity will be available by 1980—a thousand-fold increase in density in 10 years.

Another source of Fairchild's progress stemmed from semiconductor-oriented equipment the company manufactured for its own use. In the early 1960's Fairchild developed its own test equipment for use on its semiconductor manufacturing lines and soon realized it had test machines far better than anything commercially available. The company decided to sell this equipment to other firms in the industry, and from this effort evolved the Test Systems Group now headquartered in San Jose, California.

In 1975, the company entered the consumer electronics field with a full line of electronic digital watches. Today, Fairchild has expanded the consumer line to include digital clocks and a programmable video entertainment system for the home.

Operations began in 1977 at Fairchild's VLSI plant in South San Jose, Calif., one of the most advanced semiconductor manufacturing facilities in the world. Production of complex VLSI devices including Fairchild's 65,000-bit charge-coupled-device memories are centered there.

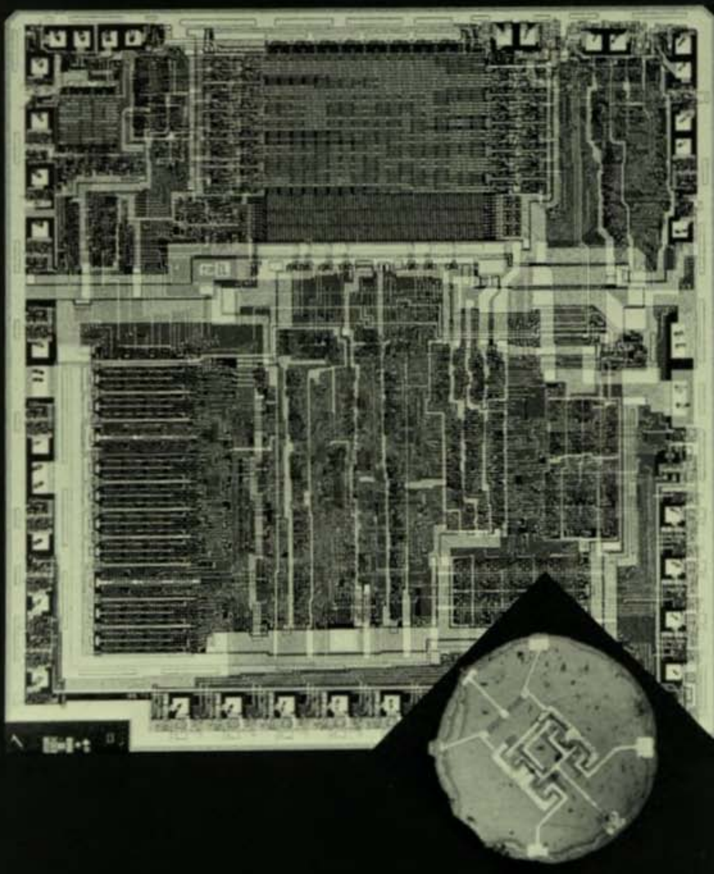
In early 1978, Fairchild introduced the 9440 Microflame™ 16-bit microprocessor, the industry's first such product capable of executing minicomputer instructions with full minicomputer performance. The 9440 is based on Fairchild's proprietary I³L technology.

Facing page:

1. The 9440 Microflame™ 16-bit microprocessor, the first circuit with minicomputer power on a single chip, is based on Fairchild's proprietary Isoplanar Integrated Injection Logic (I³L™).

2. This resistor-transistor logic (RTL) product, introduced in 1961, was the first integrated circuit available as a monolithic chip.

*TM—Trademark of Fairchild Camera and Instrument Corporation



2

SEMICONDUCTOR PRODUCTS

DISCRETE PRODUCTS GROUP:

Diode Division
Location:
4300 Redwood Highway
San Rafael,CA 94903
415-479-8000

Products: switching diodes, zener diodes, high reliability diodes, varactor diodes, diode arrays, rectifiers

Optoelectronics Division
Locations:
313 Fairchild Dr.
Mountain View, CA 94042
415-962-5011

4001 Miranda Ave.
Palo Alto, CA 94304
415-493-3100

Products: light-emitting diode and liquid crystal displays, solid-state lamps, phototransistors, infrared sensors and emitters, optical couplers

Transistor Division
Location:
313 Fairchild Dr.
Mountain View, CA 94042
415-962-5011

Products: power and small signal silicon transistors, multiple transistor arrays

INTEGRATED CIRCUITS GROUP:

Automotive Division
Location:
369 Whisman Rd.
Mountain View, CA 94042
415-962-5011

Products: automotive ignition modules, hybrid regulators, hybrid circuits, hybrid modules for telecommunications, digital panel meters

CMOS Products Division
Location:
3105 Alfred St.
Santa Clara, CA 95050
408-247-7660

Products: standard and custom complementary metal oxide semiconductor components, small, medium and large scale integration digital watch circuits, clock circuits, tuning and video display interface circuits

Digital Division
Locations:
313 Fairchild Dr.
Mountain View, CA 94042
415-962-5011

333 Western Ave.
South Portland, ME 04106
207-774-6211

Products: standard and custom digital integrated circuits, including low-power Schottky, transistor-transistor logic, medium and large scale integration circuits

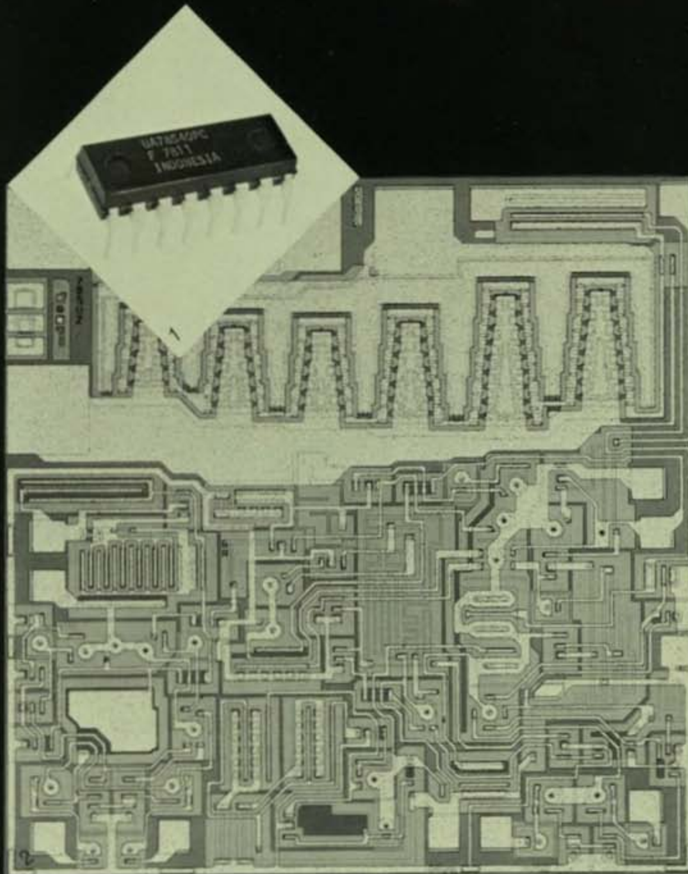
Linear Division
Location:
464 Ellis St.
Mountain View, CA 94042
415-962-5011

Products: linear integrated circuits

Facing page:

1. and 2. This low-cost three-terminal voltage regulator from Fairchild's Linear Division is designed for use in electronic consumer products.

3. The Sentry™ line of semiconductor test systems from the Test Systems Group provide fast testing of high-complexity devices.



INDONESIA
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3

LSI PRODUCTS GROUP:

Bipolar LSI Division
Location:
464 Ellis St.
Mountain View, CA 94042
415-962-5011

Products: bipolar memory circuits including random-access, read-only and programmable read-only memories, microprocessors, emitter coupled logic circuits, large scale integration circuits

MOS/CCD Division
Locations:
464 Ellis St.
Mountain View, CA 94042
415-962-5011

4001 Miranda Ave.
Palo Alto, CA 94304
415-493-3100

101 Bernal Rd.
San Jose, CA 95119
408-224-7000

All Angels Hill Rd.
Wappingers Falls, NY 12590
914-297-0161

Products: metal-oxide semiconductor memories and logic circuits, microprocessors, charge-coupled device products

Manufacturing Services Division
Domestic Locations:

441 Whisman Rd.
Mountain View, CA 94042
415-962-5011

33 Healdsburg Ave.
Healdsburg, CA 95448
707-433-6541

International Locations:

Fairchild Semiconductor (HK) Ltd.
135 Hoi Bun Rd.
Kwun Tong
Kowloon, Hong Kong

Wing Kai Electronics Ltd.
CPTL 49 Sun Ping Circuit
Hung Cheung Rd.
Tuen Mun, Castle Peak
N.T. Kowloon, Hong Kong

P.T. Fairchild Semiconductor
C/O Tromol POS 183
Djakarta, Indonesia

219-6 Karibong Dong
Youngdung po-ku
Seoul 150-06, Korea

Fairchild Singapore Pty, Ltd.
No. 11 Lorong 3
Toa Payoh, Singapore 12
Republic of Singapore

Time Products Division
Location:
4001 Miranda Ave.
Palo Alto, CA 94304
415-493-3100

Products: Digital watches and clocks, related components

WORLDWIDE SEMICONDUCTOR MARKETING

Area headquarters:

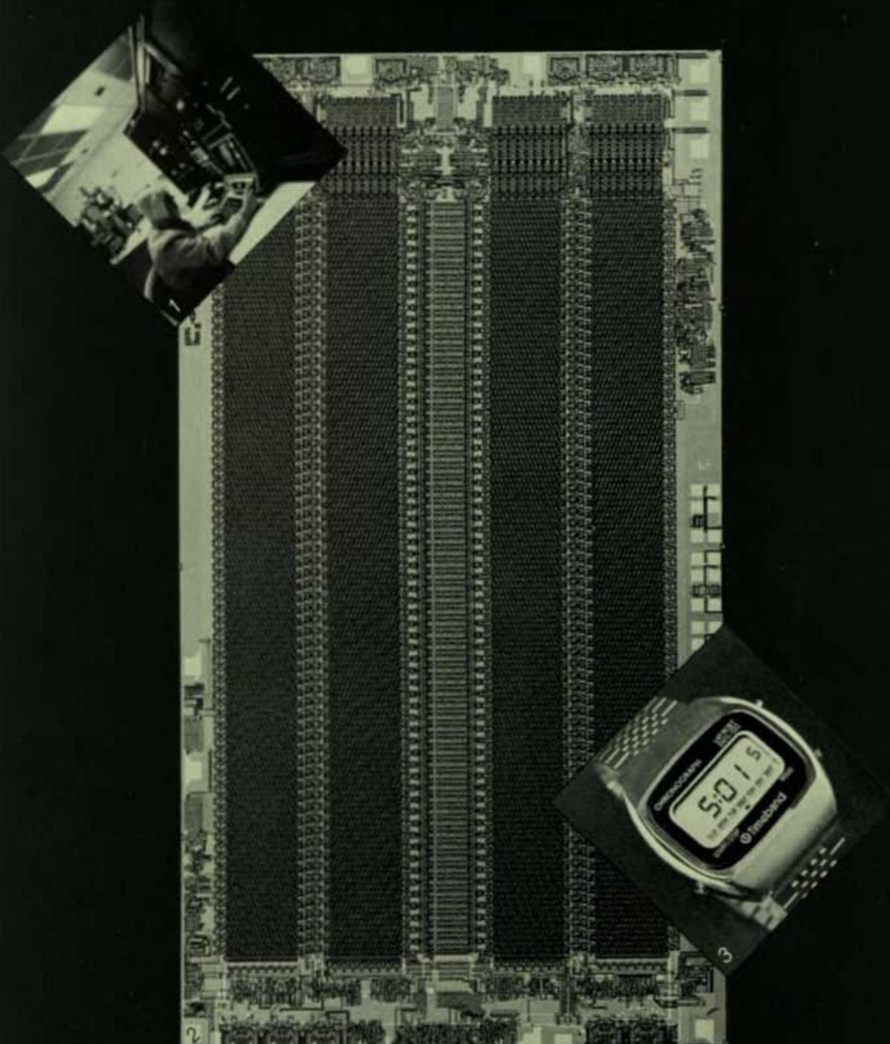
Europe
Northern Europe—London
Fairchild Camera and Instrument (UK) Ltd.
230 High St.
Potters Bar
Herts, England

Facing page:

1. Fairchild's electron beam mask-making machine reduces the time required to make a new photomask set from weeks to days.

2. Significantly increased memory capability in a fraction of the chip size previously required is provided by this 16K random-access memory, produced by the MOS/CCD Division.

3. The Timeband™ six-digit chronograph operates as a 60-minute stopwatch in addition to performing regular timekeeping functions.


1
2
3
Timeband

Central Europe—Munich
Fairchild Camera and Instrument
(Deutschland) GMBH
8046 Garching-Hochbruck
Daimlerstr XV
Munich, West Germany

Southern Europe—Milan
Fairchild Semiconductor SPA
Via Rosselini, 12
20124 Milano, Italy

Far East
Hong Kong
Fairchild Semiconductor (HK) Ltd.
135 Hoi Bun Road
Kwun Tong
Kowloon, Hong Kong

Japan
Fairchild Japan Corp.
Pola Bldg.
1-15-21, Shibuya I-Chome
Shibuya-ku, Tokyo 150, Japan

Latin America
Brazil
Fairchild Semiconductores, Ltda.
RUA Dr., Oswaldo Cruz, 505
CAIXA Postal 948
Campinas, S.P., Brazil

Mexico
Fairchild Mexicana, S.A.
Blvd. Adolfo Lopez Mateos, No. 163
Mexico City 19, D.F. Mexico

SYSTEMS AND EQUIPMENT

TEST SYSTEMS GROUP:

Sentry Division
Location:
1725 Technology Dr.
San Jose, CA 95110
408-998-0123

Products: automatic semiconductor test systems

Testline Division
Location:
North Brevard Industrial Park
Titusville, FL 32780
305-267-7212

Products: printed circuit board test systems

Xincom Division
Location:
20450 Plummer St.
Chatsworth, CA 91311
213-885-1050

Products: automatic semiconductor memory test systems

GOVERNMENT AND INDUSTRIAL PRODUCTS GROUP:

Imaging Systems Division
Location:
300 Robbins Lane
Syosset, NY 11791
516-931-4500

Products: aerial reconnaissance and surveillance camera systems and CCD electro-optical imaging systems

Facing page:

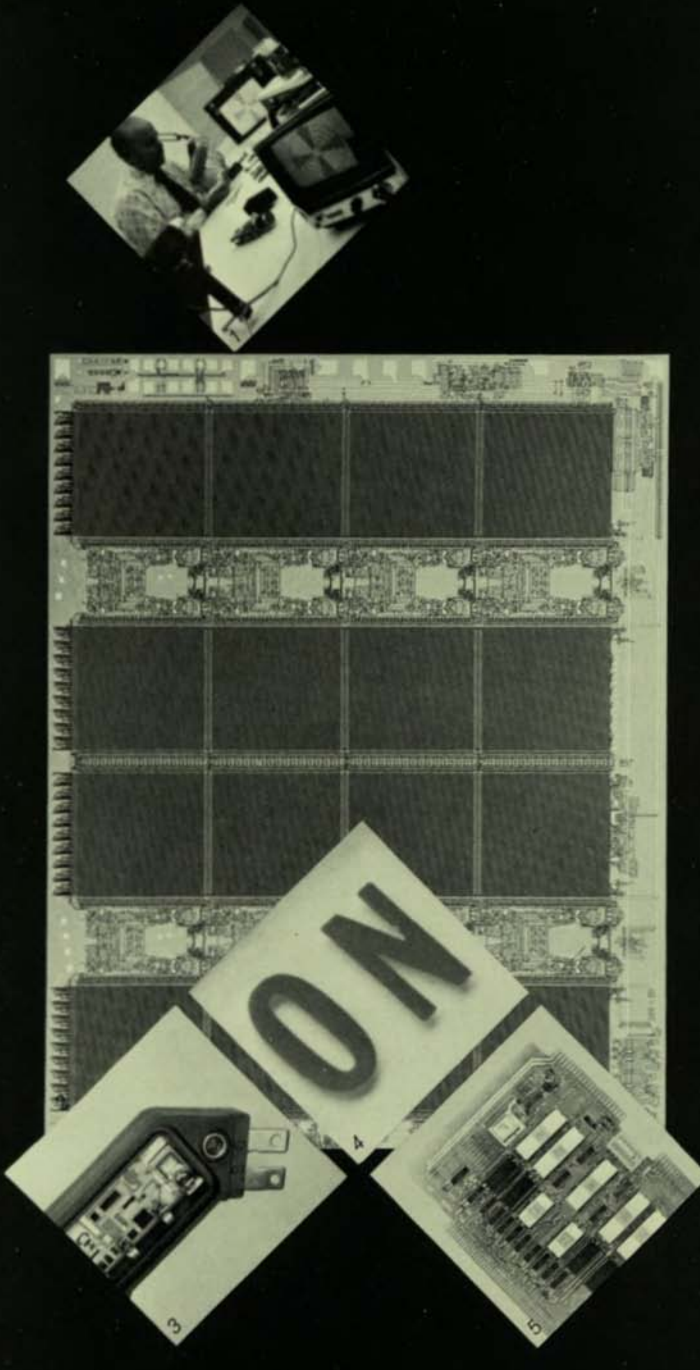
1. Miniature television cameras using charge-coupled device technology are used extensively by government and industry.

2. This 65K CCD block addressable memory is the first semiconductor device suitable for the bulk memory market.

3. Fairchild supplies ignition systems to major U.S. and international automobile manufacturers.

4. Datakey™, made by the Optoelectronics Division, incorporates a versatile reflective display structure within a small cell that can be used as part of a control keyboard or as a replacement for an illuminated switch.

5. The OCM-1 is a microprocessor board used with Fairchild's F8™ systems in applications ranging from low-volume production to systems development.


ON

Space and Defense Systems Division
Location:
301 Robbins Lane
Syosset, NY 11791
516-931-4500

Products: electronic data systems, secure communications systems, signal processing equipment and electronic timing and control systems

COMSEC Systems Unit
Location:
219 Wilmer Rd.
Horsham, PA 19044
215-674-8480

Products: encryption and decryption equipment for securing digital and voice communication systems

RF Systems Unit
Location:
300 Robbins Lane
Syosset, NY 11791
516-931-4500

Products: radio frequency systems including electronic countermeasures systems, surveillance systems and jam resistant communications systems

Industrial Products Division
Locations:
75 Mall Drive
Commack, NY 11725
516-864-8500

5921 East Sheila Street
Los Angeles, CA 90040
213-723-9601

World Magnetics (a subsidiary)
810 Hastings Street
Traverse City, MI 49684
616-946-3800

Products: portable 8mm, 110 filmstrip and 35mm slide rear screen sound projection systems, cockpit voice and flight data recorders, aircraft weight and balance systems, pressure sensors and magnetic heads

VIDEO PRODUCTS DIVISION
Location:
3105 Alfred St.
Santa Clara, CA 95050
408-247-7660

Products: programmable electronic television games, Videocart™ game cartridges

ADVANCED TECHNOLOGY

Research and Development Laboratory
Location:
4001 Miranda Ave.
Palo Alto, CA 94304
415-493-3100

Services: technology research and development, analytical services

Advanced Product Development
Location:
464 Ellis St.
Mountain View, CA 94042
415-962-5011

Products: microcomputers and related products.

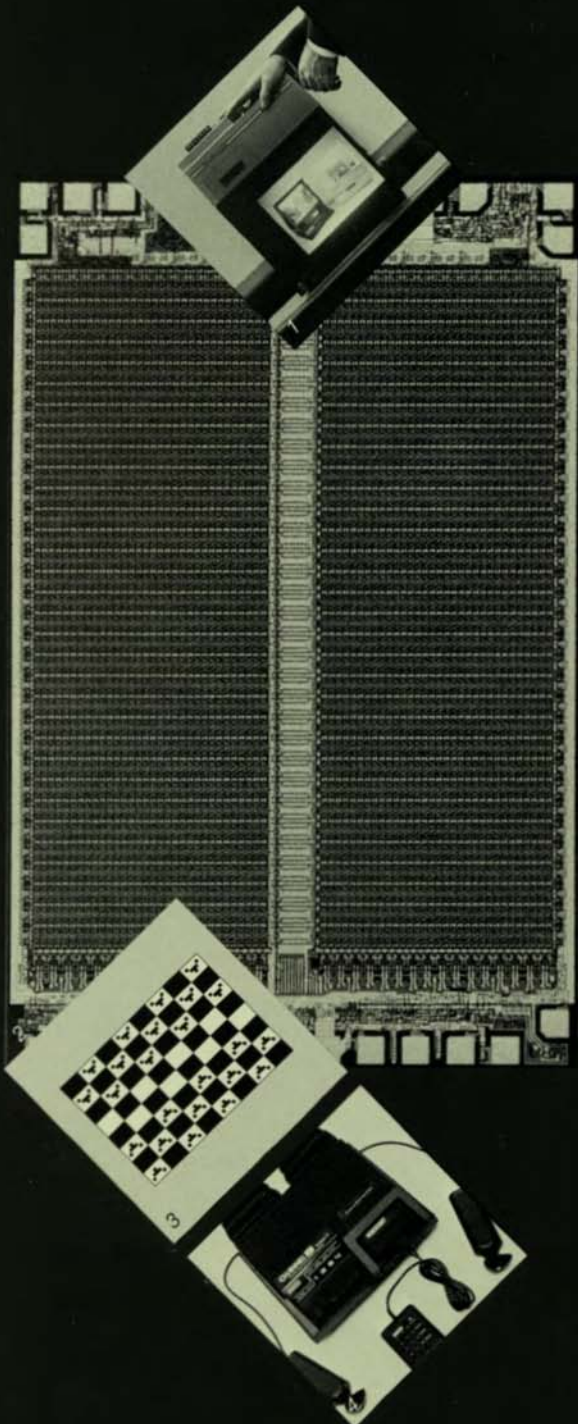
CORPORATE HEADQUARTERS
464 Ellis St.
Mountain View, CA 94042
415-962-5011

Facing page:

1. The Industrial Products Division's Synchro-Slide™ 35mm projector offers front and rear screen projection capabilities.

2. This 4K static bipolar random access memory is the densest 4K high-speed static memory available.

3. and 4. Fairchild's Channel F™ Video Entertainment System II offers individual game programming with an optional plug-in keyboard. Games available on the system's Videocarts™ range from baseball to checkers.



DIRECTORS
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C. Lester Hogan
Vice Chairman of the Board of the Corporation
Albert Bowers
President, Syntex Corporation; Vice Chairman of the Board, Syntex Corporation (pharmaceuticals and chemicals)
Walter Burke
President, Director and Member of Sherman Fairchild Foundation, Inc.
Walter J. P. Curley
Private Investor and Private Venture Capital Operations
William C. Franklin
Consultant
Roswell L. Gilpatric
Counsel, law firm of Cravath, Swaine & Moore
Louis F. Polk, Jr.
Chairman, President and Chief Executive Officer, Leisure Dynamics, Inc. (hobby and game products)
William A. Stenson
Director, Santa Fe National Bank

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Nelson Stone
Vice President—General Counsel and Secretary
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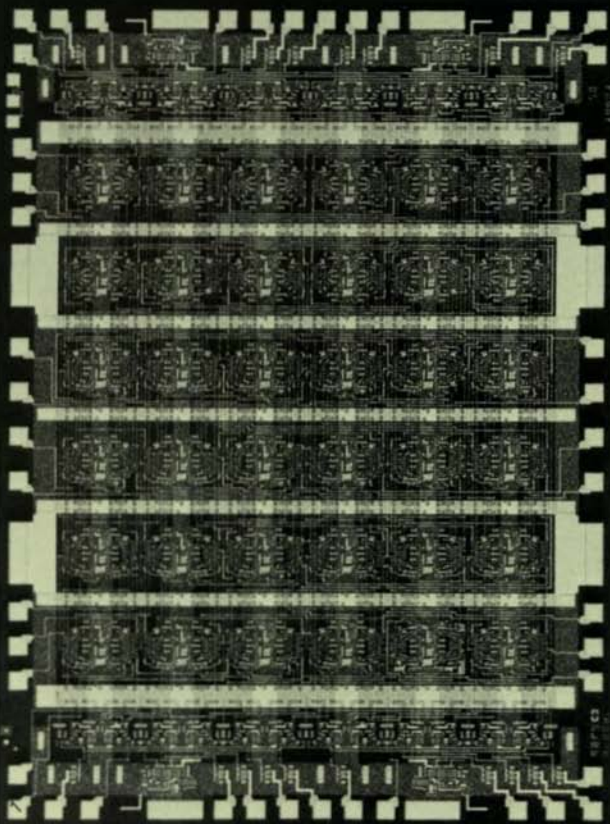
David J. Marriott
Vice President and General Manager—LSI Products Group
Louis H. Pighi
Vice President and General Manager—Government and Industrial Products Group
Richard Franklin
Assistant Secretary
Stanley Winston
Assistant Secretary (attesting)

Facing page:

1. This emitter-coupled logic (ECL) gate array from Bipolar LSI Division performs at subnanosecond speeds while offering optimum packing density.

2. Fairchild corporate headquarters complex in Mountain View, Calif.



Fairchild Manufacturing Locations Worldwide


Seoul, Korea
Hong Kong
Singapore
Djakarta,
Indonesia

FAIRCHILD
CAMERA AND INSTRUMENT CORPORATION

Fairchild Camera and Instrument Corporation
464 Ellis Street, Mountain View, CA 94042
(415) 962-5011

please print your name here

thank you Fairchild

FAIRCHILD

1920

Do not remove
this stub.
It will be
collected at
the door.

1920

INVITATION


SILICON VALLEY
Vintage 1957
thank you Fairchild
FAIRCHILD

You're invited to a party to celebrate the memory of Fairchild Semiconductor and to give our thanks to the prolific progenitor of Silicon Valley.

Come visit with founders, friends and fellow-alums. There'll be food, drink, music and memorabilia of a time when we didn't have to ask if we were having fun.

Date: Wednesday, March 16, 1988

Time: 6 to 10 P.M.

Place: Hyatt Rickeys Ballroom
4219 El Camino Real
Palo Alto, CA

Admission: $25.00 per person (advance)
$35.00 per person (at the door)

Lavish buffet and one drink included in admission price. (No host bar)

Space is necessarily limited so make reservations early. Make checks payable to: Silicon Valley Wayfairers Association or (SVWFA). Do not send cash. Tickets will be mailed for orders received by March 7, 1988

(Excess of receipts over expenses will be donated to charity)

Please return this portion with your check, in envelope provided.

Name: ______________________

Company Name: ______________________

Home Address: ______________________

____

____

Phone: ______________________

Enclosed is $ __________ for __________ tickets

☐ I can't attend but please add me to your mailing list for future events.

Fairchild 71

An Open Letter to All Employees from Charles E. Sporck . . .

This week Fairchild Semiconductor became a different and better company. The changes are so important, and will affect you in so many ways, that I want to tell you about them in my own words.

First, we have established an ambitious but realistic goal! It is our intention to expand and grow fast enough that by 1971 we will be doing $400,000,000.00 worth of business per year.

FOUR HUNDRED MILLION DOLLARS!

Many of you have been with us for five or more years, and have pitched in as we overtook long-established competition to take over the worldwide lead in sales of silicon semiconductor components. The growth you witnessed was swift and exciting, and brought many rewards to employees in the form of new positions and job assignments, promotions, gradual growth of salaries and company benefits, and perhaps most important of all, long-range job security based on your company's need for your experienced efforts.

Our goal of $400 million yearly sales by 1971 is part of a large program called FAIRCHILD '71, which contains, in addition to our sales and profit goals, several developments in the way we manage our business. So many parts of our company have grown so swiftly that many of us don't realize how big we are unless we stop to think about it. Once we spoke proudly of a single plant in Hong Kong. Today we have major operations in Hong Kong, Australia, Canada and Mexico. This part of our family will continue to parallel our expansion in the United States. Once we produced a handful of parts at Mountain View. Today we make thousands of different items at five locations in America, and we have complicated requirements for materials, for testing, and for the dozens of other specialties that go into our production force.

We have new business ventures, new management systems which use the latest abilities of electronic computers, new needs to manage our money wisely and use it in the most efficient manner, new markets to penetrate and dominate, new improvements to make in the way we design our work areas and communicate with our employees, and more research and development needs than ever before. Every one of these vital functions is a full-time management job.

All of the various endeavors carried out under our division activity have been divided into logical groups and assigned to directors who will report to me. We have separate directors to handle International Operations, Domestic Opera-

tions, Marketing, Integrated Circuits, Transistors and Diodes, Research and Development, New Business, Finance, Management Information and Industrial Relations.

These men, meeting in frequent executive session, will share their common problems and coordinate their activities. They and the managers who report to them will implement our plans and see to it that every Fairchild facility all over the world is doing its part to make the company grow.

The expansion period we are beginning this week will bring a far stronger sense of security to several important groups of people. Our customers will realize that we are building capacity to increase our ability to make on-time delivery of the parts they need so badly. Our suppliers will find new and better ways to serve us, and will find sympathetic listeners to their proposals for ways to save us money on purchased goods and services.

And finally, our own organization will have a need for experienced workers to step into positions created by our growth. We will be hiring and promoting more people than ever before. You, and every other employee at Fairchild, represent our most important resource—*people.* Your individual contributions will make possible the attainment of our goals.

Simply stated, Fairchild '71 means:

We know where we are going.

We know how to get there.

We need your experience to help us grow.

We need more good people like you!

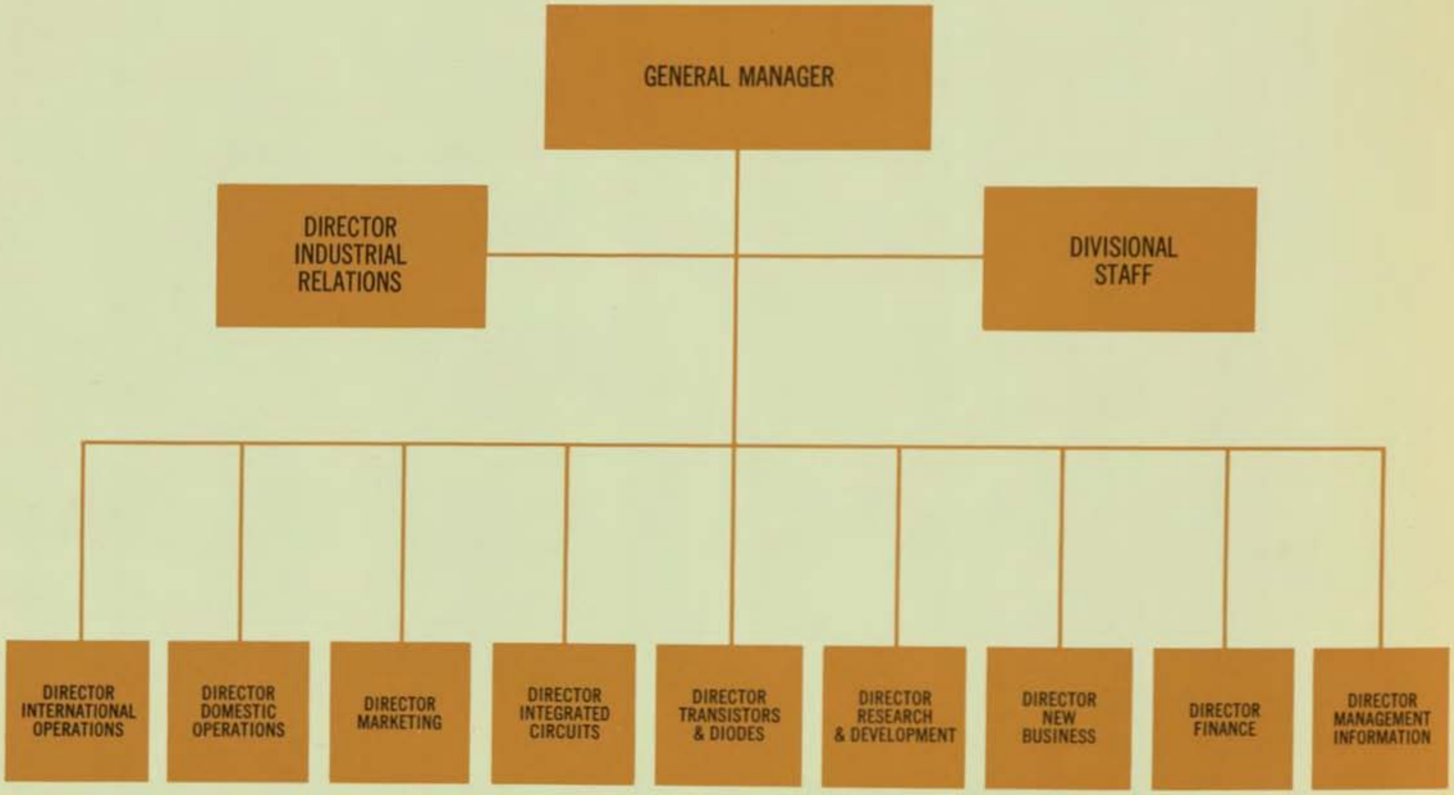
Let's get on with the job.

Sincerely,

C.E. Sporck

Charles E. Sporck, General Manager
Fairchild Semiconductor
a division of
Fairchild Camera and Instrument Corporation

Fairchild 71 *begins with a realignment of the executive staff group composed of the general manager, his staff, and directors.*



OUR NEW EXECUTIVE ORGANIZATION

FAIRCHILD

SEMICONDUCTOR

A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

GERI HADLEY

RELIABILITY '65

PREDICATIONS AND MEASUREMENT

The reliability of our product is a fundamental and universal concern at Fairchild Semiconductor. In this brochure you will find documentation of Fairchild reliability, details on the tight manufacturing control and test procedures we use to assure it, and a resume of the Fairchild FACT program.

Because in the final analysis reliability begins with design, we have included a separate section detailing the development of the Fairchild-patented Planar process and technological refinements which help us build reliability into all our products.

Table of Contents

View through operator's microscope of a Micrologic wafer in the process of 100% electrical testing of all dice on the wafer.

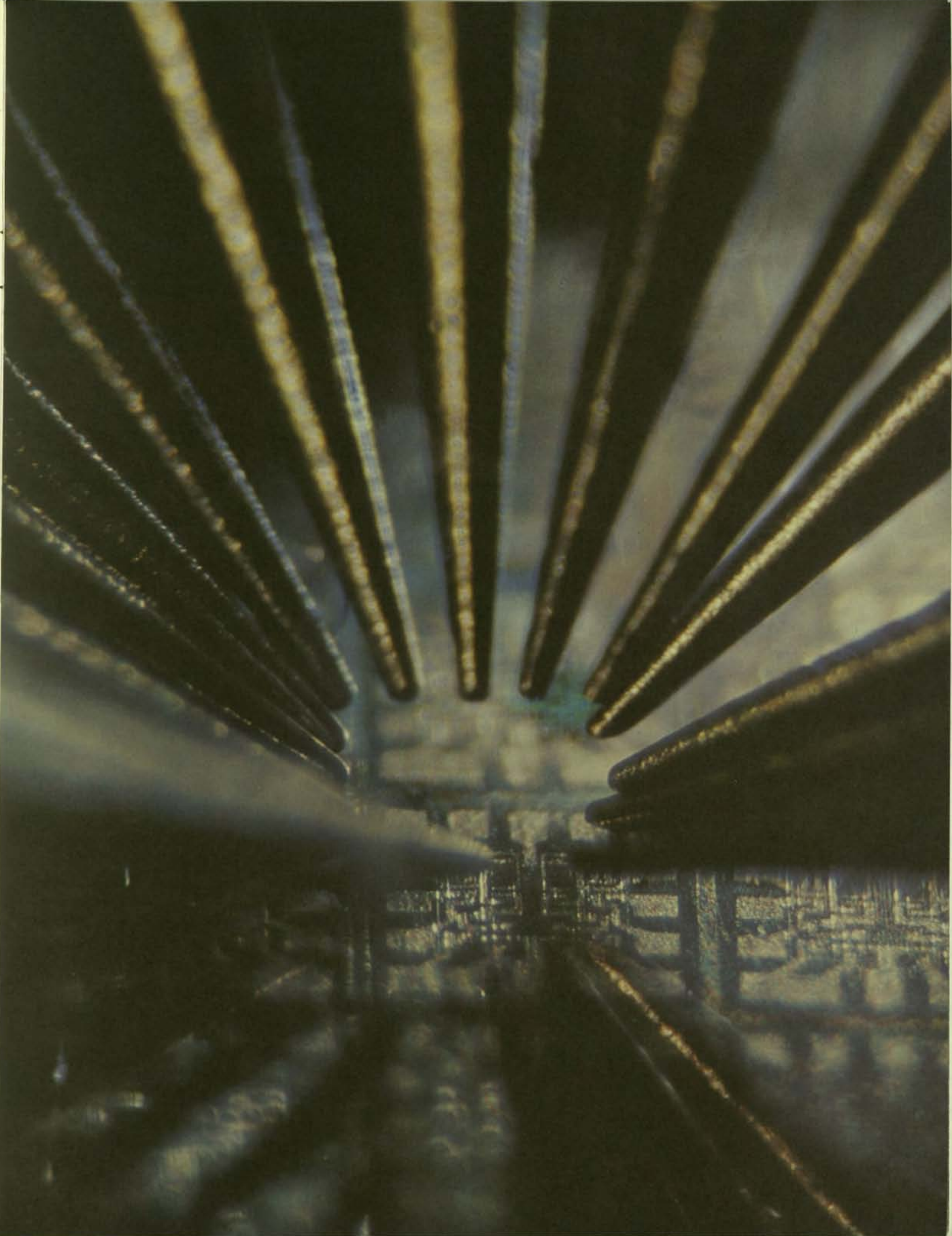


FIGURE 1
Microcircuits — Epitaxial Extended Life Test

Ring Counter — Rings are monitored daily to assure continuous operation

Date Placed on Test	Element Sample Size	Hours per Day	Test Conditions	Total Test Hours Accumulated
February 4, 1964	Three-Input Gate TO-5 μL903 2018 Units	48,432	V_{CC} = 3 Volts T_A = 125° C	17,556,600 (362.5 Days of Continuous Operation)
March 18, 1964	Three-Input Gate TO-5 μL903 922 Units	22,128	V_{CC} = 3 Volts T_A = 125° C	7,690,796 (319.5 Days of Continuous Operation)
April 17, 1964	Three-Input Gate TO-47 SL 1091 205 Units	4,920	V_{CC} = 3 Volts T_A = 125° C	1,424,340 (289.5 Days of Continuous Operation)
April 17, 1964	Dual Two-Input Gate TO-5 MWμL 910 184 Units	4,416	V_{CC} = 3 Volts T_A = 125° C	1,278,432 (289.5 Days of Continuous Operation)
September 15, 1964	Dual Four-Input Gate TO-5 DTμL 50 Units	1,200	V_{CC} = 6 Volts T_A = 125° C	168,000 (140 Days of Continuous Operation)
October 6, 1964	Dual Four-Input Gate TO-5 DTμL 100 Units	2,400	V_{CC} = 6 Volts T_A = 125° C	285,600 (119 Days of Continuous Operation)
December 30, 1964	Dual Four-Input Gate TO-5 DTμL 147 Units	3,528	V_{CC} = 6 Volts T_A = 125° C	112,896 (32 Days of Continuous Operation)
TOTAL January 31, 1965	3,626 Units	87,024	27,895,664 No Failures F. R. 0.0033%/1000 hours at 60% confidence F. R. 0.0082%/1000 hours at 90% confidence	

Reliability in Operation

No failures in 77.9 million hours extended life tests

The exceptional reliability of Fairchild products has been documented repeatedly. MIT's Instrumentation Laboratory, working on the Apollo program, has conducted operational life tests on Micrologic elements totalling over 50 million hours without a single failure. Additional microcircuits are on test at Fairchild, and as of January 31, 1965, the two programs had accumulated more than 77.9 million element-hours without a single failure, generating a combined failure rate of 0.0012% per thousand hours at a 60% confidence level (0.0030% per thousand hours at 90% confidence).

Fairchild devices have also scored an impressive record for performance in missiles and satellites. The Vela nuclear detection satellite is one example. When it was launched in October, 1963, its lifespan was estimated at six months. In February, 1965, sixteen months later, it was still operating perfectly, monitoring radiation levels in outer space. Among its components are more than 1 thousand transistors and 3 thousand diodes manufactured by Fairchild.

Major missile and satellite programs featuring Fairchild devices are the Mariner II, Gemini, Injun I, Injun III, Apollo, Vela, Surveyor, OGO, Snycom, Hawk, Sprint, Pershing, Titan, Ranger, Minuteman, and Polaris.

Failure rate of 0.0012% per 1000 hours for microcircuits at 60% confidence

Fairchild integrated circuits have demonstrated the following failure rates on operating life tests:

1. The Martin Co. in Orlando, Florida, operated Fairchild integrated circuits in a ring oscillator for 1 million element-hours at 25°C and 1 million element-hours at 75°C without a failure.

Failure rate = 0.045% per 1000 hours at 60% confidence (0.114% per 1000 hours at 90% confidence).

Indicator lights on a typical temperature-cycling chamber in the reliability laboratory at Fairchild.


MED. HEAT

FIGURE 2
High Stress Tests
μL903 Gate TO-5 Package

Subgroup and Test Conditions	Sample Size	Bonds Stressed	Per MIL-STD 750 Para. No.	Stress Level (KG's)	Temperature (°C)	No. of Failures				
						After Each Stress				
						A	B	C	D	E
1. Centrifuge (Y_1 orientation only) (Each sample stressed at same G level 5 times)	18	108	2006	20	—	0	0	0	0	0
	18	108		40		0	0	0	0	0
	18	108		100		0	0	0	0	0
	18	108		161		4	0	1	0	0
	18	108		202		2	1	0	0	0
2. Thermal shock, 10 cycles. (Sample subjected to test 5 times, or 50 cycles)	10	60	1056	—	−65 to 200	0	0	0	0	0
3. Shock test. (Each sample subjected to 30 blows 5 times (150 blows) at the same G level.)	10	60	2016	3	—	0	0	0	0	0
	10	60		6		0	0	0	0	0
	10	60		12		0	0	0	0	0
						After Each Readout				
						0	250	500	1000	
4. Storage and centrifuge. (Units centrifuged and readout at 0, 250, 500, and 1000 hours.)	10	60	1031 & 2006	40	25	0	0	0	0	
	10	60		40	150	0	0	0	0	
	10	60		40	200	0	1	0	0	
	10	60		40	300	0	0	0	0	

2. Extended life tests, in house at Fairchild, on nonepitaxial units manufactured before 1963.
Failure rate = 0.0084% per 1000 hours at 60% confidence (0.022% per thousand hours at 90% confidence).

3. Extended life tests, in house at Fairchild, on epitaxial material produced during 1964.
Failure rate = 0.0033% per 1000 hours at 60% confidence (0.0082% per 1000 hours at 90% confidence).
(0 failures in 27.8 million hours)

4. MIT Instrumentation Laboratory tests of circuits for Apollo. Failure rate = 0.00185% per 1000 hours at 60% confidence (0.0047% per 1000 hours at 90% confidence).
(0 failures in 50 million hours)

5. The combined failure rate of (3) and (4) above for current epitaxial microcircuits was 0.0012% per 1000 hours at 60% confidence (0.0030% per 1000 hours at 90% confidence).

Figure 1 details the extended life tests on Fairchild microcircuits manufactured during 1964. As of January 31, 1965, no failures had occurred in 27,895,664 element-hours!

Figure 2 lists results of typical high-stress tests performed by Fairchild's Reliability Laboratory. Centrifuging produced no failures until the 161 thousand G level. (Military specifications normally require 20,000 to 40,000 G's.) Only 1 failure occurred in a sample of 40 units stored at 200°C for one thousand hours and centrifuged 4 times during that period at 40,000 G's. No failures occurred in another 40-unit sample stored at 300°C for the same period and subjected to the same stress.

Failure rate of 0.00001% per 1000 hours for diodes at 60% confidence

Figure 3 lists results of high-temperature storage tests conducted on three diode families. Since the number of failures found in any of the families was very low, the failure rates computed here are primarily a function of the number of element-hours accumulated. High-temperature (150°C) storage tests for 600,000,000 element-hours with the FD-100 produced no failures, generating a failure rate of 0.00001% per 1000 hours at 60% confidence (0.00038% per 1000 hours at 90% confidence).

Temperature cycling and burn-in area of reliability laboratory at Fairchild.

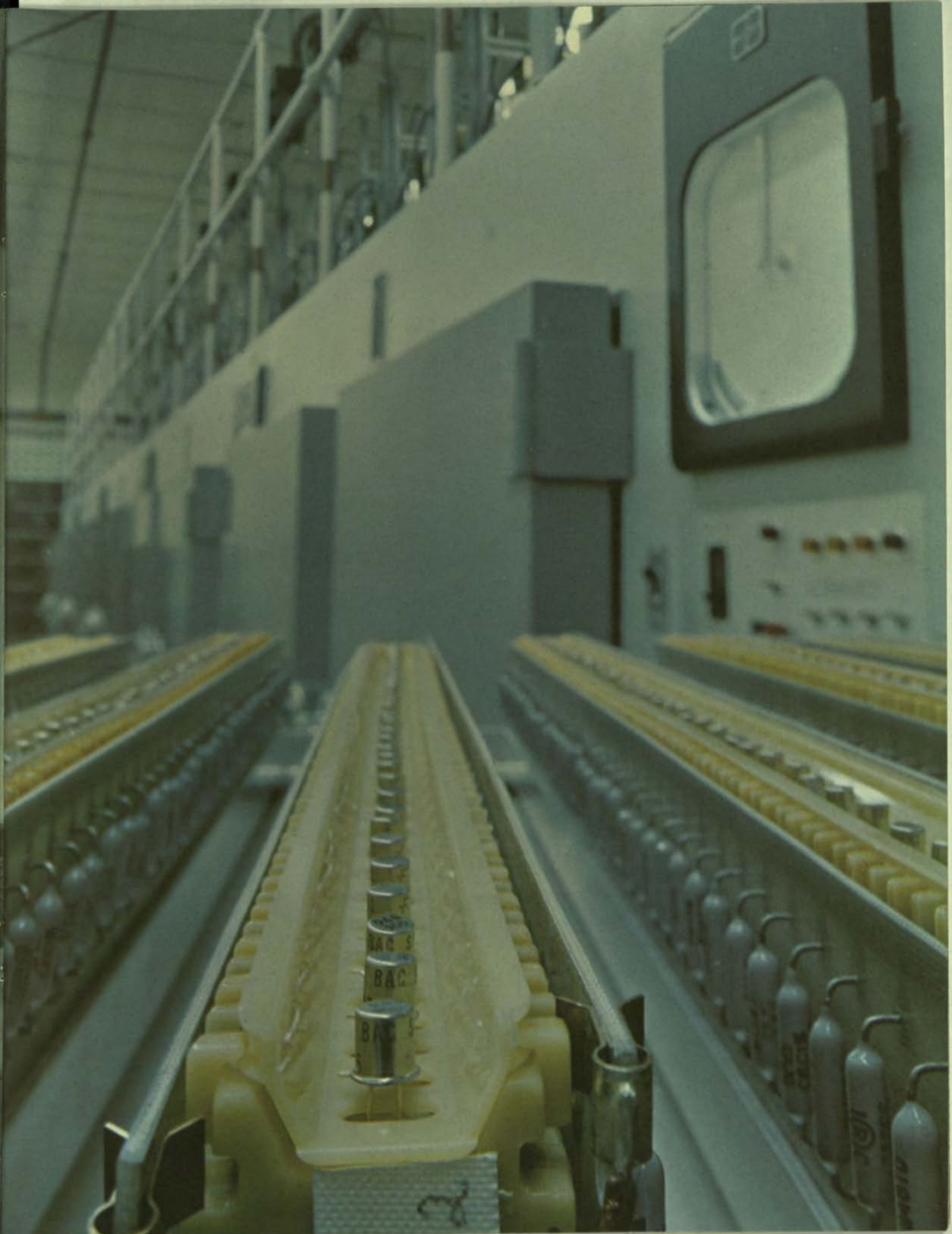

BAC

FIGURE 3
High-Temperature Storage Tests
on Three Representative Diode Families

Family	High-temperature Storage (150° C)		
	Sample Size	Element-Hours	Failure Rate* (%/1000 hours)
FD-100	90,209	600,000,000	0.00001
FD-200	8,320	12,500,000	0.008
FD-600	8,320	12,500,000	0.016

*At 60% confidence

Failure rate of 0.002% per 1000 hours for transistors at 60% confidence

In extended operating life tests on a typical device in connection with the Minuteman program a total of 84.6 million transistor-hours generated a failure rate of 0.002% per 1000 hours at 60% confidence (0.005% per thousand hours at 90% confidence).

Operating life tests conducted during 1964 on 10,825 transistors of many different types accumulated a total of 21,809,249 element-hours, generating a failure rate of 0.039% per 1000 hours at 60% confidence (0.053% per thousand hours at 90% confidence).

Same order of reliability for Fairchild consumer products

The epoxy consumer products have demonstrated the same order of reliability as Fairchild military products. The SE6001-2N3566 family, for example, has had no failures in the last ten consecutive lots on storage life at 125°C or on operating life test at 300 mW. This represents nearly 250,000 hours without a failure.

Their solid construction makes the epoxy units virtually immune to mechanical shock and vibration. Shock tests up to 15,000 G's have yielded no failures. There have been no failures to date under the rigorous Fairchild FACT program (see Page 20 and Figure 9) on dynamic tests (shock 3,000 G's, plus vibration fatigue, plus vibration variable frequency), and in addition all lots are subjected to and consistently pass atmospheric tests consisting of thermal shock, temperature cycling and moisture resistance in accordance with MIL-STD-750.

It is important to note that all failure rates cited are actual failure rates, without acceleration factors.

Transistors mounted in a production centrifuge. Fairchild devices receive this test during the manufacturing cycle.

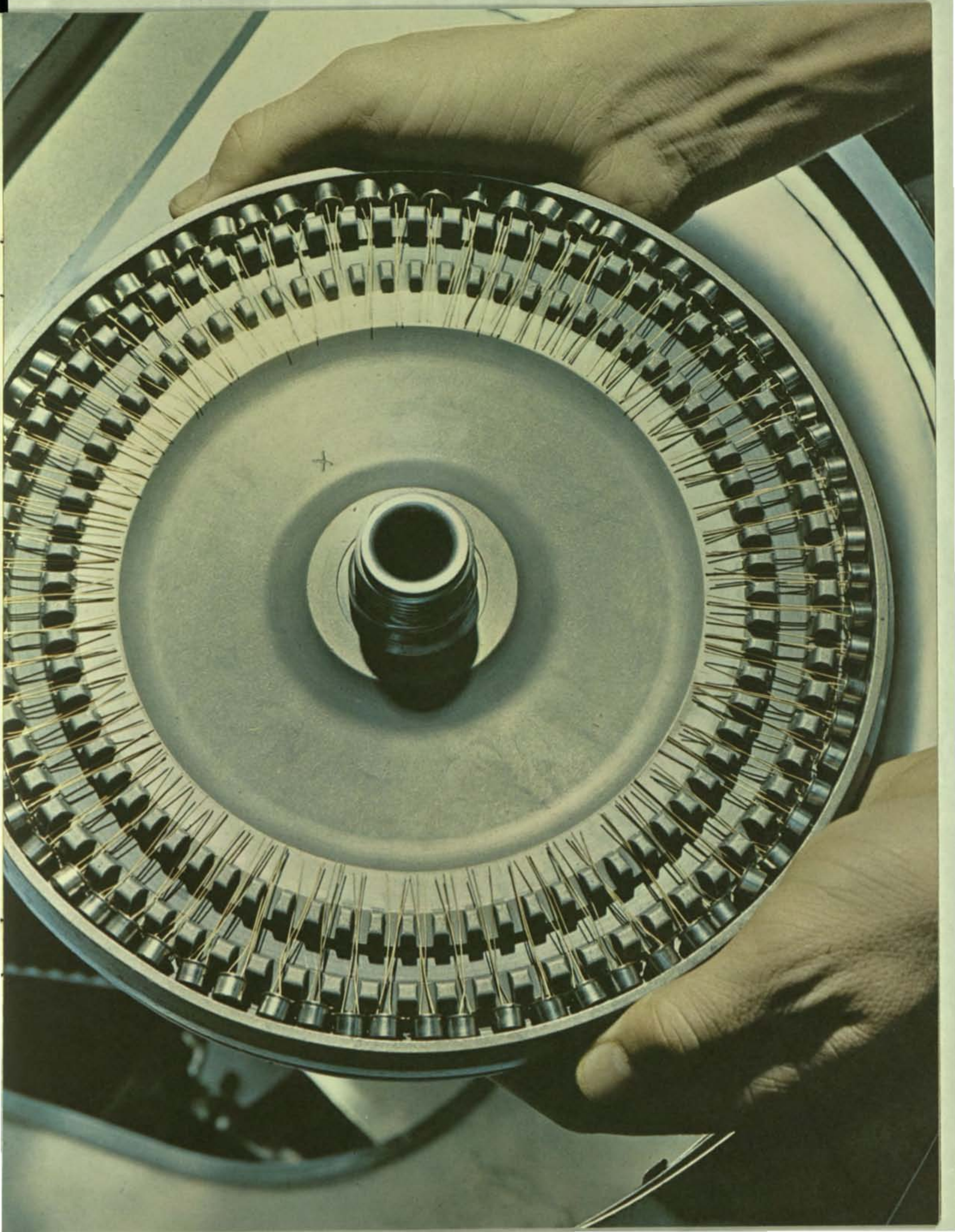
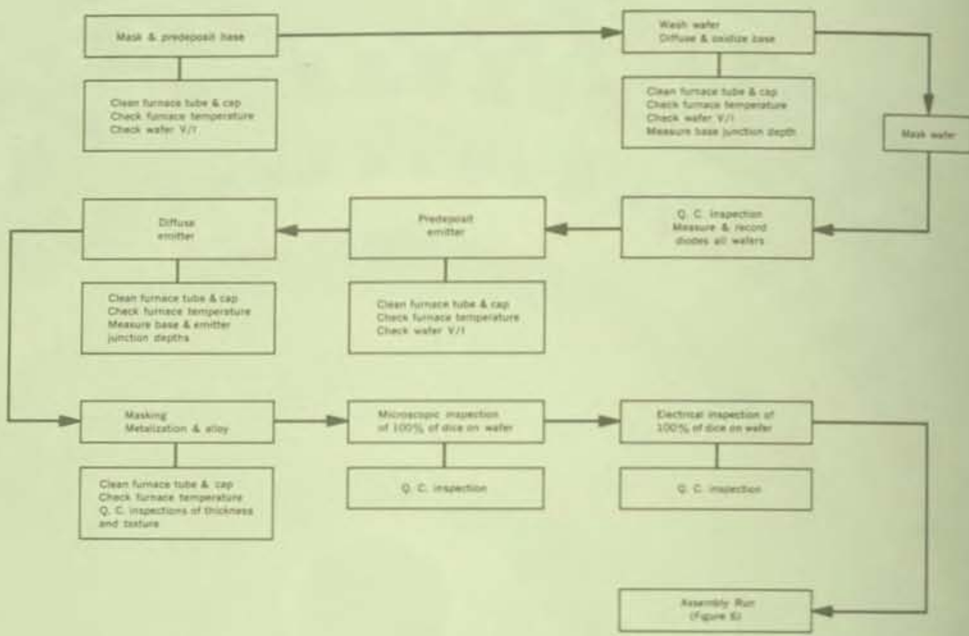


FIGURE 4
Wafer Fabrication



Maintaining Reliability by Tight Process Control

Thus the problem is not how to make a reliable product. Fairchild products are reliable. The question is how to maintain reliability. The answer, since we know our processing techniques produce a good product, is tight process control. We have written specifications; we check each step to make sure the operators are following the specifications; we 100% visually and electrically test all units frequently during processing and assembly; we make control charts to compare today's data with those of yesterday, last month and last year; when devices do not meet the exacting Fairchild standards, we submit them to a thorough defect analysis to pinpoint the problem; and we take corrective action.

Wafer fabrication

Figure 4 shows the typical procedures followed in wafer fabrication and routine step-by-step cleaning and checking done to assure continuity of process. At each step the furnace tube and cap are cleaned according to specification, furnace temperature checked, and the wafer measured to determine surface leakage. These V/I calculations are plotted on control charts and compared graphically with limits set by specification (see Figure 5). In this way the slightest process deviation is corrected as soon as it occurs.

Wafers of identical resistivity are processed together. This is done because the electrical parameters of final units are determined by wafer resistivity – wafers of the same resistivity producing a tight parameter distribution. If wafers were chosen at random, even from the same crystal, parameter spread in finished units would be so wide that any slight change in "typical" values might pass unnoticed. Thus it is essential to isolate identical-resistivity wafers and process them together.

Operator's view of planar transistor on completed wafer.

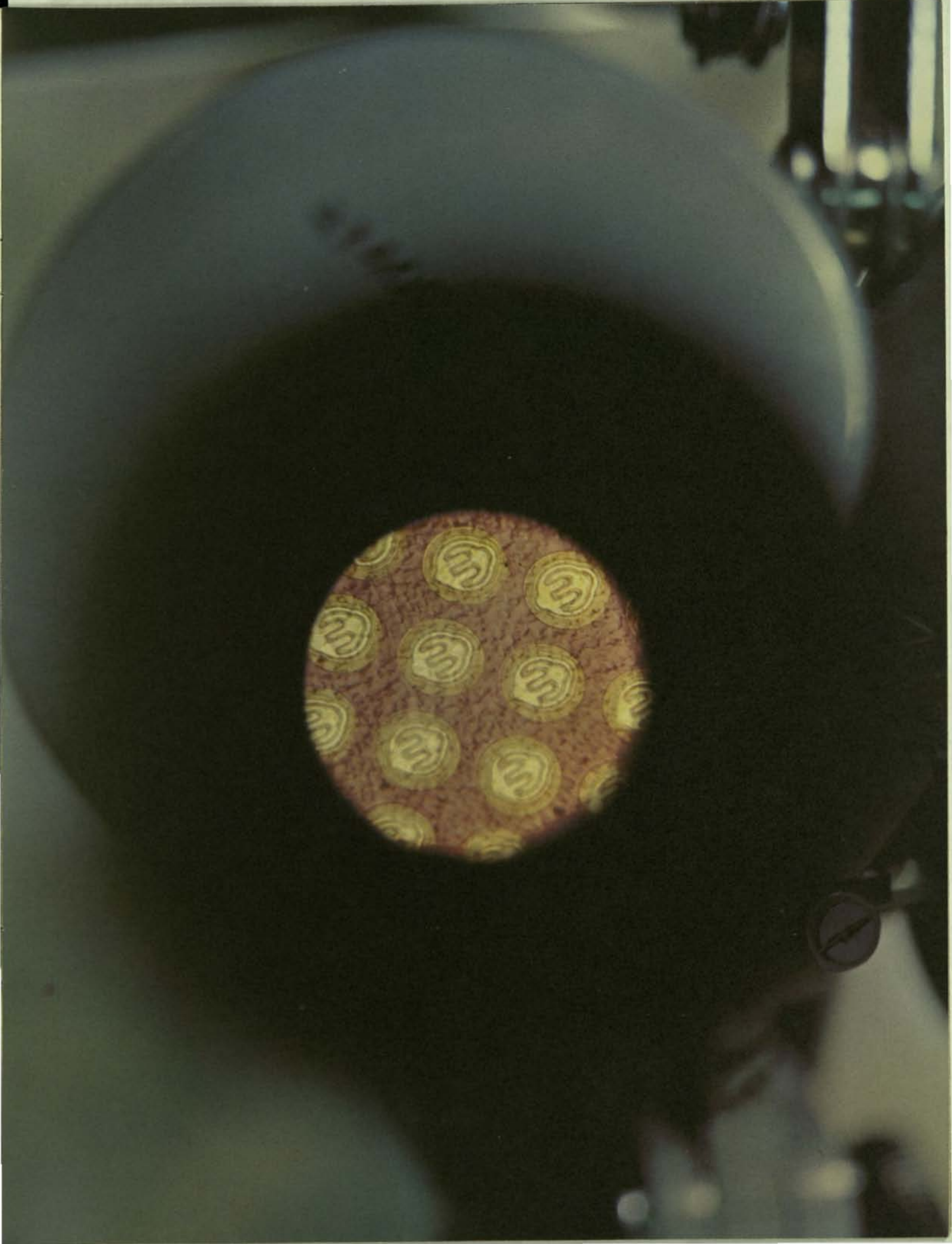
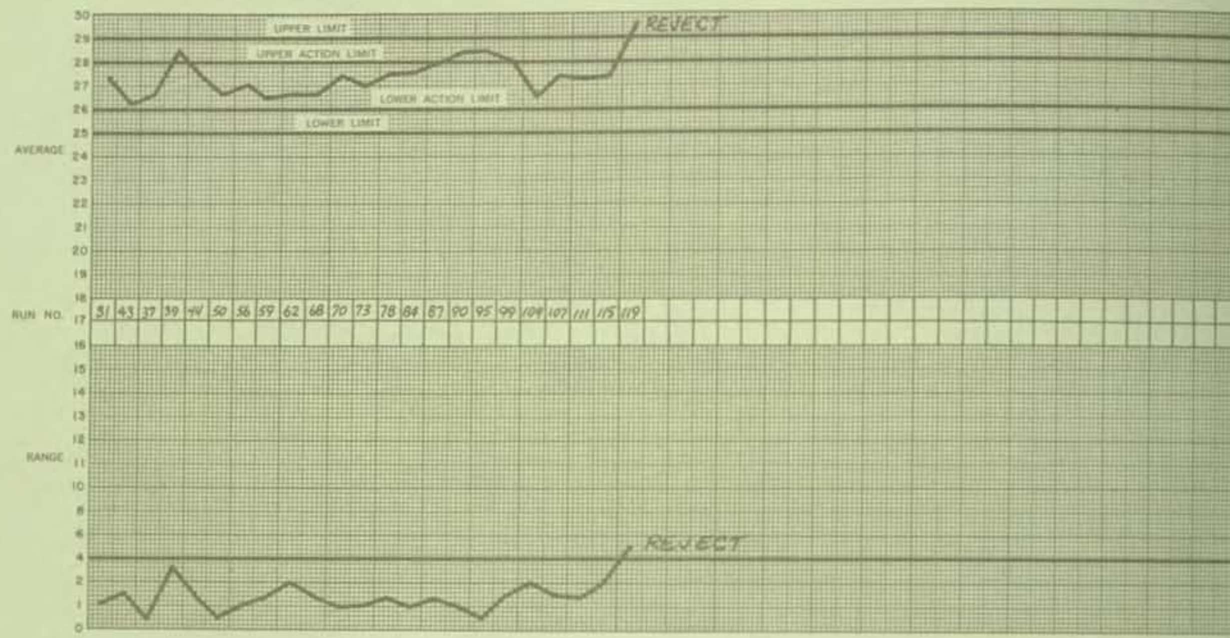


FIGURE 5
Typical diffusion control chart.



100% visual and electrical inspection of all dice on each wafer

All dice on each wafer are 100% visually inspected by manufacturing personnel according to carefully detailed specifications, and samples of their work are inspected hourly by Quality Control inspectors to make sure the specification is met. At the wafer test station each die on the wafer is electrically inspected, and the electrical inspection is sample-checked hourly by Quality Control inspectors to ensure process stability. Control charts comparing typical parameters with specified limits quickly reveal any errors in process or machine calibration.

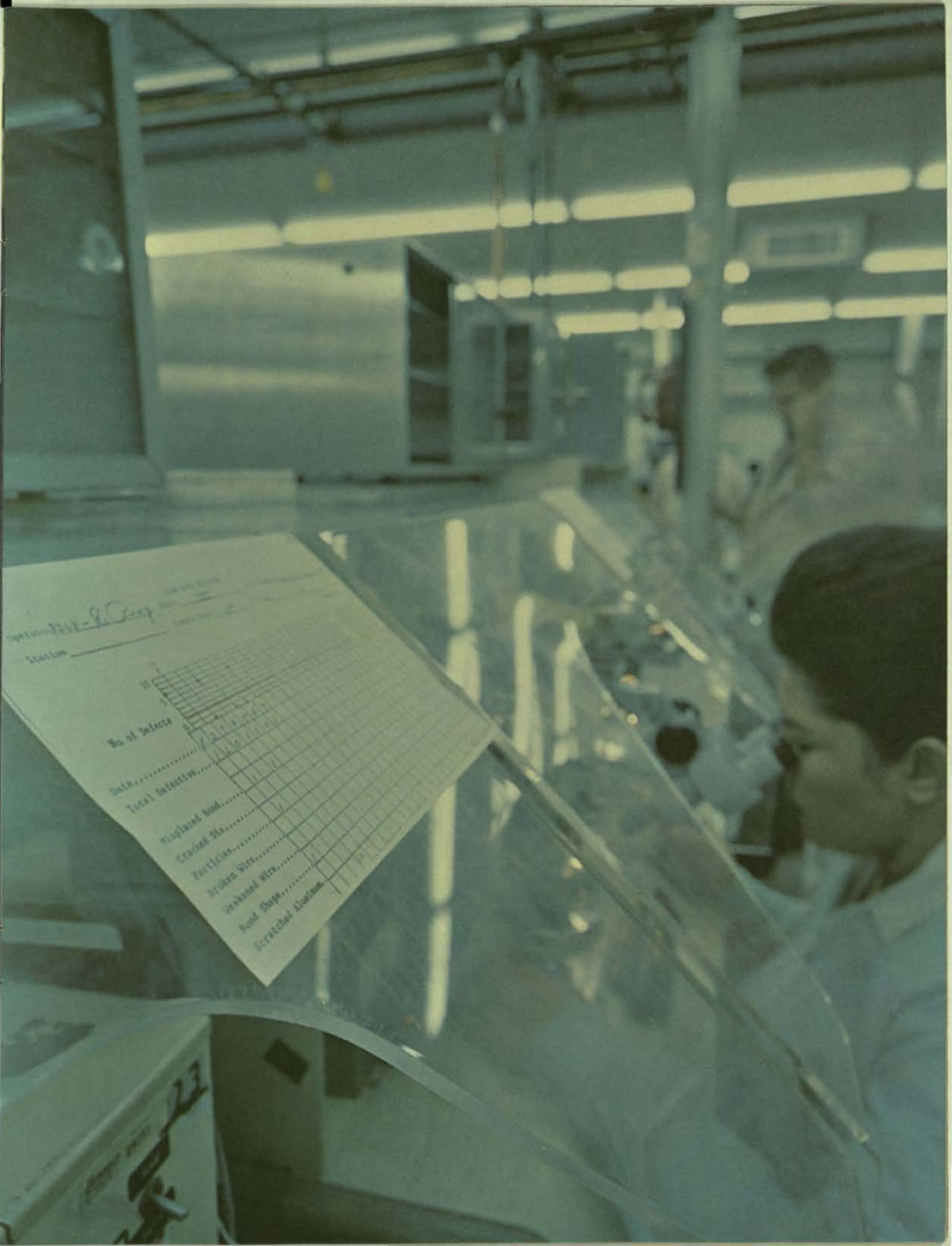
Assembly

Similar tight process control is exercised in the assembly of every product type – diodes, transistors, and microcircuits. The techniques which produce the most reliable product depend on the characteristics of the family and may vary slightly with the product, but on all assembly lines in every Fairchild plant the same principles apply: (1) strict adherence to written specifications; (2) step-by-step monitoring to screen imperfect units and remove their cause; and (3) immediate feedback to correct the slightest process deviation. Figure 6 shows the steps followed in the assembly of all products. Note that after die attach, lead bond, and lead weld, samples of each operator's work are tested by Quality Control inspectors and a control chart of her work plotted as illustrated in the photograph on the facing page.

100% environmental tests on all units after assembly

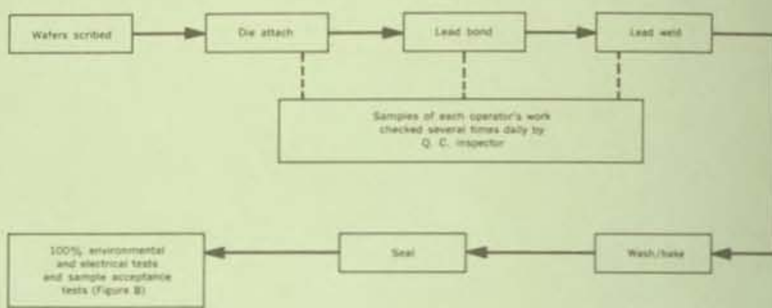
At the end of the line all units undergo rigid environmental tests listed in inserts to the data sheet for each product type. The tests are designed to stress the structure and package of the units so that substandard units will be rejected by the 100% electrical classification tests that follow. Figure 7 describes the tests. All units are subjected to temperature cycling, dynamic tests (shock at 30 to 60 KG's or centrifuge at 20 KG's), a hermeticity test such as the Joy bomb, oil bath, or Radiflo, and aging for more than 24 hours at 200°C. In all cases the 100% processing is designed to segregate mechanically substandard units.

Control chart of operator's quality posted at operator's position.



Station
No. of Defects
Date
Total Defective
Misplaced Bond
Cracked Die
Particles
Broken Wire
Weakened Wire
Bond Shape
Scratched Aluminum

FIGURE 6
Assembly Run



100% electrical classification tests on all units after assembly

Before an assembly run undergoes 100% electrical classification, test equipment is checked to assure proper calibration and programming, and a random sample is classified. From this sample, data are recorded and analyzed. Any fallout devices are studied to determine the reason for deviation from specifications. If necessary, units are sent to the Defect Analysis Department for a thorough analysis to ensure that product engineering has constant feedback relative to fallout or possible fallout trend.

If the sample reveals no inconsistencies, 100% of the units in the run are then electrically classified. As many as 100 different electrical tests may be performed at this time.

Transistors and special devices such as matched units are tested on the Fairchild 200 tester, which tests 1500 transistors per hour and checks its own calibration before each test. Microcircuits are tested on the Fairchild series 4000 tester, a very rapid (17 msec per test), completely digital machine with a magnetic disc for storing programs.

Fairchild integrated circuits mounted in Fairchild-developed universal carriers sliding into the automatic Fairchild series 4000M tester. This machine tests both flat and header-type packages with up to 20 active leads at a rate of 60 Go/No-go decisions per second. Final electrical classification and testing of microcircuits is done on this machine.

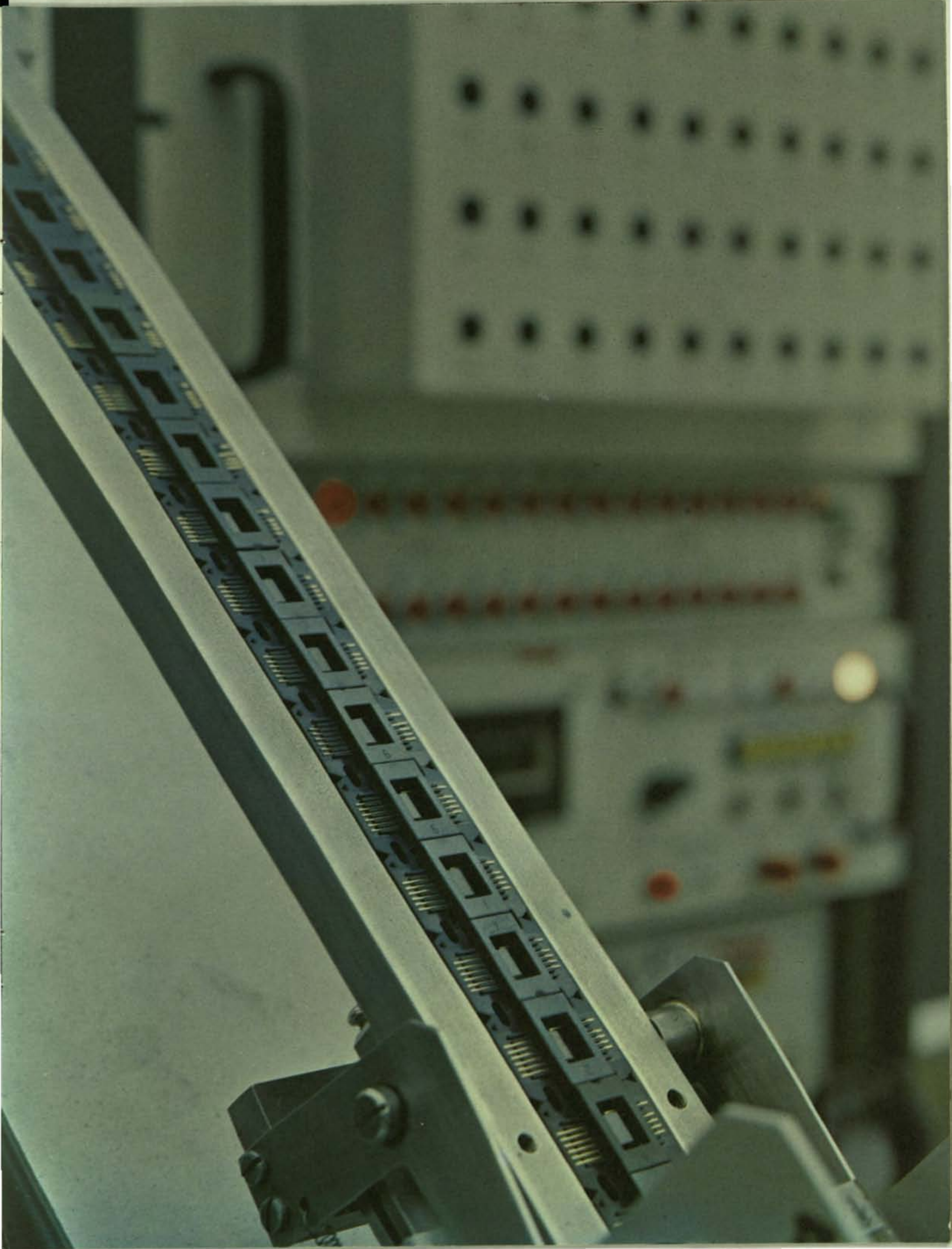


FIGURE 7
100% Environmental Tests

A. Temperature cycling (to stress hermeticity)

Device is subjected to temperature extreme (e.g., −65°C), allowed to stabilize, returned to room temperature, subjected to opposite extreme (e.g. 200°C), and returned to room temperature: usually 3 cycles, 15 minutes at extremes, 5 minutes transfer time (see data sheet).

B. Dynamic tests (to stress bonding/welding)

1. High-impact shock. Units are shot from Fairchild-designed pneumatic air guns ("Pneupactors") against a nylon plate with a steel backing. G levels on impact: 30 to 60 KG's.

2. Centrifuge. Device is centrifuged at acceleration of 20 KG's for 1 minute.

C. Leak tests (to check package)

1. Joy bomb. Device is placed in a chamber with water and detergent. Gas is pumped in under pressure to force liquid into the can if possible.

2. Oil bath. Device is immersed in hot oil. Any slight opening in the package produces a bubble in the oil.

3. Radiflo. Device is subjected to radioactive gas under pressure and checked for signs of radioactivity. Limits are allowed to vary from 10^{-9} cc/sec for some products to 10^{-8} cc/sec for others.

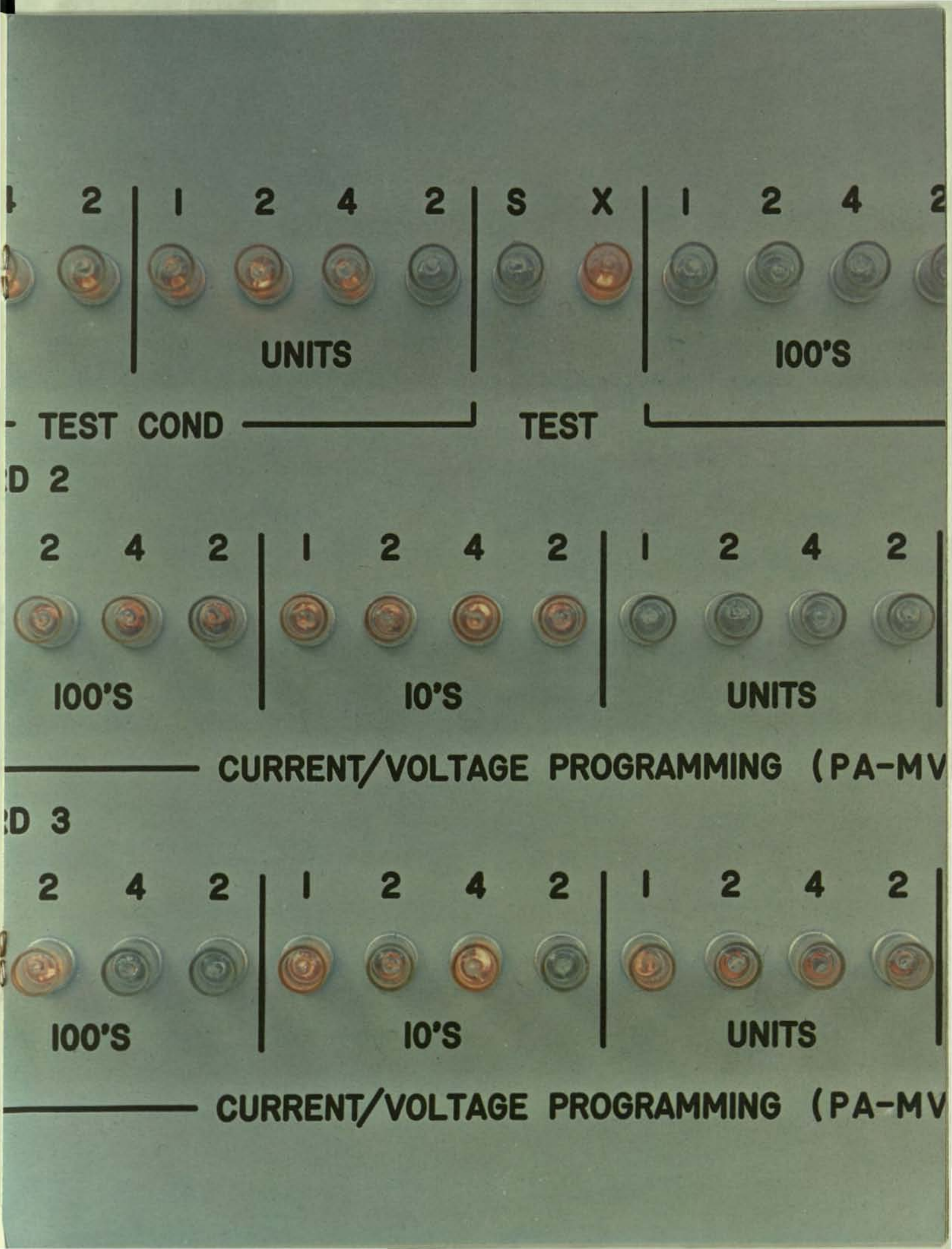
D. Aging

Device is baked at 200°C for more than 24 hours.

Training and motivation of operators

Because in the final analysis the quality of the manufacturing process depends on the performance of each line operator, all Fairchild operators are thoroughly trained and motivated to produce consistently high-quality products. New operators undergo training periods averaging two weeks and must meet rigid quality standards before taking their place in the line. Each operator's work is checked several times daily by a Quality Control inspector and a control chart of her quality is kept beside her position. If her performance falls below the quality standard, she is sent back for retraining as a new operator. Periodic salary reviews are based on the quality of her work. In addition, operators are encouraged in every way to take pride in their craftsmanship. They learn from experience as well as from observation that only personnel of high caliber can perform the delicate operations involved in the manufacture of semiconductor products. They are constantly reminded by posters, periodic lectures, and training movies that Fairchild products are used in missiles and satellites in which reliability is essential to national prestige – perhaps to national survival.

Classification indicator on the Fairchild series 200 tester. Any combination of 24 tests is possible with this tester in any sequence using only 4 plastic punched cards. The test rate with all 24 tests in use is approximately 1500 transistors per hour.


2
1 2 4 2
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TEST COND
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CURRENT/VOLTAGE PROGRAMMING
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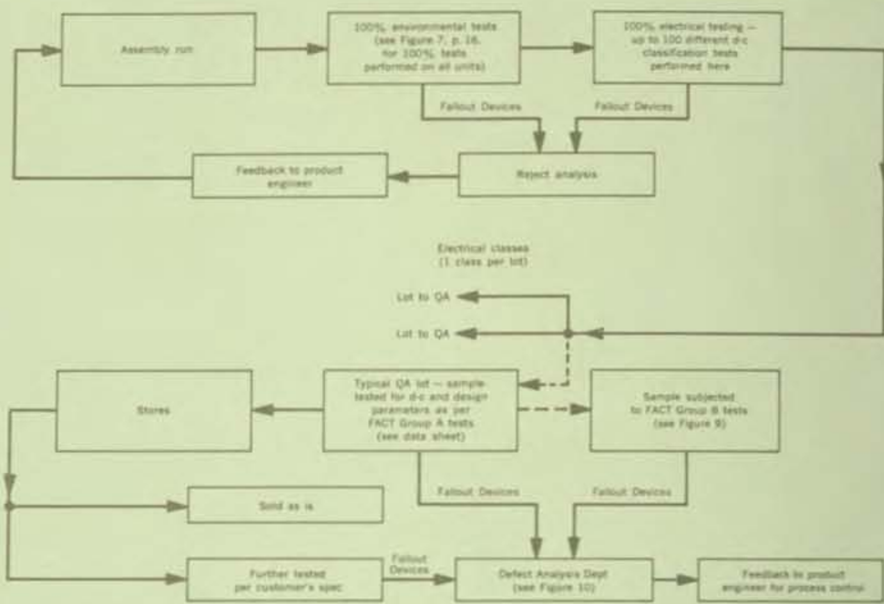
UNITS
CURRENT/VOLTAGE PROGRAMMING

FIGURE 8
Standard Fairchild Tests



Assuring Reliability by Comprehensive Testing

In addition to Quality Control inspections after each step in the processing and assembly and 100% testing at the end of the line, we also rigorously test incoming direct materials as a matter of routine. Tests performed on incoming direct materials include:

1. Chemical and spectrographic analyses of wire and preform;
2. Functional tests to duplicate the actual environment experienced in manufacture;
3. Checking of wire tensile strength by the Instron Tester;
4. Checking of all dimensions spelled out in the blueprint.

Routine lot acceptance tests

Test facilities at Fairchild include over 225,000 sockets for operating life tests, many high-temperature storage chambers, each capable of storing hundreds of thousands of devices, and complete equipment for environmental testing: shock and vibration equipment, temperature cycling, thermal shock equipment, moisture resistance chambers, lead fatigue and lead tension equipment, Radiflo, etc. All units, regardless of where they are assembled, are subjected to the same rigorous Quality Assurance tests (see Figure 8). Each lot, identified by product type and electrical characteristics, is electrically sample-tested on the Fairchild 500 series tester, a direct-reading, data-logging instrument with a unique digital measuring technique which permits an unusually high degree of repeatability and accuracy. Not only are the parameters previously 100% tested rechecked at this time, but additional a-c and design parameters considered in the industry to be the most critical are also tested in accordance with MIL-S-19500 and MIL-STD-105.

After these routine sample acceptance tests the lot is either placed into stores or sent back for 100% rescreening if it exceeds the required LTPD or AQL.* Depending on the customer's requirement, lots available for sale are (1) sold without further tests, (2) electrically screened (if the customer requires a tighter parameter spread), or (3) electrically screened and also given further high-reliability processing, such as burn-in, x-ray, etc. Approximately 100,000 units are burned in and individually tested each month for use in missile and space systems.

*LTPD — Lot Tolerance Percent Defective
AQL — Acceptable Quality Level

Lead tension equipment capable of exerting up to 150-oz pull on each lead.

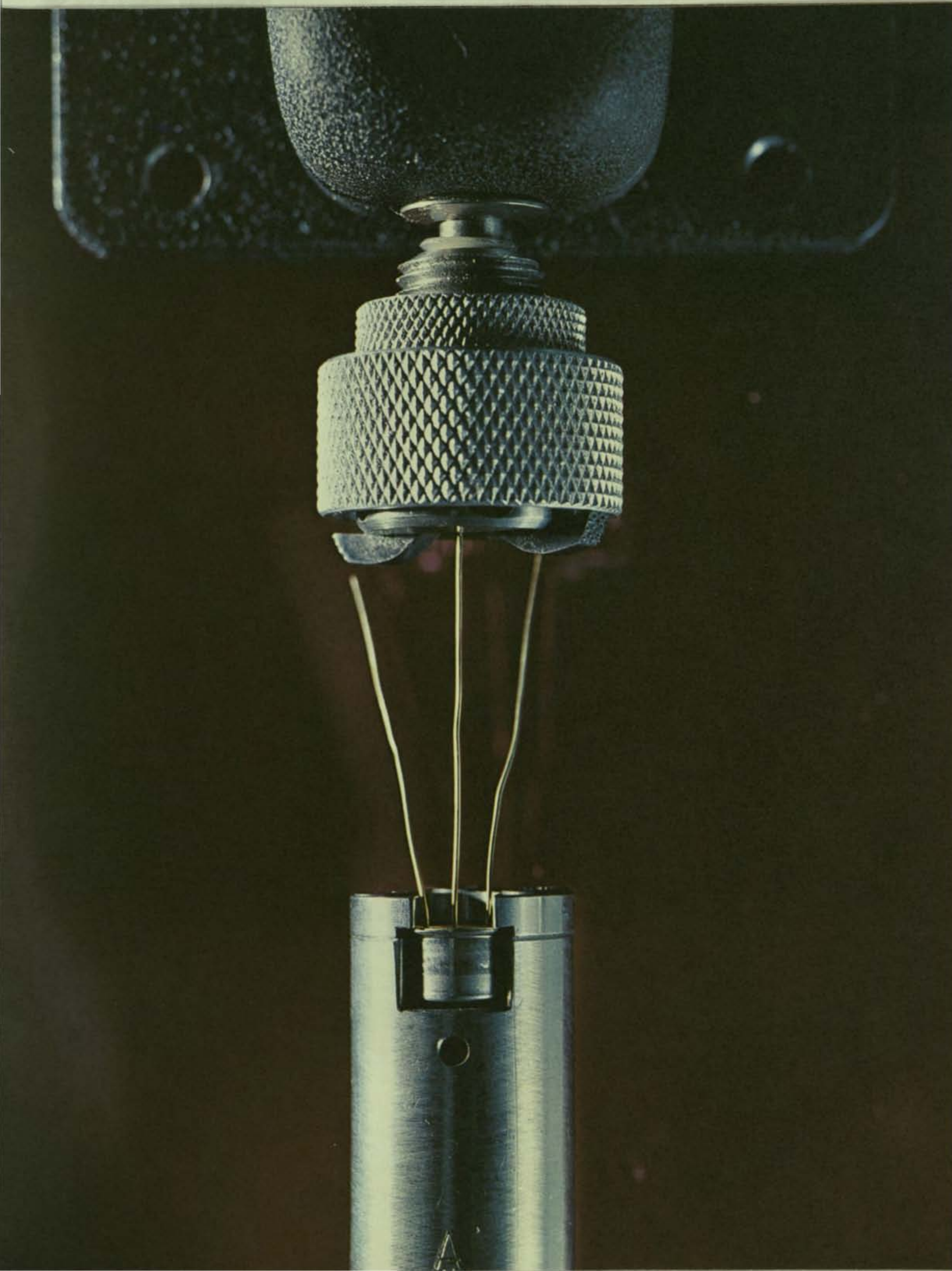
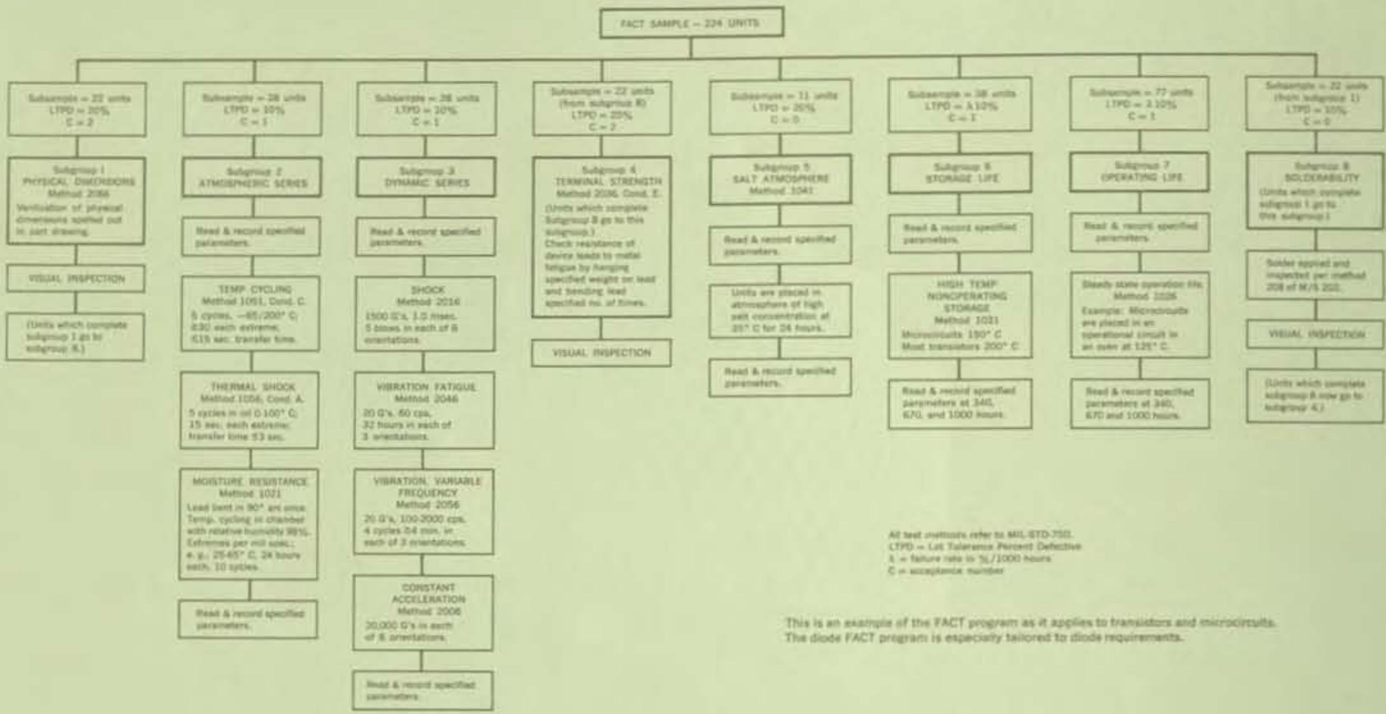


FIGURE 9
Fairchild Assured Component Test (FACT) Program



All test methods refer to MIL-STD-750.
LTPD = Lot Tolerance Percent Defective
λ = failure rate in %/1000 hours
C = acceptance number

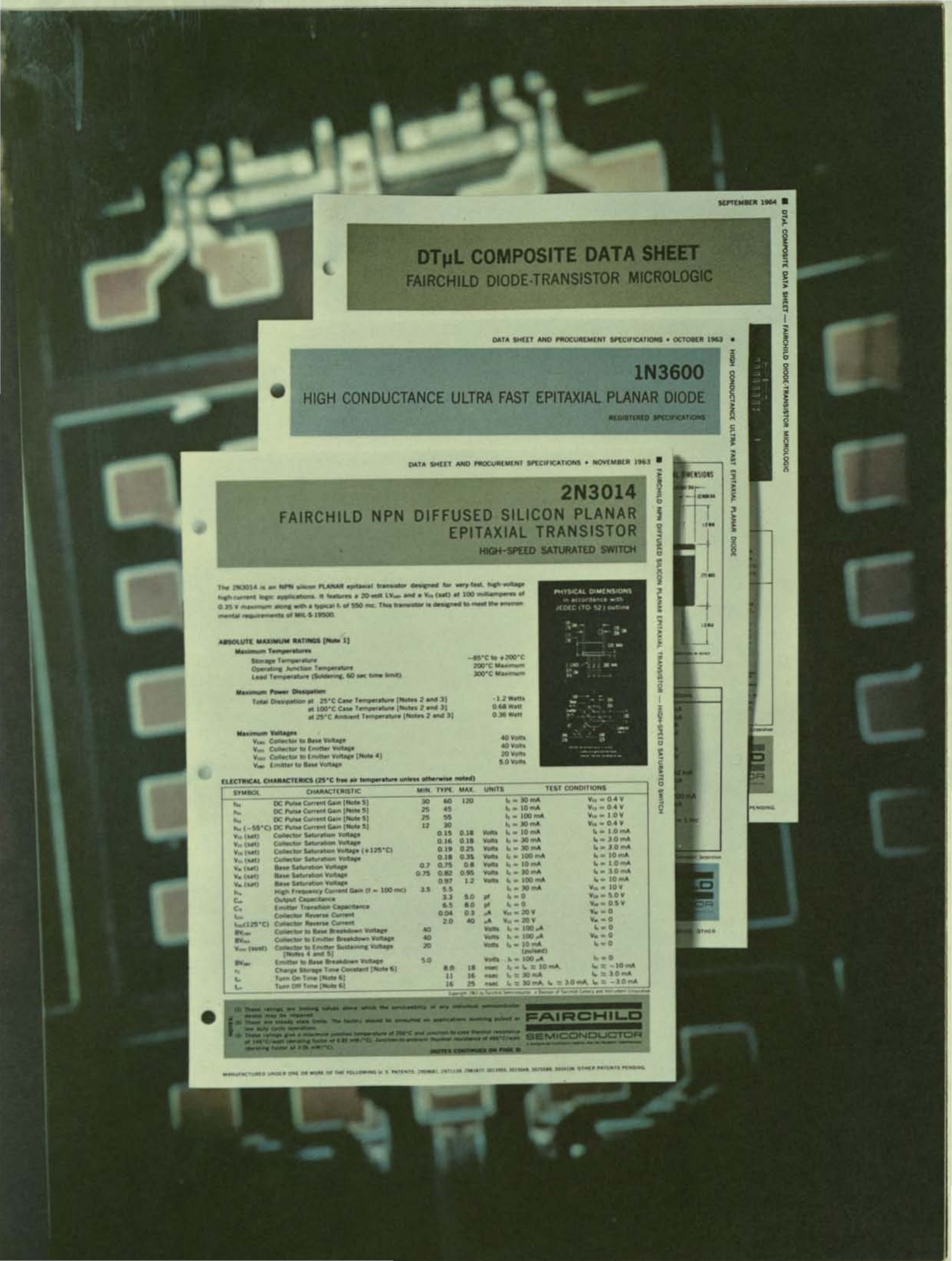
This is an example of the FACT program as it applies to transistors and microcircuits. The diode FACT program is especially tailored to diode requirements.

This is true 100% high-reliability processing, since parameters (typically 5 but can be many more if the customer desires) of each unit are measured before and after burn-in and the data are included with each device shipped. Testing is done on the Fairchild 500 series tester, which punches IBM cards for each unit. It has been estimated that on some contracts Fairchild ships anywhere from 10 to 50 pounds of reliability data for each pound of devices sold!

The FACT program — comprehensive lot reliability verification

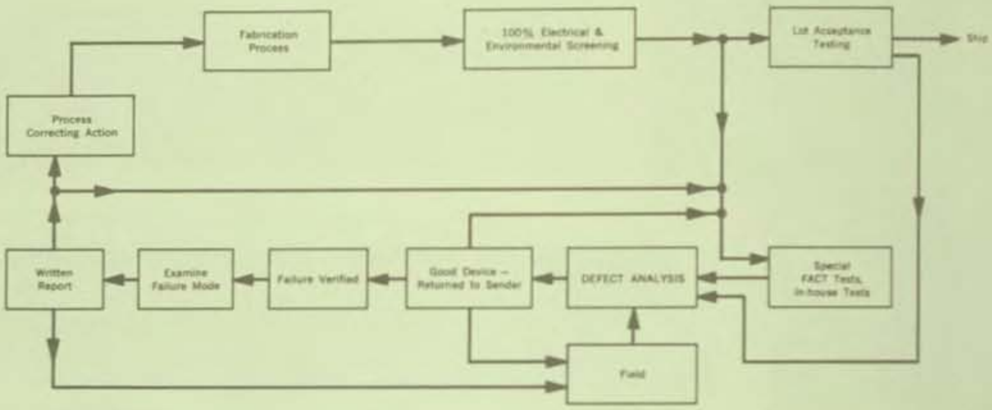
Procurement specifications which call for a special, complex series of tests sometimes cause shipment delays and extra costs. The Fairchild FACT program fulfills the requirement for reliability processing without special handling; it provides our customers with comprehensive lot reliability verification at minimum cost and without delay.

Most special procurement specifications call for various 100% environmental and electrical tests performed as a matter of routine at Fairchild, plus additional sample tests such as operating life, shock, salt atmosphere, etc. Under the FACT program we list all 100% environmental and electrical tests with the data sheet pertaining to each device, giving guaranteed parameter values. In addition we take samples from every week's production of each device after it has passed the 100% environmental and electrical tests and routine Quality Assurance tests, and we perform the Group B inspection shown in Figure 9. The FACT program, recently revised, has shortened the test time and tightened the test conditions. The quality conformance inspection is in strict accordance with MIL-S-19500. The tests performed are those set forth in MIL-STD-750, and in most cases the test conditions and limits are more stringent than specified in the pertinent military specification. Notice in Figure 9 that specified parameters are read and recorded before and after operating life tests and various stress tests. The parameters chosen (see data sheet for specific parameters chosen for each device) are those



SEPTEMBER 1964
DTμL COMPOSITE DATA SHEET
FAIRCHILD DIODE-TRANSISTOR MICROLOGIC
DTμL COMPOSITE DATA SHEET — FAIRCHILD DIODE-TRANSISTOR MICROLOGIC
DATA SHEET AND PROCUREMENT SPECIFICATIONS • OCTOBER 1963
1N3600
HIGH CONDUCTANCE ULTRA FAST EPITAXIAL PLANAR DIODE
REGISTERED SPECIFICATIONS
HIGH CONDUCTANCE ULTRA FAST EPITAXIAL PLANAR DIODE
DATA SHEET AND PROCUREMENT SPECIFICATIONS • NOVEMBER 1963
2N3014
FAIRCHILD NPN DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTOR
HIGH-SPEED SATURATED SWITCH
FAIRCHILD NPN DIFFUSED SILICON PLANAR EPITAXIAL TRANSISTOR — HIGH-SPEED SATURATED SWITCH
PHYSICAL DIMENSIONS
in accordance with
JEDEC (TO-52) outline
ABSOLUTE MAXIMUM RATINGS [Note 1]
ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)
FAIRCHILD
SEMICONDUCTOR

FIGURE 10
Tight Process Control Through Defect Analysis and Feedback



considered in the industry to be the most critical, providing the best measure of device reliability. The FACT data supplied to the customer verify the fact that the line has been running smoothly and on a continuous basis. Thus the customer can maintain a high degree of confidence that the devices are in fact high-reliability units.

Options

The FACT program offers a variety of options which meet almost any high-reliability requirement, including 100% burn-in on all devices purchased by the customer. These options provide high-reliability testing with optimum delivery and minimum cost.

Defect analysis and feedback

An essential step in tight process control is the analysis of any out-of-tolerance units that may occur in lot acceptance and FACT test programs, and, on rare occasions, in the field,* in order to determine failure modes and permit corrective action by the product engineers. Figure 10 shows the vital function performed by the Defect Analysis Department at Fairchild. This department is equipped with all needed equipment: an infrared scanner, curve tracers, electrical test jigs, photographic equipment (both color and black and white), microscopes, microprobes (to probe the die when electrical connections have been severed), and equipment for potting, sectioning, staining and etching units.

*Of the 40 million devices sold between the months of August and December, 1964, 0.00012% were returned to the factory because of device defects.

Also, Research and Development facilities, including an electron beam microscope, are available for defect analysis. In addition to the regular analysis of all units submitted to it, the Defect Analysis Department does literature researches and maintains contact with suppliers to keep up to date on techniques and equipment for analysis. Each device is either (1) found to be still good and therefore returned to the originating department or (2) if the failure is verified, subjected to a thorough analysis to discover the cause. Was the failure due to an inherent defect in the device or was it due to misapplication of the device? Was the damage electrical or physical? Etc. In each case a detailed report is written and submitted, with photomicrographs of the device, to the line engineer for corrective action as well as to the originating department.

Fairchild series 500C tester with tape programming option, which increases the number of parameters that can be tested in any sequence and in any combination from 12 to a number limited only by the length of the tape, at 1 test per inch. Test results are available in direct digital reading display and digital outputs, which can be adapted to drive optional readouts such as printout, typeout, and card punch.

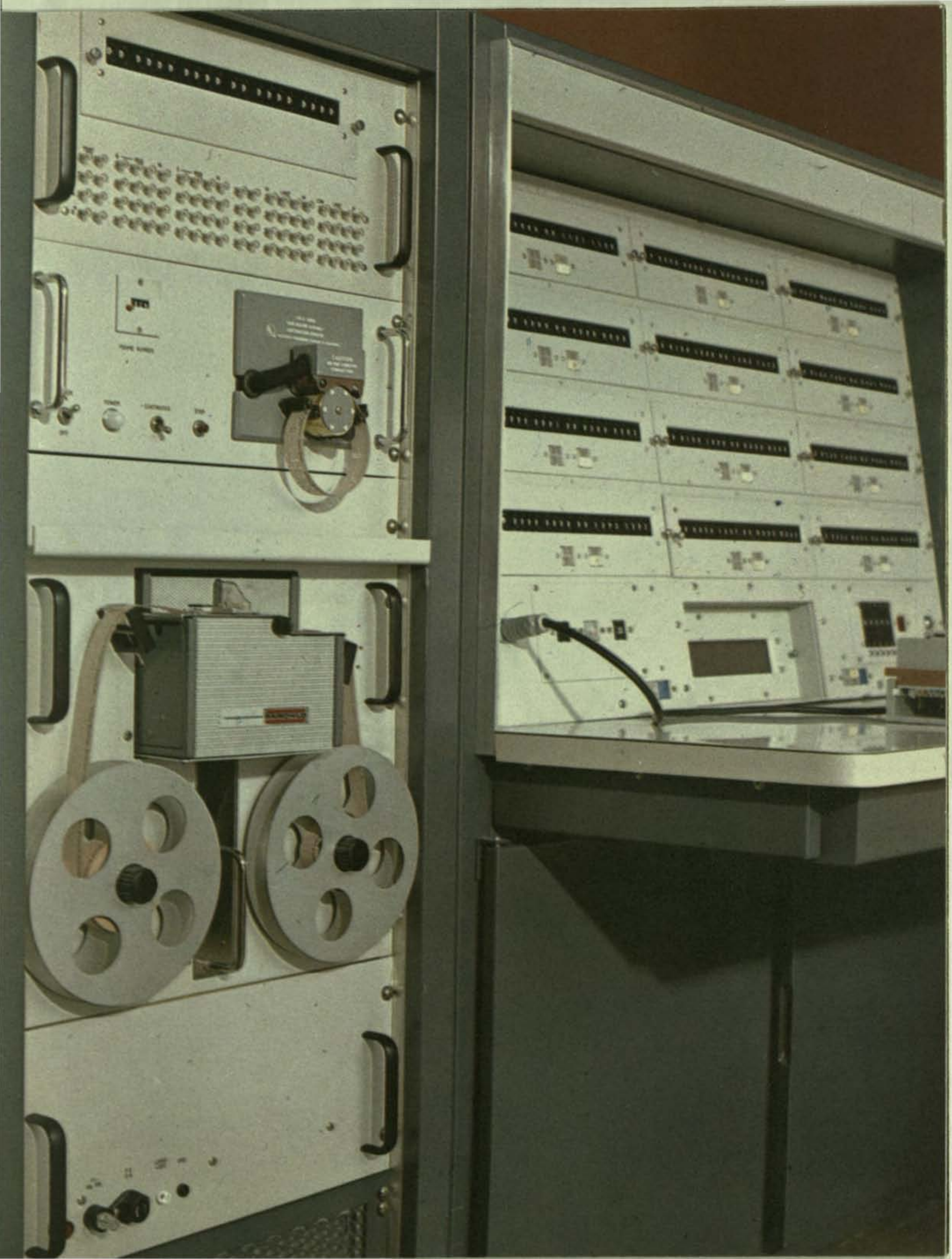
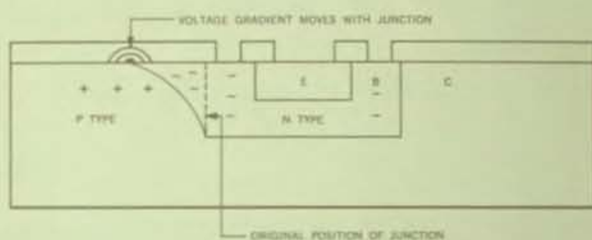


FIGURE 11

Cross-sectional view of pre-PLANAR II PNP transistor showing inversion layer.



Designing Reliability into the Product

Since its beginning as the first large-scale producer of silicon transistors, Fairchild has led the industry in developing and improving reliability and performance by improving the basic product design. Shortly after the silicon mesa transistor had become accepted as the most reliable transistor available, Fairchild made a second giant evolutionary step: the Planar process. This process was – and is – an invaluable tool for solving problems in transistor technology, opening up areas of development previously impossible. One of its most fruitful outgrowths has been the monolithic integrated circuit – another Fairchild "first." A new order of reliability for circuit functions was established by this development – comparable to that of a single transistor.

The steps involved in making a transistor by the Planar process are essentially the same as those required to make a diode or integrated circuit, differing primarily in the number and order of diffusions. Aside from refinements such as the addition of an epitaxial layer, this Planar technique is the same as that used today in manufacturing all Fairchild semiconductor devices. The secret of the vast increase in reliability introduced by the Planar process lies in the fact that all junctions are formed beneath the oxide layer and are never exposed to atmospheric contaminants. As a result all characteristics which are sensitive to surface conditions – reverse leakage current, breakdown voltage, noise figure, current gain, and therefore reliability – are vastly improved.

The third giant evolutionary step made by Fairchild in improving reliability was the public introduction in autumn 1964 of Planar II, a complex and highly proprietary method of growing stable oxides. This process makes it possible to produce PNP's with voltage breakdowns in excess of 200 volts and reliability figures equalling those of the finest NPN transistors. It also makes possible mass production of practical MOS FET's (such as the Fairchild FI 100) capable of withstanding electric fields of the order of 2 million volts per centimeter without dielectric charge migration.

Cross-sectional view of silicon chip enlarged 200X showing a typical gold ball bond.

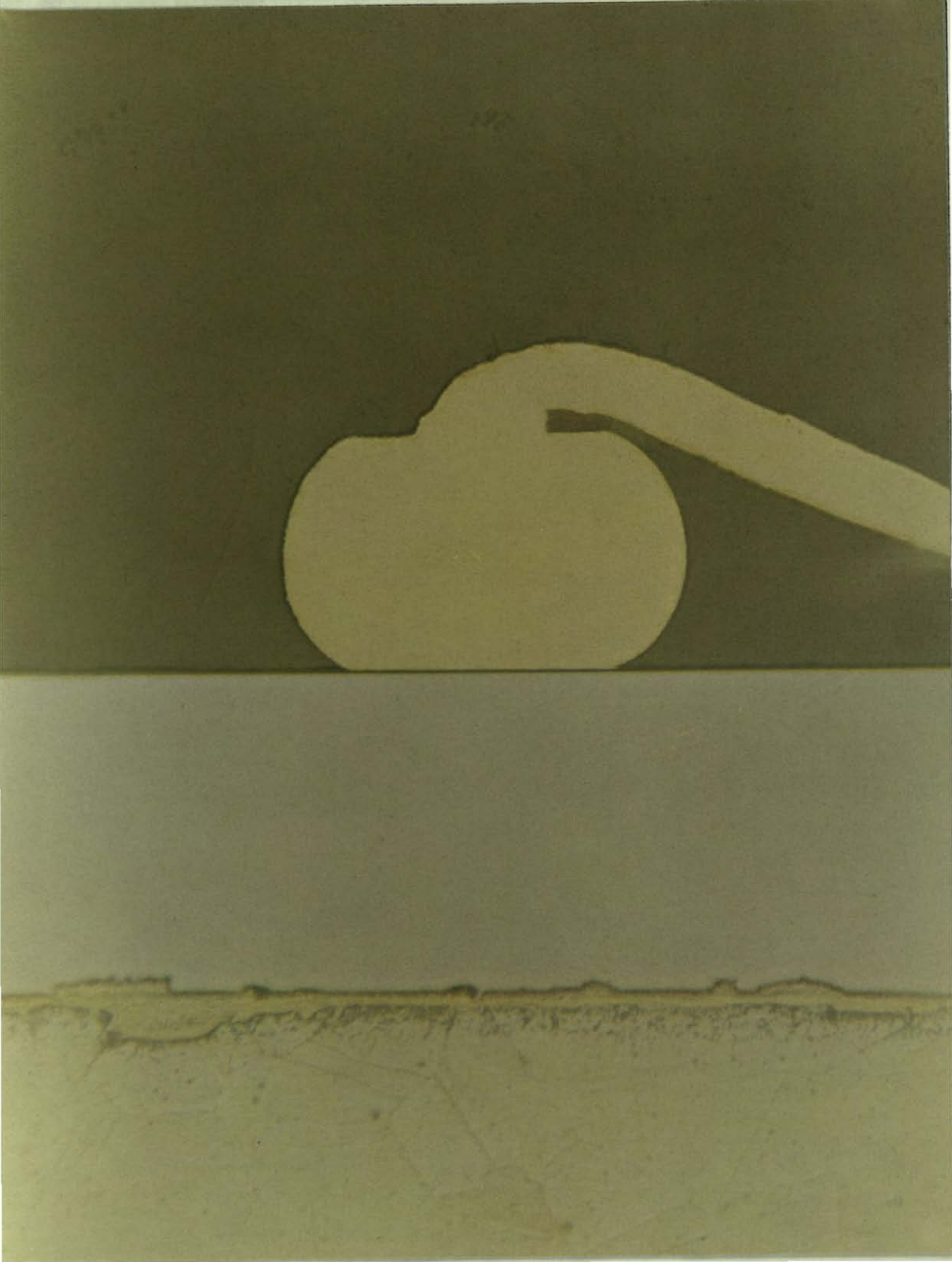
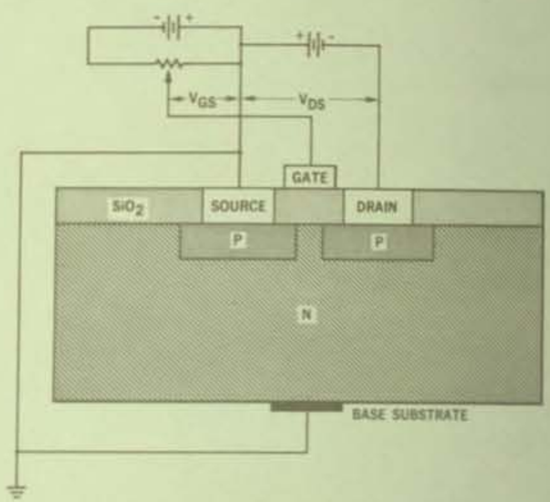


FIGURE 12
Cross-section of P-type MOS FET with correct biasing polarity.



The problem in PNP's solved by PLANAR II is briefly summarized as follows:

In a diffused transistor the collector is very lightly doped compared to the base and emitter. This is particularly true of high-voltage transistors, in which very light collector doping is used to increase the voltage breakdown characteristic. The oxide layer in the ordinary Planar device is not a purely passive coating but tends to be quite heavily loaded with mobile positive ions. The voltage gradient across the junctions in the silicon beneath the oxide extends into the oxide and causes the ions to cluster about the junction at the interface.

The positive ions affect the majority carriers in the silicon and can actually invert the polarity of lightly doped P-type material to N-type.

This fact causes no particular problem in the NPN transistor. Its N-type collector merely appears more heavily doped than would be expected and its P-type base is too heavily doped initially to be inverted; but, it can be a serious problem in a PNP as shown in Figure 11.

If inversion takes place adjacent to the collector-base junction, in effect the junction is extended, causing increased leakage and reduced breakdown voltage. When the junction moves along the interface, the force field – and thus the ions – moves with it. As the junction "creeps" along the interface, leakage continues to increase. The new junction formed between the inverted N and the non-inverted P portions of the collector has very poor electrical characteristics and, if large enough, renders the device useless. Inability to control the inversion layer (known as a "channel") in pre-Planar devices made it difficult to build high-yield, reliable PNP transistors.

Pneumatic Avco, automatically programmable. Will impose a shock up to 15 KG's for 0.1 msec in step-stress tests. (Typical military shock is 1500 G's.)

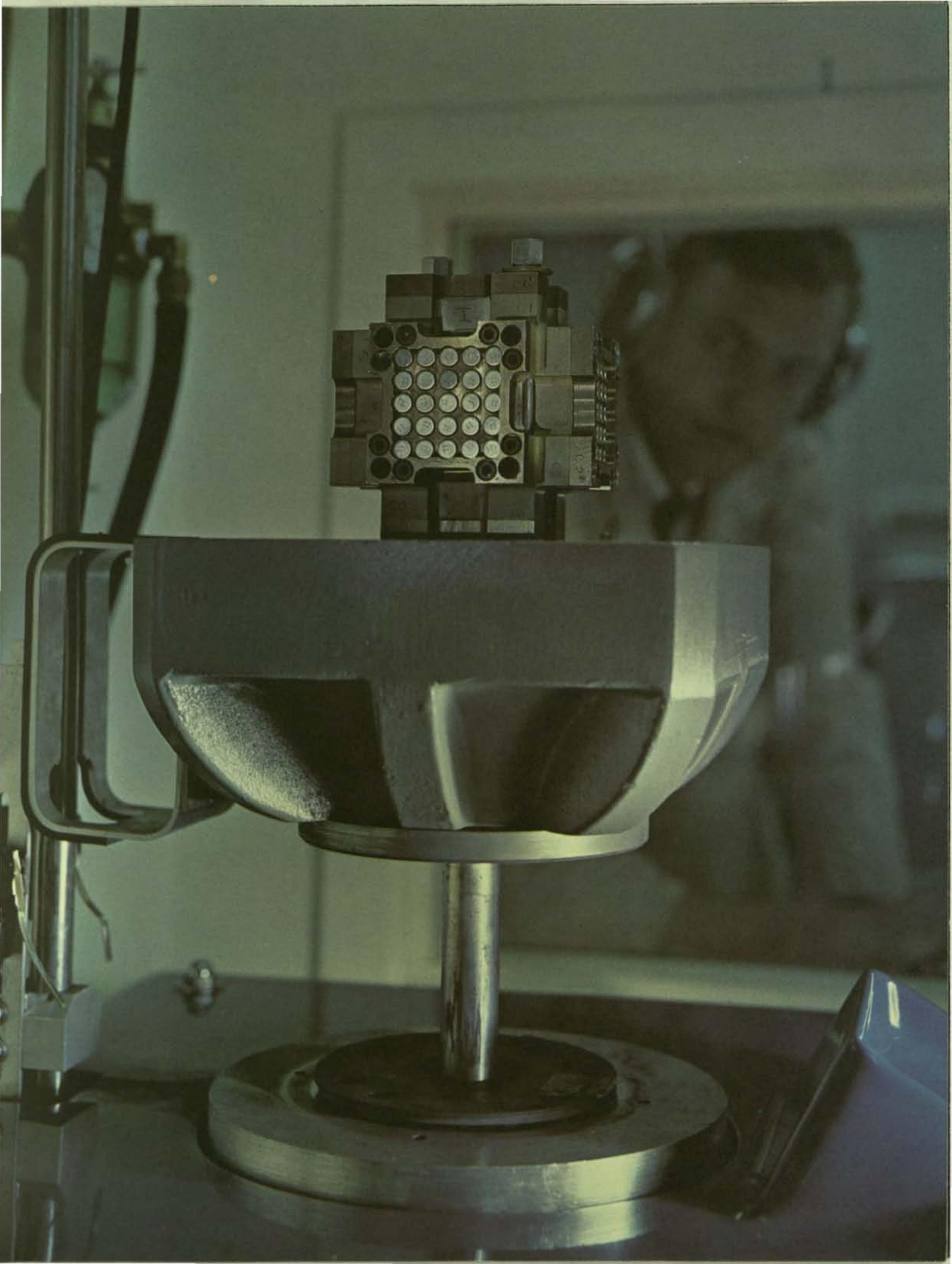
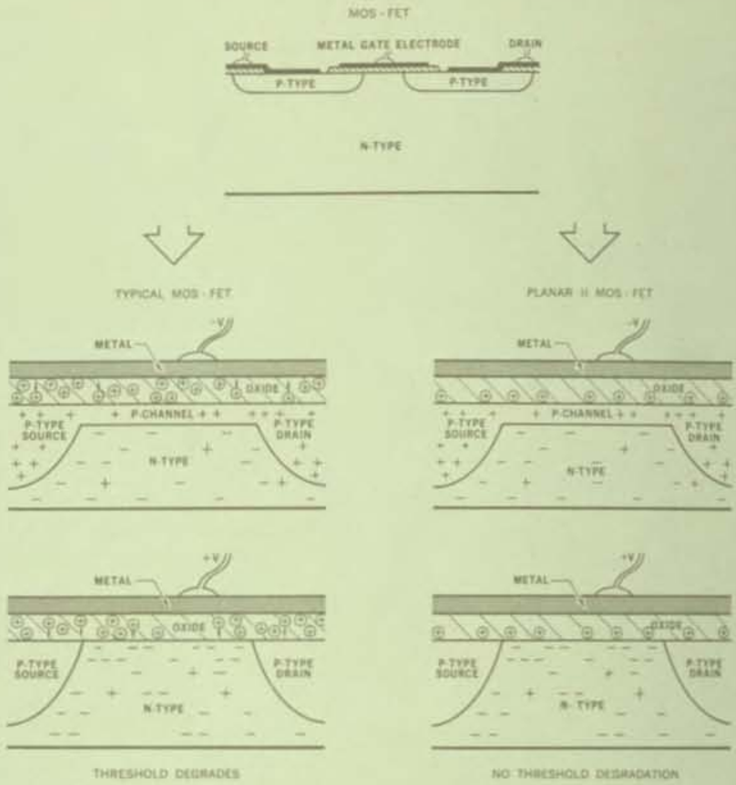


FIGURE 13
Comparison of PLANAR II MOS FET with pre-PLANAR II type.



A similar problem exists with the pre-PLANAR II MOS FET. Figure 12 shows a cross section of a P-type MOS FET with correct d-c biasing polarities. In this MOS FET a negative gate voltage V_{GS} produces a P-type channel in the N-type silicon beneath the gate so that current can flow from source to drain.

Unfortunately V_{GS} induces a voltage gradient across the oxide. The resulting changes in gate threshold voltage and capacitance due to ionic drift in the oxide are depicted graphically in Figures 13, 14, and 15. Note that in the PLANAR II device ions are completely immobilized and oxide stability increased by three orders of magnitude (100V change versus 0.1V change). Among the advantages are:

1. Complete elimination of channel development;
2. Stability at operating junction temperatures of 175°C;
3. Stability at storage temperatures of 200°C.

Process refinements: Gold ball bond

The experience gained in manufacturing Planar devices naturally led Fairchild engineers to the development of new processing techniques and new test equipment. The gold ball bond, used in Minuteman transistors and today a standard technique throughout the industry, is one example. Before the invention of this type of bond the gold lead was commonly

Devices mounted inside a heated salt-mist chamber (subgroup 5 of FACT program).

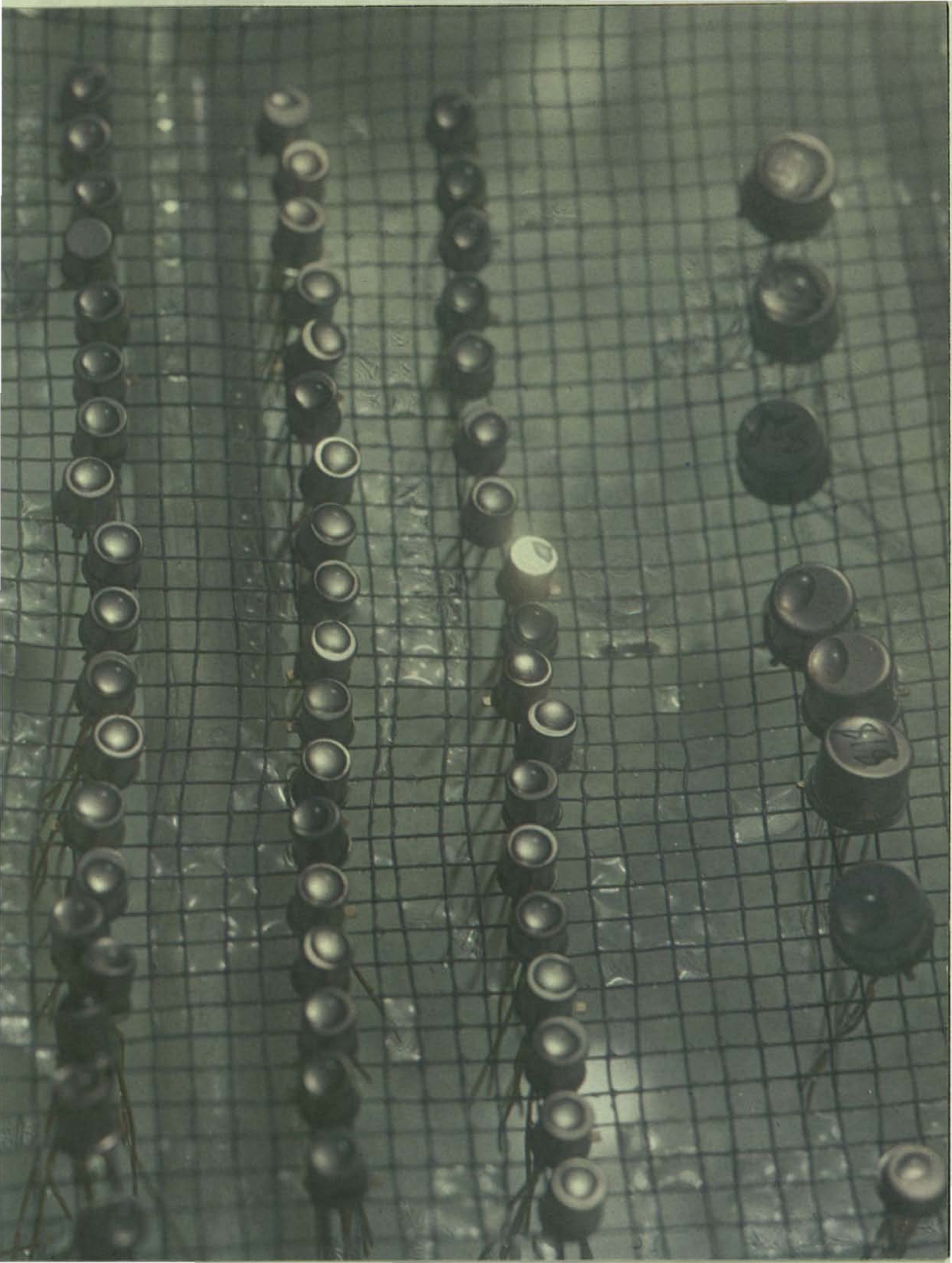
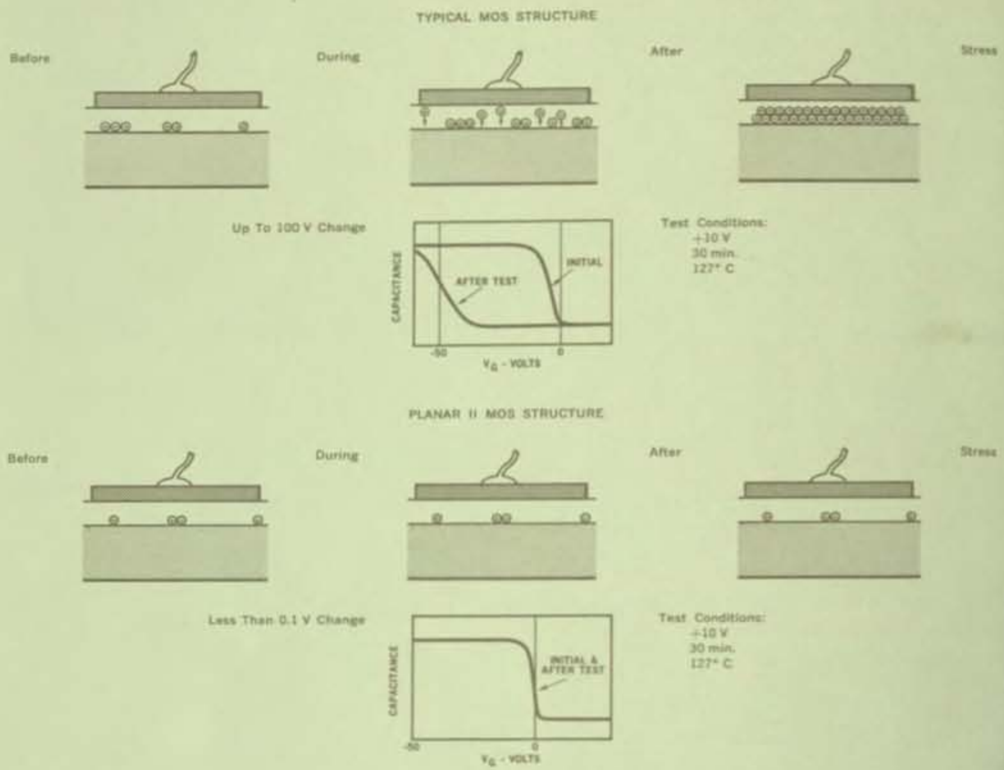


FIGURE 14
The Physics of PLANAR II oxide stability demonstrated in a metal oxide capacitor.



applied to the bonding pad by a wedge-shaped tool under heat and pressure, which tended to deform and weaken the lead. The "gold ball" bond is so called because a ball formed of melted gold at the tip of the wire is pressed against the chip by a capillary needle. This type of bond is more resistant to shock, contacts a larger area of the bonding pad, and permits the use of a larger wire.

Ultrasonic bond

A recent development at Fairchild is an adaptation of the ultrasonic bond for bonding aluminum leads. Among its advantages over the aluminum wedge bond are that it (1) does not appreciably weaken the aluminum or reduce its cross-sectional area, illustrated in the photograph on the facing page, and (2) requires no external source of heat. It is used in SCR's, power transistors, and in all flat-package integrated circuits.

Metal-over-oxide

Another major advance in processing techniques was the Fairchild-patented metal-over-oxide technique. This is a method of evaporating aluminum over the oxide in strips from the base and emitter to form large pads on the periphery of the chip, to which the leads are bonded. This method increased the reliability of all product families by providing a larger target for the bonding operation than the base and emitter stripes themselves. It was of particular importance in the development of high-speed, high-frequency devices, which require the smallest possible base and emitter areas.

Aluminum leads bonded by wedge bond (top) and ultrasonic bond (bottom).

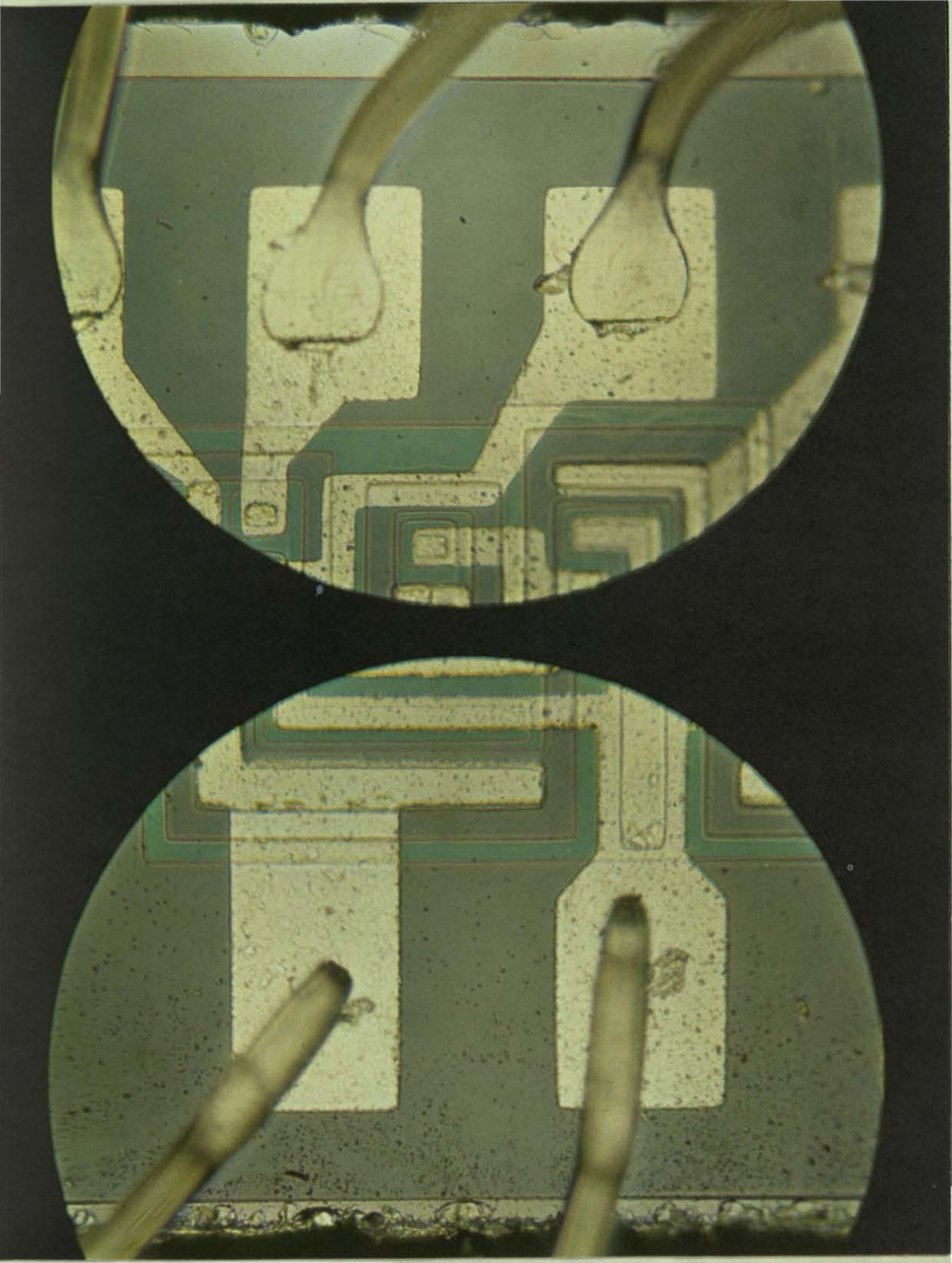
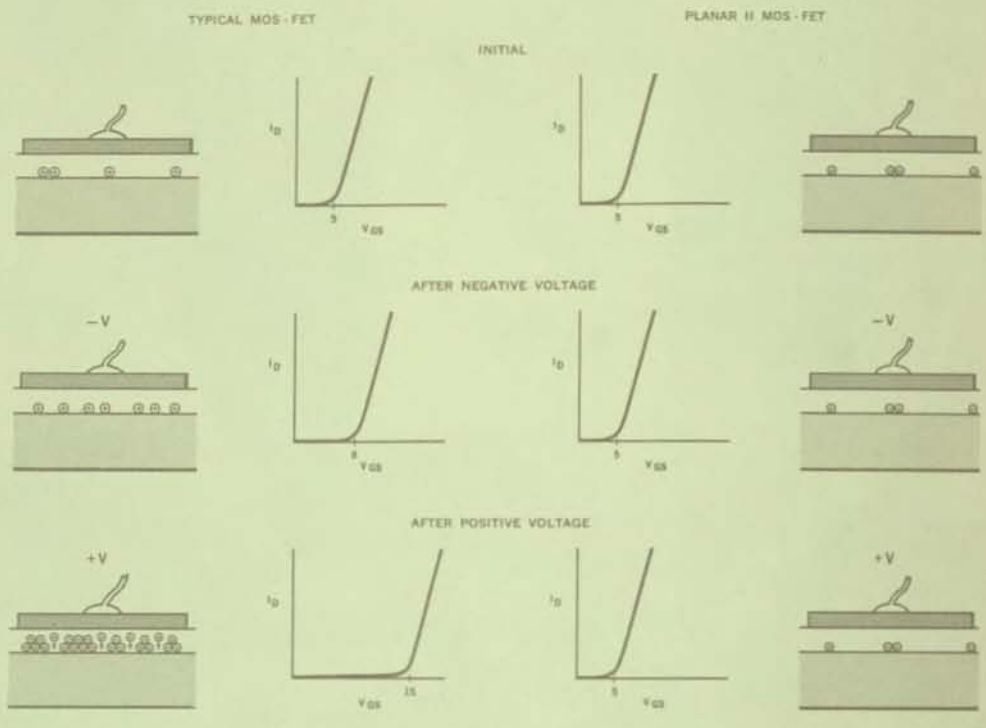


FIGURE 15
Threshold voltage is a function of ion migration.



Reliability is More Than Statistical Data

Statistical calculations of failure rate express reliability, but people create it: People in Research and Development who design devices with inherent stability; people in Manufacturing who rigidly follow procedures known to produce reliable products; people in Instrumentation who custom design equipment for testing every unit repeatedly during its manufacture; people in Quality Assurance who painstakingly check all phases of production from incoming materials, through manufacture, to end-of-line testing, in order to eliminate the slightest deviation as it occurs; people in management who focus attention on reliability. Fairchild is rich in creative, dedicated people. And these people, who invented and use the Planar process, continue to lead the industry in discovering and using new technological tools for building reliability – a tradition at Fairchild Semiconductor.

FAIRCHILD

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Integrated circuits: their future in appliances

BY *Robert B. Hood* • FAIRCHILD SEMICONDUCTOR DIV., FAIRCHILD CAMERA AND INSTRUMENT CORP.

PART I

Occasionally, an industry has the opportunity to examine the merits of an entirely new method for approaching its design problems. Many authorities feel the integrated circuit bears careful consideration at this time as a relatively exotic component which has reached price levels attractive to the appliance and other consumer markets.

THE INCREASING COMPLEXITY of modern appliances—particularly in the white goods market—has created a requirement for more and more intricate control systems. Appliances such as the home laundry washing machine or the kitchen dishwasher may have more than ten separate output devices claiming signals from the control system. As an example, the washing machine is required to monitor its own water level, water temperature, soap and bleach dispensing, spin and agitation speeds, etc. Control systems presently being used to direct these functions are the product of many years of refinement. Integrated circuits are seen as auxiliary to these systems which, although new in concept, may work in excellent harmony to increase the overall efficiency.

For instance, a large central air conditioner could use a microcircuit amplifier as the interface between a temperature sensor and a power contractor. Other applications would be the use of microcircuit amplifiers to respond to the sensing of low-level light intensities, small variations in pressure, or changes in ambient humidity.

While some solid-state controls using discrete (single-function) components have already found acceptance, the span of their future application is limited by material, packaging and manufacturing costs. Multi-step logic functions require more total silicon area if the function is performed by a number of discrete devices, thus causing higher material costs. Packaging cost becomes important because a solid-state function requires a number of packages, while the microcircuit control often requires only one package. Finally, when insertion and other handling operations involved with solid-state components require an addition in overall system cost (frequently not tolerable to the OEM) manufacturing economies could virtually dictate the use of integrated circuits.

A REPRINT
From METAL PRODUCTS MANUFACTURING Magazine

In general, the main attributes of a good appliance control system could be listed as: 1. reliability 2. accuracy (and repeatability) 3. flexibility 4. marketing appeal 5. low cost.

Other desirable features include: low heat and power dissipation, quiet operation, and ease of production assembly.

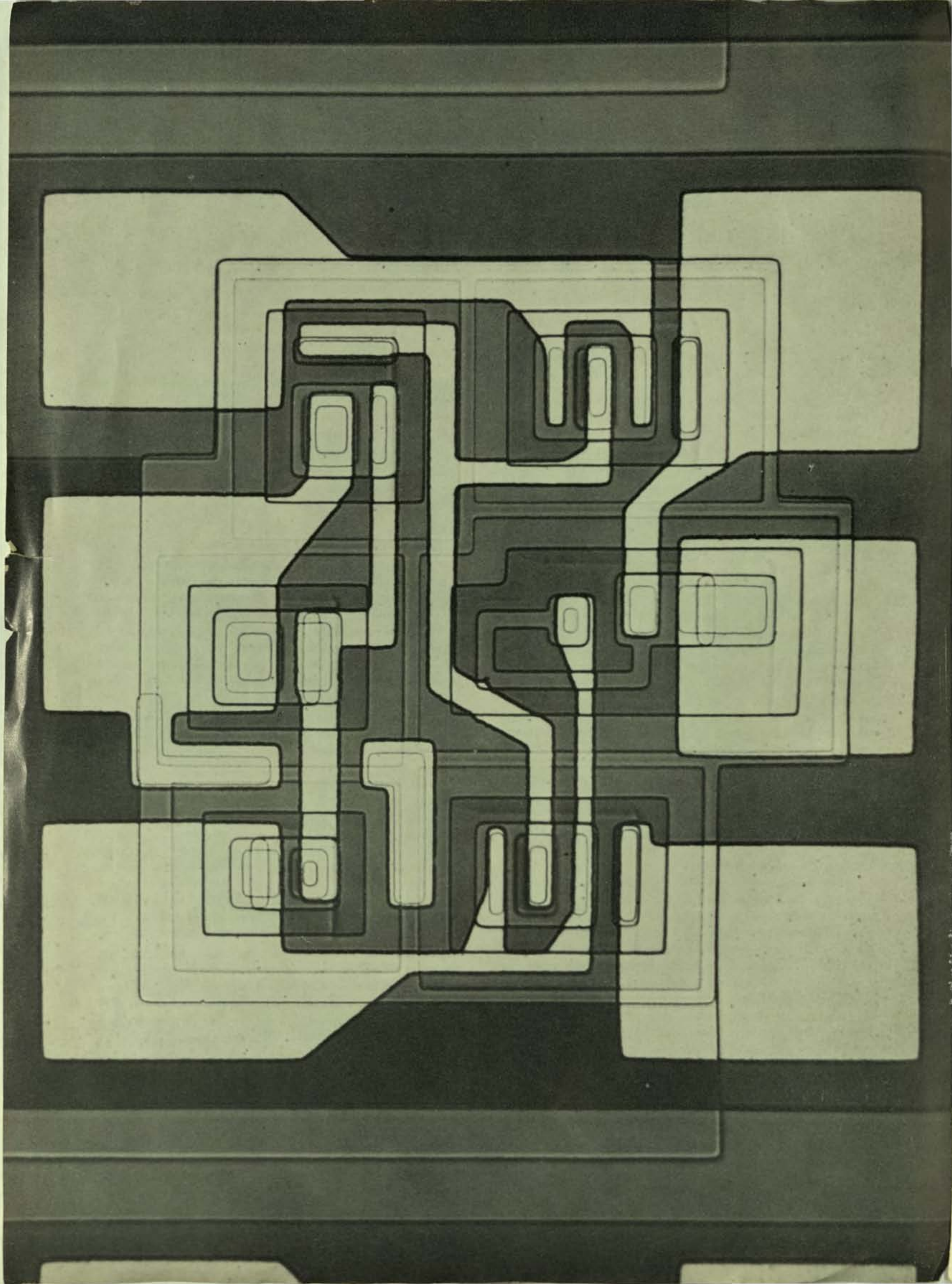
These general attributes supply reasonable standards for comparison which may be used to analyze the advantages of this new control system.

Reliability

One of the strong points of the integrated circuit is reliability. An intrinsically simple device, its active section is contained within a large silicon crystal, the surface of which is protected by a glass coating. In spite of the millions of hours of testing these devices have undergone, they have no known fatigue mechanism. If they are properly applied in a control circuit, they should never wear out. This may seem like an extremely broad statement, but there are cases on record of test programs that have run over 100 million device hours at high temperature without a single failure.

Of course, it would be unrealistic to say that there are no failure possibilities. The perfect device is not yet in hand. With microcircuits, most of the opportunities for damage occur in the package rather than in the circuit itself. As examples, leads can fatigue in a vibration environment, circuits can be overheated during their attachment to printed circuit boards, or the package can become separated from the chip in a manner that interrupts the conduction of heat away from the silicon. Any of these flaws can lead to failure. However, most weaknesses will be revealed during conventional final assembly line inspection. Breakdown of microcircuit devices after shipment from the OEM factory should be extremely rare, particularly when compared with the reliability experienced with other types of control devices.

Although the advantages of increased reliability are obvious, a numerical example might emphasize the cost savings to be gained with systems that have greatly reduced failure rates. Let's develop a hypothetical situation: Say that a good quality relay is being used by a manufacturer in an appliance. Assume the relay has a mean time before failure (MTBF) of 50,000 cycles of operation. Suppose also that the appliance requires five of these relays, and that market surveys show that the average unit is used for 100 complete operational cycles annually. As an additional factor, say that each relay operates four times during a typical appliance cycle. This means that each appliance in the field experiences 2000 separate relay operations in the course of a year. Then, if the manufacturer produces 100,000 com-



plete appliances each year, he can expect a total of 400 million relay operations to occur in one year. Further, if the relays have the MTBF figure listed above, the manufacturer can expect to have 4000 relay-caused service calls in a five-year period. If each service call (including parts and paperwork) costs $25, then $1000,000 will be spent by the manufacturer or his customers to repair these components.

For comparison, consider the same appliance in which all relays have been replaced by a single microcircuit-semiconductor-power switch combination. Assume that this system has a failure rate due to random causes such as lead fatigue or cold solder joints of one per 10 million complete cycles. (Computer systems are an order of magnitude better.) Since the manufacturer's appliances complete 10 million cycles each year, he should expect only five microcircuit service calls in five years. If each service call still costs $25, the service for the year's production for the five year period should run to only $125. The net saving for the microcircuit system is $100,000 minus $125, or $99,875—plus a good deal of customer satisfaction.

This may seem to be an extereme example unless it is understood that reliability problems common to both systems (such as interconnection wiring and the motors or solenoids being controlled) have been bypassed. The point of the example is clear: a saving of almost $1 for each appliance manufactured has been realized due only to the increased reliability of one part of the control system.

Accuracy (and repeatability)

The second major attribute a good control system should have is control accuracy. A new system introduced to the appliance market should be able to perform its control function(s) without appreciable drift or erratic operation for the entire life of the mechanical parts of the appliance. The control's operation should be insensitive to reasonable variations in line voltage, ambient temperature and relative humidity.

There is also a marketing side to the accuracy and repeatability question. A housewife will very often "live with" inaccurate control systems in her appliance rather than risk the inconvenience or expense of having the unit repaired. Rather than have a faulty control replaced, she will impatiently, but doggedly, cook with an oven with erratic temperature control, or launder with a washer that occasionally stops with the drum full of water. These inaccuracies are continuous irritants which she will remember when time comes to purchase a new appliance or when a neighbor asks her how she likes the machine she is using. From this aspect, an inaccurate control may be worse than one that does not work at all. At least the unit that has catastrophically failed will be replaced and forgotten.

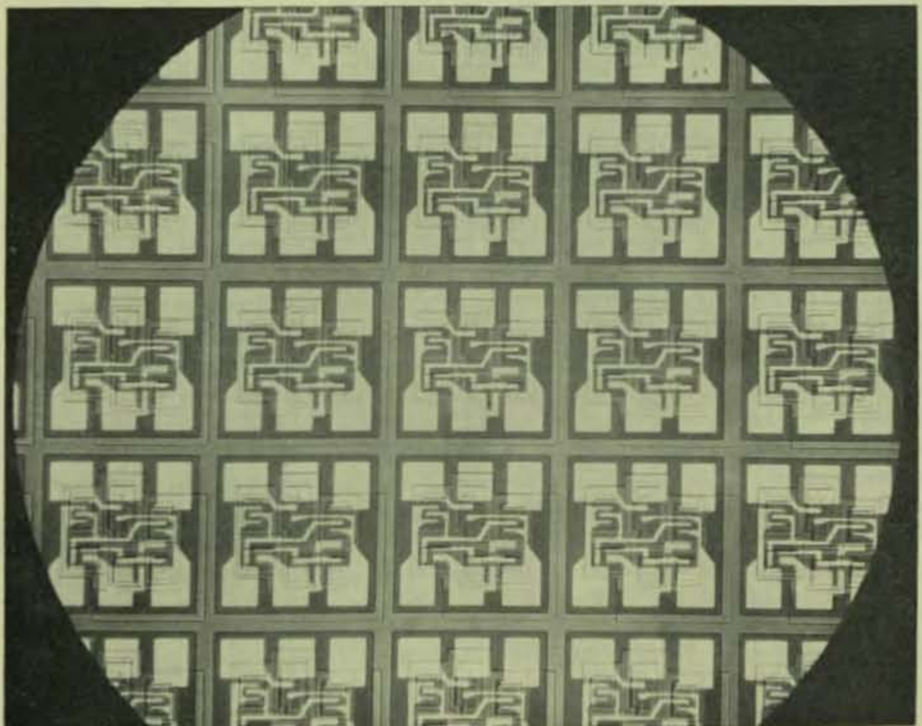
How will microcircuit control systems function with respect to accuracy and repeatability? For the same reasons that the microcircuit is so reliable (no wear or failure mechanism) its accuracy should remain unimpaired over the appliance's useful life. The microcircuit, because of:

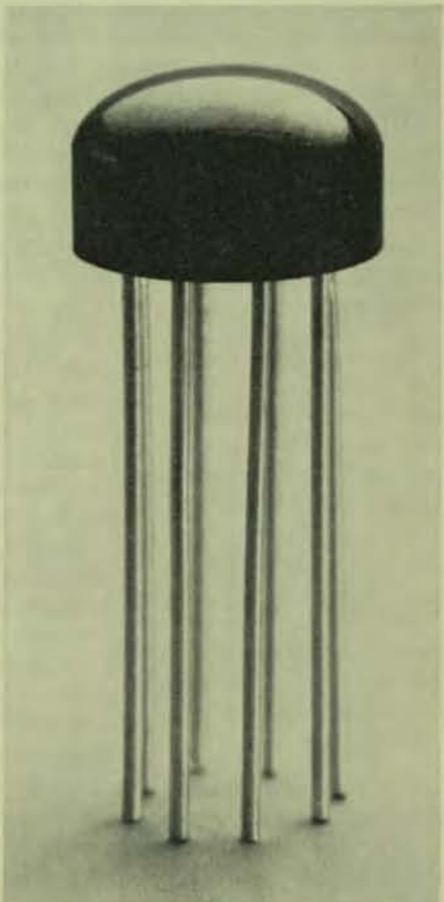
1. its lack of moving parts with their attendant friction and wear,
2. its protection from ambient moisture due to the impervious case materials and the glass layer covering the active chip,
3. the ease with which control systems designed for it can be temperature compensated,

should surpass most of the existing control systems in long-term accuracy and repeatability.

(Right) — A typical consumer-product type epoxy microcircuit package. Combination of impervious case material and glass layer covering active chip gives complete protection from ambient moisture. Second part of article, to appear next month, will describe microcircuit construction process.

(Below) — A large portion of a wafer from which uA 703 circuits are separated into individual circuit chips. Millions of hours of testing have revealed no known microcircuit fatigue mechanism.





Flexibility

With the demand for annual control feature and model changes on the increase, one of the important characteristics of a useful control system should be flexibility. Some of the more recent developments in microcircuitry show that future devices will be able to offer extreme variability of control function with a minimum of design change.

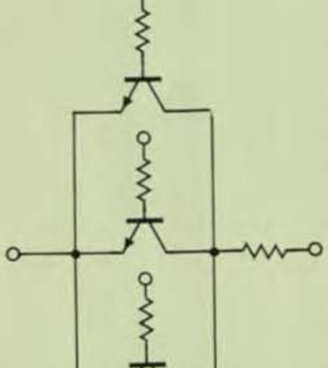
One company has recently announced the development of a two layer interconnect technology for MOS and bipolar logic systems that can accommodate up to 200 gate input functions on a chip only ⅛ in. sq. This system is expected to be available for space and military applications by mid-1967. It is therefore a few years away from production for appliance applications. However, there is no reason to expect that microcircuits of this type will not eventually be offered to the appliance market. The flexibility of a control system using these devices should be outstanding when one considers that only 15 of these ⅛ in. sq chips are sufficient for a 3000-circuit aerospace computer. The number of appliance control combinations possible with just one or two of these devices is correspondingly large.

With multilayer interconnect technology, model turnaround could be accomplished by changes within the silicon chip rather than by expensive wiring changes to the finished appliance. At present, this appears to be a "blue sky" approach, but when it is considered that the whole microcircuit technology has sprung in six short years from the invention of the planar process to a 1965 annual business volume of $95 million, these systems do not seem far away.

Cost advantages

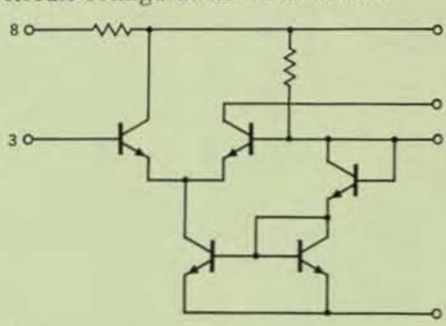
Probably the one major factor to be considered by the appliance industry when weighing any new control system is the long-term cost expectation for that system. If the control meets all of the technical and marketing requirements but still does not have a long-term low cost future, it has no value for the industry. Fortunately, microcircuits are now reaching attractive price levels. To demonstrate the cost future for microcircuits, three examples are selected: the μL 903 three input gate, the μA 703 IF amplifier (for TV and FM), and the NPN - PNP low voltage trigger.

First, the μL 903: This is a basic computer element consisting of three NPN transistors and four resistors. It has been used for a number of years as a NAND/NOR gate in micrologic systems. The circuit for the device:



This circuit sold for over $200 per copy about four years ago. The current price for the device in small production quantities is in the neighborhood of $1. It is important to recognize that although the μL 903 is a device that was developed for the computer industry, it is representative of a general trend. The obvious next question is "what about circuits designed specifically for the consumer industry?"

The first microcircuit to be offered for the high-volume, low-cost entertainment market has been the μA 703 amplifier. This device is a linear high frequency amplifier used for the sound IF stages of TV and FM receivers. The circuit, basically a differential amplifier with a controlled current source, contains five transistors and two resistors in the circuit configuration shown below:



The characteristics of the circuit:

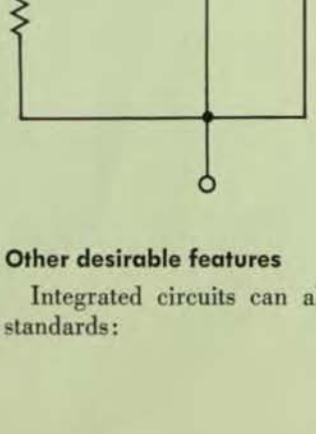
20db useful amplification at frequencies up to 100mHz

6db noise figure

20 v output excursion

This device, an excellent general purpose amplifier limiter, was introduced in high-volume quantities at prices below a dollar.

In still another low-cost application for integrated circuits, several semiconductor manufacturers have developed a low-voltage trigger. The unit incorporates a resistor, zener diode, and an NPN-PNP transistor pair and is primarily intended as a gate trigger element for semiconductor power switching devices such as the SCR (silicon controlled rectifier). It has good power transfer from the driving circuit due to its low dynamic impedence. It is also capable of dependably triggering high current SCR's with firing voltages down to 7 volts. Its circuit configuration is the analogue of the SCR structure:



One company's published prices for production prices of this device fall in the region of one-half dollar.

These three examples clearly show that integrated circuits have arrived for the low-cost consumer market. The price barrier has come down rapidly enough to warrant the attention of designers throughout the consumer industry. The rate of price decrease makes the integrated circuit a competitive component for the advanced prototype appliances now being designed.

Other desirable features

Integrated circuits can also be evaluated by additional standards: CONTINUED ON PAGE 8

The Author: Robert B. Hood is appliance circuits group leader in the Consumer Applications Dept., Fairchild Semiconductor Div., Fairchild Camera and Instrument Corp., Mountain View, Calif. He has worked with appliance control system designs for a number of years. Prior to joining Fairchild he served as chief engineer of a radio station. Hood is a graduate of the University of Michigan and a member of IEEE.

Integrated circuits: their future in appliances

BY *Robert B. Hood* • FAIRCHILD SEMICONDUCTOR DIV.,
FAIRCHILD CAMERA AND INSTRUMENT CORP.

PART II

THE DESIGN PROCESS

THERE ARE A NUMBER of fairly complex steps through which a new circuit design must pass before it can become an integrated circuit. Because of the very high cost for setup, extreme care is exercised to determine the proposed product's technical and market capabilities.

Development is begun when a need for the circuit function is demonstrated. This may come about in two ways. Often, application engineers or marketing personnel within the semiconductor manufacturer's plant may recognize a need and initiate work on the product. With about equal frequency, however, a customer will suggest the requirement for a product that will readily lend itself to integration. In this case, the circuit will generally be developed in fairly close cooperation with the customer. Once the growth of a product has commenced, it follows the path outlined below:

The circuit solution for the design problem is cooperatively worked out by engineers from the integrated circuit manufacturer and the customer (the appliance manufacturer). First an analysis of the design is done to see how well it fits within the special constraints pertaining to integrated circuits. A number of breadboard models are then constructed using discrete components.

These models will be laboratory and field tested to determine the actual performance of the circuit under the conditions. Later, any revisions indicated by these tests are made and checked out. At this point, the design must be frozen. Any subsequent change in the circuit is expensive and time-consuming because a committment must now be made for extremely expensive and highly specialized tooling.

First, a series of masks are drawn which lay out the areas of the silicon chip which will be subject to impurity deposition, various schedules of diffusion, metallization, passivation and etching. These masks — about a yard square — are optically reduced to control the processes in an area only .0016 in. sq.

When the masks have been completed, various test production runs are made to establish proper operation of the finished devices. Any necessary modifications in the masks or diffusion technique are made at this time.

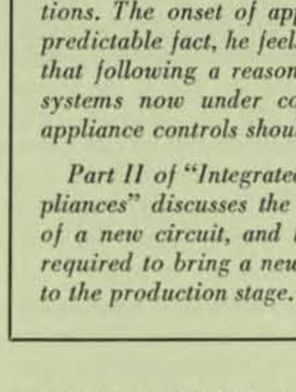
Concurrent with the development of the masks and the diffusion process, a less glamorous but equally important process is taking place. Special equipment is designed and constructed or purchased to test the circuits during production. Custom test jigs and electronics are needed to inspect the device function both before removal from the wafer and after assembly into the completed package. Optimum use of production facilities demands that this test equipment be designed for each new circuit and that it be ready at the same time the device's development reaches the production stage.

In Part I of this article (August 1966 issue) Mr. Hood expressed the belief that integrated circuits will soon find their way into low-cost systems which either perform logical functions or transpose sensor signals (responding to light intensity, temperature variation, air flow, speed, and pressure) into output power functions. The onset of appliance integrated circuits is a predictable fact, he feels. Furthermore, the author feels that following a reasonable development time for the systems now under consideration, integrated circuit appliance controls should be commonplace.

Part II of "Integrated Circuits: Their Future in Appliances" discusses the process involved in the design of a new circuit, and the complex construction steps required to bring a new design from the concept stage to the production stage.

THE CONSTRUCTION PROCESS

AN INTEGRATED CIRCUIT could be described as a collection of electronic components on a single silicon chip. These components, including resistors, capacitors, diodes, and transistors, are simultaneously formed in a complex series of steps. Since most of the operations required for the construction of an integrated circuit are also used for the building of a bipolar NPN transistor, this device will be taken as an example.



CIRCUIT SYMBOL FOR THE DEVICE

To put things into perspective, the component to be described is physically very small. When finished, its size will be approximately .006 in. wide, .008 in. long, and only .0002 in. thick. It will be part of a group containing possibly ten other transistors that are parts for a circuit that measures .040 by .040 by .0002 in. The circuit, along with several hundred duplicates, is to be formed on a silicon wafer about the size of a quarter.

1. *Preparation*: A wafer of monocrystalline silicon (high purity silicon crystal with a uniformly oriented lattice structure) is cut from an ingot about 1 in. in diameter. During the formation of this ingot a very small quantity of material

called P dopant has been added to the silicon. The dopant is used to determine the electronic characteristics of the material. (A discussion of the function of P and N regions is beyond the scope of this article, but for the purpose at hand, it is sufficient to regard the construction of semiconductor devices as a system for forming P and N regions under controlled conditions.) The surface of the wafer is lapped, polished, and cleaned. It is then placed in a controlled atmosphere oven and heated to about 1000° C (1832° F). An acid gas is introduced into the furnace to remove a very thin surface layer. This separates any remaining imperfections or contamination, and places the wafer in the condition shown in Fig. 1. An oxidizing agent such as oxygen gas or steam vapor is then passed over the wafer. This combines with the surface of the silicon to form silicon dioxide (glass). The reaction takes place between 900 and 1300° C (1650 to 2370° F).

2. *Predeposition*: An acid (such as modified hydroflouric acid) is used to etch a window for the deposition of a new material. The wafer — now in the condition shown in Fig. 2 — is again placed in the furnace and heated. A gas rich in N type impurity (generally containing phosphorous) is passed over the wafer and allowed to modify its surface. In the area covered with glass this deposition material does not penetrate to the P type silicon substrate, but at the etched windows, it does come into contact with the base wafer. Fig. 3 schematically shows this as a layer on top of the wafer. This is not strictly true because the deposition material does combine with the wafer's surface. The N+ area to be formed at the aperture in the glass will eventually separate the transistor from the wafer substrate.

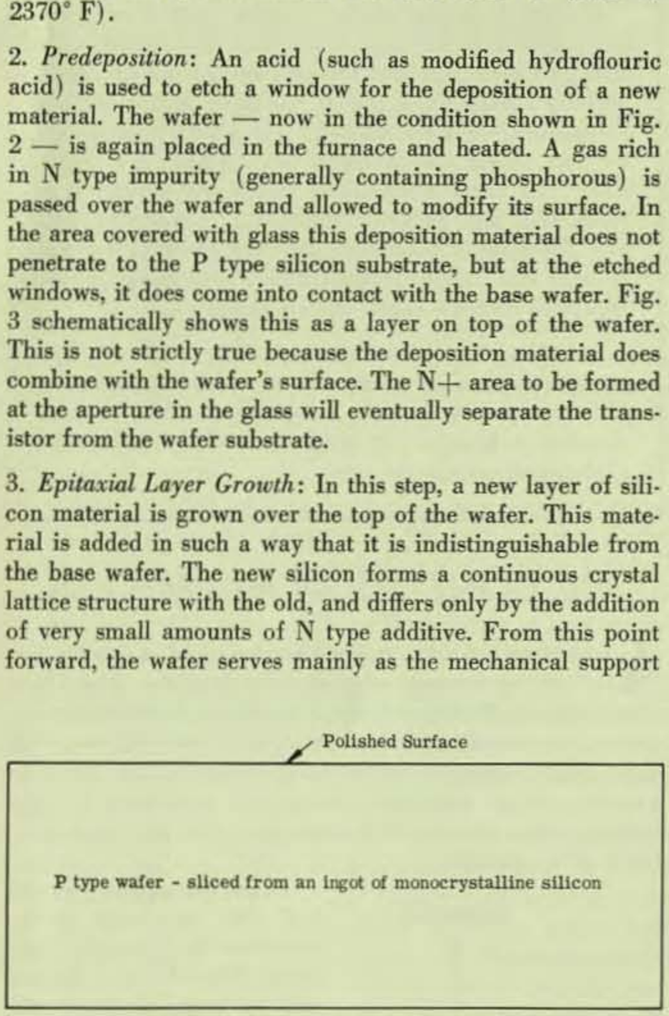
3. *Epitaxial Layer Growth*: In this step, a new layer of silicon material is grown over the top of the wafer. This material is added in such a way that it is indistinguishable from the base wafer. The new silicon forms a continuous crystal lattice structure with the old, and differs only by the addition of very small amounts of N type additive. From this point forward, the wafer serves mainly as the mechanical support for the epitaxial layer. The layer formed in this step is about 1/10th as thick as the wafer, and is the zone in which the integrated circuit components are made. This is accomplished as follows:

a. The glass and unwanted dopant (predeposition material) are removed by an acid etch. The predeposition remains, however, where there were windows in the glass.
b. The heated wafer is placed in a gas which carries silicon and a very small percentage of N type impurity. This atmosphere is maintained until a relatively thick layer has united with the wafer surface. The N region so formed is the epitaxial layer.
c. The step is completed when a thin surface glass is created by reaction with an oxidizing gas. Fig. 4 shows the condition of the wafer at this stage.

Note that the predeposition material has diffused both upward and downward during this step, resulting in an N+ region at the bottom of the epitaxial layer.

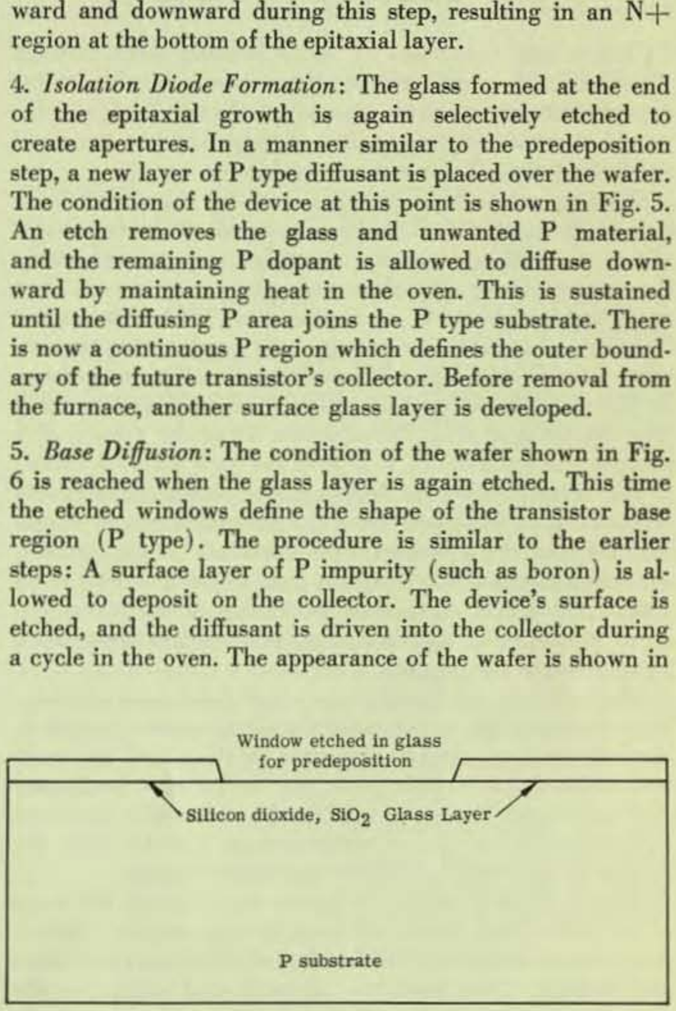
4. *Isolation Diode Formation*: The glass formed at the end of the epitaxial growth is again selectively etched to create apertures. In a manner similar to the predeposition step, a new layer of P type diffusant is placed over the wafer. The condition of the device at this point is shown in Fig. 5. An etch removes the glass and unwanted P material, and the remaining P dopant is allowed to diffuse downward by maintaining heat in the oven. This is sustained until the diffusing P area joins the P type substrate. There is now a continuous P region which defines the outer boundary of the future transistor's collector. Before removal from the furnace, another surface glass layer is developed.

5. *Base Diffusion*: The condition of the wafer shown in Fig. 6 is reached when the glass layer is again etched. This time the etched windows define the shape of the transistor base region (P type). The procedure is similar to the earlier steps: A surface layer of P impurity (such as boron) is allowed to deposit on the collector. The device's surface is etched, and the diffusant is driven into the collector during a cycle in the oven. The appearance of the wafer is shown in



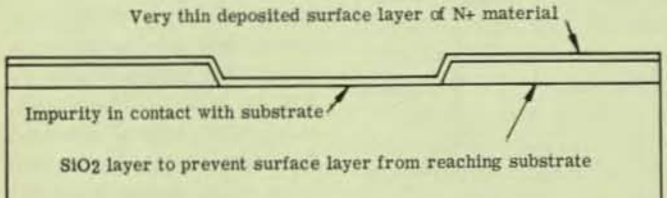
Start of the Process - The Basic Wafer

FIG. 1



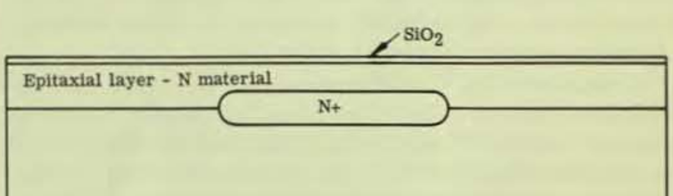
Base Wafer with Etched Oxide Layer

FIG. 2



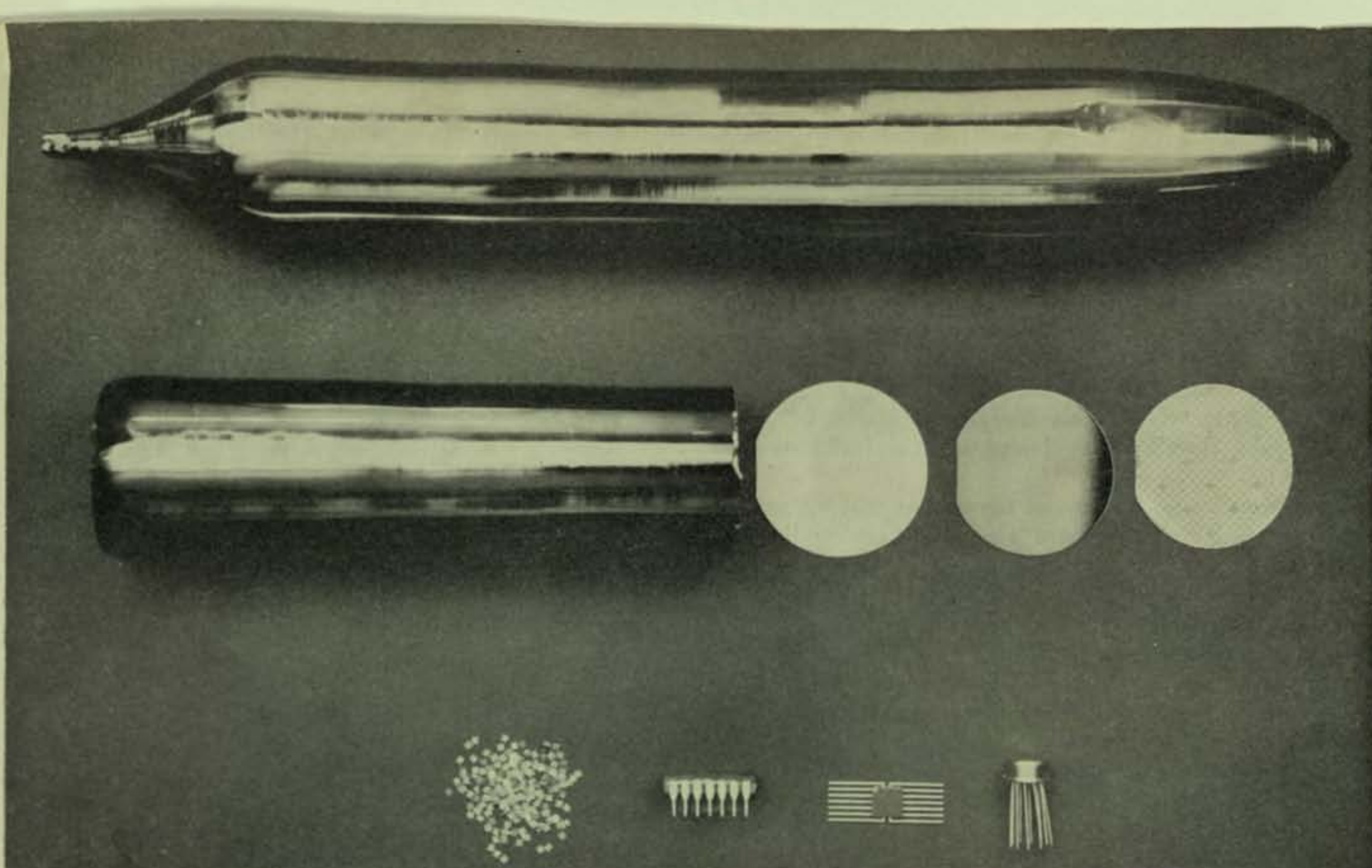
Impurity Layer for Predeposition Step

FIG. 3



Growth of Epitaxial Layer (N Type)

FIG. 4



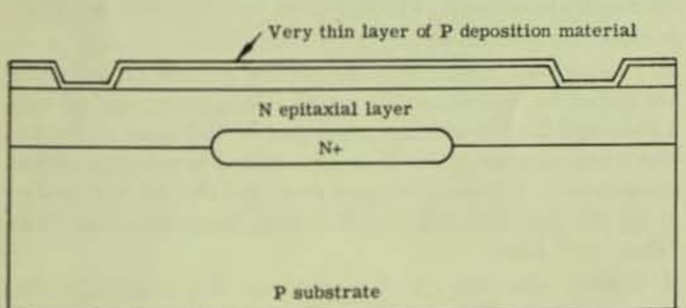
This photograph shows the various components that go into the construction of a microcircuit. The cylindrical object at the top is the grown silicon crystal ingot. The middle group shows the wafers as they are sliced from the ingot. Note that the wafer on the far right has had microcircuits diffused onto it. At bottom of photo is a group of individual chips after separation from the wafer, and the packages in which they are marketed.

Fig. 7. As before, the step ends when a glass layer forms on the unit's surface. The transistor now has a collector and base; only the emitter is required for completion.

6. *Emitter Diffusion*: For this step, two windows are etched into the glass. The first — in the center of the device — outlines the shape of the transistor's emitter. The second — on the left side in Fig. 8. — is to allow some of the emitter diffusant to combine with the collector to aid electrical contact with external circuit elements. Highly doped N+ material is deposited through these windows and allowed to diffuse a relatively short distance into the base and collector regions. Upon completion of this step, a glass layer is again formed.

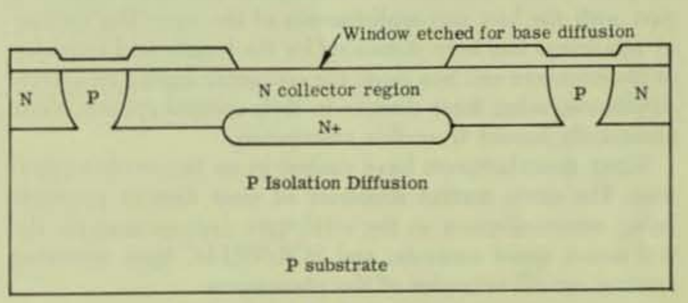
7. *Metallization*: The glass layer on the surface of the wafer is etched in the areas which will have external electrical connections. The wafer is then placed (after cleaning) in a

CONTINUED PAGE 8



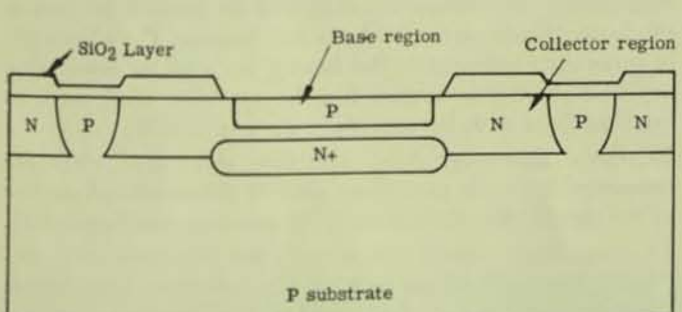
Deposition of P Material to Form Isolation Diode

Fig. 5



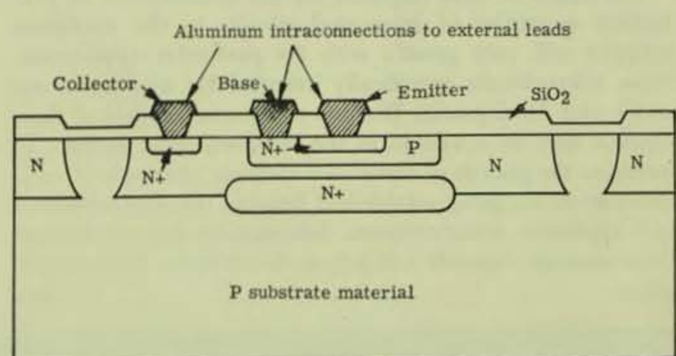
Wafer Before Base Diffusion Step

Fig. 6



Base Diffusion Step

Fig. 7



Finished Device

Fig. 8

Integrated circuits: their future in appliances

PART I

CONTINUED FROM PAGE 4

Low heat and power dissipation — IC's are fairly good in this respect, with most of them rejecting less than 250 mw into their environment. Unfortunately, the power switches they control (SCR's) dissipate about the same amount of heat as a power relay. (This dissipation can be handled easily in most cases by heat sinking into the frame of the appliance.)

Quiet operation — because of the lack of moving parts, most integrated circuit systems are silent. (It should be recognized that some early semiconductor devices had a tendency toward noise, but newer packaging techniques have eliminated this problem.)

Ease of production line assembly — the small size of microcircuit elements makes them convenient to use in the production situation. Their reduced size and inherent ruggedness make them less subject to damage than many of the larger electromechanical components. For very high volume production, microcircuits could also easily be offered in packages that lend themselves to automatic insertion techniques.

Marketing appeal

Today's appliance manufacturer is offering his product to a consuming public that has been exposed to one of history's greatest free advertising campaigns. Since the late 1940's, hardly a week has passed without prominent mention in the news media of some important event in which semiconductors have played a part.

The younger consumer has been intimately in touch with the opening of whole new frontiers of human endeavor: the exploration of space, the plumbing of the ocean's depths, the beginning of the computer age. All are events which have in part been made possible by the availability of solid-state devices. These control systems have been associated in the public mind with the new and exotic and have become a part with the best accomplishments of the age. The quality of this image has been enhanced by the length and intensity of the exposure and has made the consumer highly receptive. Appliances using these devices in their control systems must necessarily benefit from this association.

Many manufacturers have cashed in on the market situation. The early market successes of such diverse products using semiconductors as the solid-state dryness control, the SCR motor speed controls, and SCR/TRIAC light dimming systems are all examples of the phenomena.

Market timing

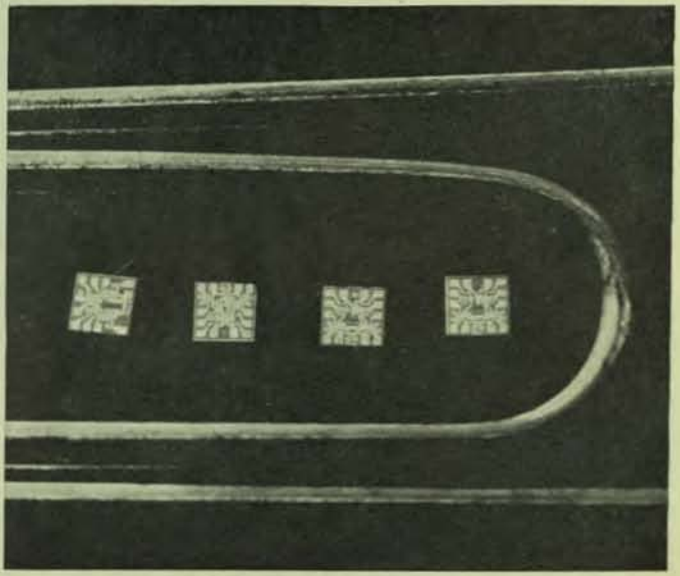
The length of time required for the introduction of production quantities of integrated circuits to the appliance industry will vary greatly with the particular application. Some microcircuits specifically intended for appliances are now under development. Discrete component models of these systems may be available in the relatively near future. To facilitate the growth of these new systems, channels of communication are being established between the semiconductor and appliance manufacturers. Information gained through these separate channels will help to direct future development efforts. MPM

A REPRINT
From METAL PRODUCTS MANUFACTURING Magazine

PART II

CONTINUED FROM PAGE 7

vacuum chamber. Subsequent to evacuation, a hot filament vaporizes molten aluminum, which coats the wafer uniformly with a thin film of the metal. The vacuum is then released and the wafer removed from the chamber. A final etch clears away unwanted aluminum and leaves a coating shaped for intraconnections between this transistor and other parts of the integrated circuit or for mounting pads for external leadwires. A final heat cycle causes the aluminum to combine with a thin layer of glass between it and the active circuit elements (e.g., emitter-base-collector regions). The metal is then in ohmic (non-rectifying) contact with these regions,



Four computer logic microcircuits grouped in the inner ring of an ordinary paper clip.

and the device is completed. Fig. 8 shows a cross section of the finished transistor. Further steps in the process are mainly mechanical handling.

8. *Testing and Separation*: All of the circuits on the wafer are tested for operational function. Rejects are marked with a dye, and the circuits are separated in the same way a glazier trims window glass: lines are scribed between individual circuits with a diamond tipped tool, and the wafer is broken along the cuts. The individual circuits are now referred to as "dies" or "chips."

9. *Header Mounting*: At this point the chip comes into contact with part of its outside package — the header. This is an assembly consisting of a flat pedestal for mounting the chip, and the lead wires which link the integrated circuit with its outside functions. The header thermal design is critical since it determines the ability of the finished product to efficiently handle power without overheating. The silicon die is generally connected to the header by a solder bond. This provides electrical contact for the isolation diode and an excellent heat path between the chip and header.

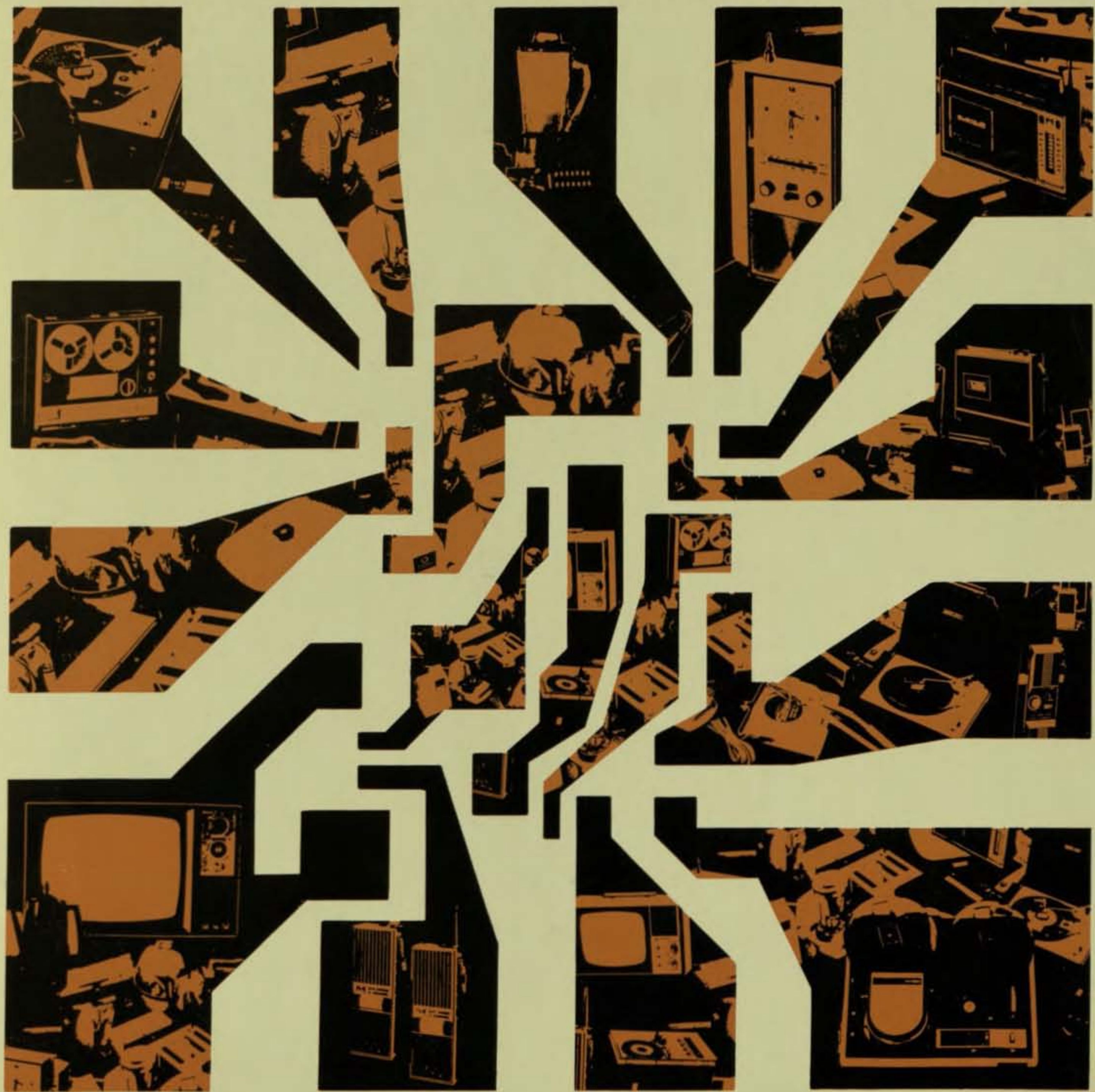
10. *Final Assembly*: After cleaning, short lead wires are connected from the mounting pads in the metallized surface of the chip to the external leads (preassembled to the header).

11. *Inspection*: Completed devices are physically and electrically inspected before packing for shipment. Tests include shock and vibration cycles, case integrity (moisture penetration), and comparison with electrical specifications. Sample lots are drawn for life test. MPM

Printed in U.S.A.

FAIRCHILD SEMICONDUCTOR

PRODUCTS AND APPLICATIONS FOR THE CONSUMER ENTERTAINMENT INDUSTRY



JUNE 1971

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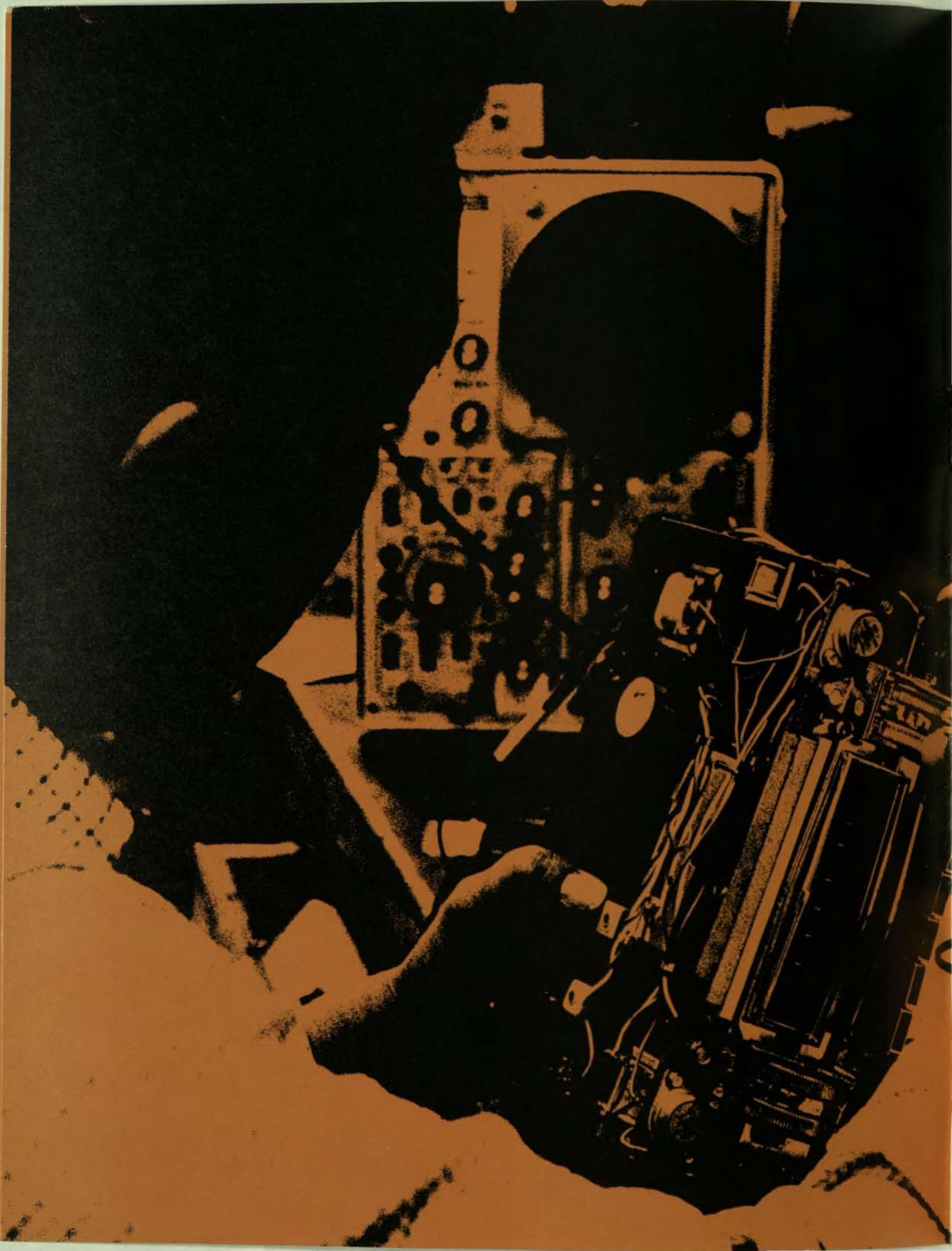
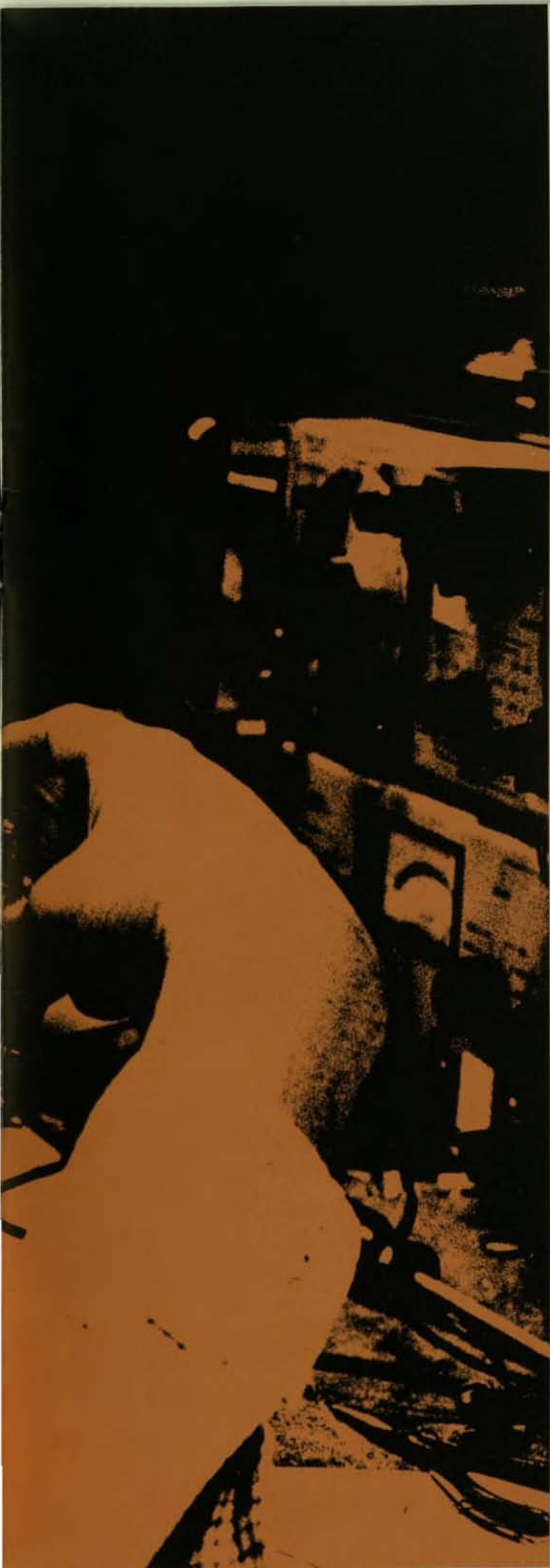




INTRODUCTION

There are several considerations that automatically define semiconductor company longevity — a thoroughly tested broad product line, a comprehensive selection of packages, a well-stocked inventory, competitive price structure, informative software and proven reliability. By definition, Fairchild has succeeded.

In addition, Fairchild offers the Consumer Industry a product/package combination for every conceivable consumer application. No application representing technological progress in television, radio, automotive or any consumer product area is overlooked. You won't hear about a Fairchild product that does not economically replace an existing design, but when we've improved a circuit both reliably and economically, we're the first to let you know. Product information as well as detailed application papers are made readily available to the Consumer Industry. Chances are, the solution to one or more of your requirements has already been covered in one of our many Application Notes. A list of some of the most recent literature is included at the end of this brochure.

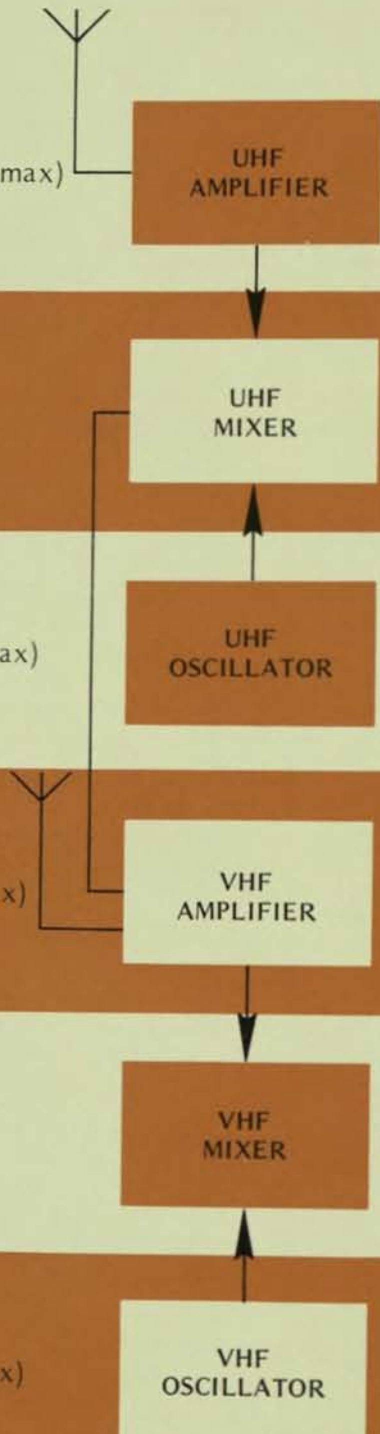
The need for a direct confidential interface between your designers and Fairchild's consumer applications engineers is obvious. Bring your queries to the attention of your nearest Fairchild Field Sales Office. Part of the total service offered by Consumer Applications, direct contact with field sales offices, allows our engineers to know of your design requirements quickly. If the situation warrants, we'll fly an Applications Engineer to you to discuss your needs on the spot.

One result of Fairchild's years of technological leadership is an extensive product line packaged for virtually any given environment and reliability requirement. To illustrate our capability for some specific functions, we've included selection tables covering RF, video, audio and signal processing applications. If you require additional information concerning your particular application, contact Fairchild Applications and we'll provide a complete report. If it is more convenient, contact one of our field sales engineers; they are always ready to talk about your needs.

Fairchild has it - product, service, reliability and economy. We are ready to assist you.

Consumer Applications Department
Fairchild Semiconductor
464 Ellis Street
Mountain View, California 94040

TELEVISION TUNERS



DIODES

VARACTOR DIODE **DIO 107***
$C_3/_{25}$ = 4.5(min), C (min) = 2.2 pF (max)
Q = 200 (min) @ 50 MHz

HOT CARRIER DIODE **FH1100**
V_F= .55 V (max) @ 10 mA
NF = 10 dB (max) @ 890 MHz

AFC DIODE **RF400**
C_3/C_{20} = 2 (min), C (min) = 7 pF (max)
Q = 250 @ 100 MHz

VARACTOR DIODE **DIO 108***
C_3/C_{20} = 4 (min), C (min) = 5 pF (max)
Q = 200 (min) @ 50 MHz

BANDSWITCH DIODE **RF100**
Reverse Capacitance = 1 pF (max)
Forward Resistance = 1 ohm (max)

AFC DIODE **RF400**
C_3/C_{20} = 2 (min), C (min) = 7 pF (max)
Q = 250 @ 100 MHz

TRANSISTORS

UHF Amplifier: PNP Metal Can, Common-base **SST108***

UHF Mixer: JFET Metal can **2N4416**; JFET Plastic **2N5486**

UHF Oscillator:
PNP Plastic **SST113***
NPN Plastic **2N5770**
NPN Plastic **SST112***

VHF Amplifier:
NPN Plastic, Common-emitter **PE5010**
NPN Plastic, Common-base **SST121***
MOSFET, Dual-gate **FT0601**

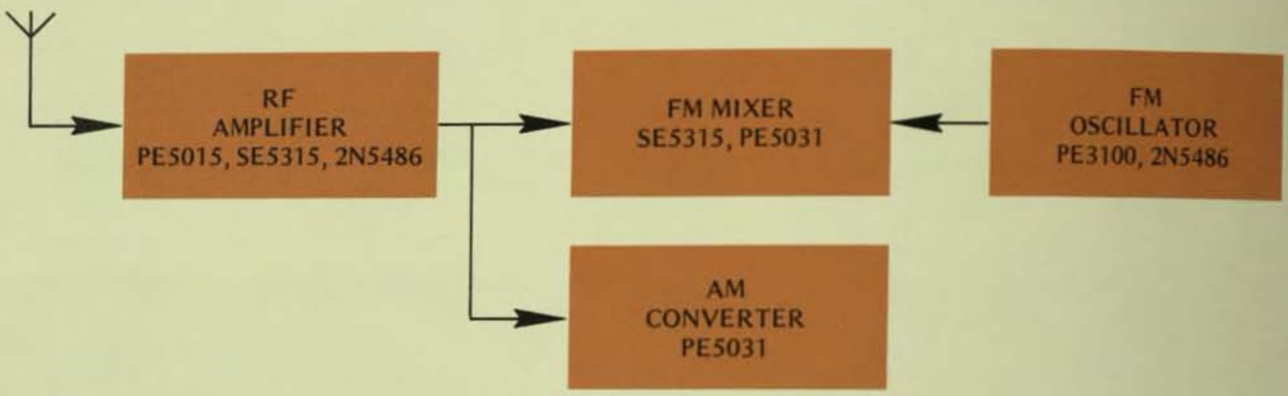
VHF Mixer:
NPN Plastic **PE5031**
MOSFET, Dual-gate **FT0601**
CASCODE, 1st stage **PE5031**
CASCODE, 2nd stage **PE5025**

VHF Oscillator:
NPN Plastic **PE3100**
JFET Plastic **2N5486**

*Developmental device

PG (min) dB @ MHz	NF (max) dB @ MHz	f_T (min) MHz	C_{cb} (max) pF	AGC (min) dB @ MHz
11 @ 900	6.0 @ 900	900	0.4	−20 @ 900
10 @ 400	4.0 @ 400		1.0	
18 @ 100	2.0 @ 100		1.0	
		800	0.5	
		900	1.7	
		800	0.8	
20 @ 200	3.3 @ 200	375	0.5	−30 @ 200
13 @ 200	3.5 @ 200	450	0.15	−40 @ 200
16 @ 200	4.0 @ 200		0.5 (C_{rs})	−50 (typ) @ 200
22 @ 200	4.5 @ 200	600	0.4	
16 @ 200	4.0 @ 200		0.04 (C_{rs})	
22 @ 200	4.5 @ 200	600	0.4	
		300	1.0 (C_{re})	
		500	0.8	
18 @ 100	2.0 @ 100		1.0	

AM/FM TUNER



TRANSISTORS

		PG (min) dB @ MHz	NF (max) dB @ MHz	f_T (min) MHz	C_{cb} (max) pF	AGC (min) dB @ MHz
2N5486	JFET	18 @ 100	2.0 @ 100		1.0 (C_{rss})	
PE3100	NPN Plastic	22 @ 200	4.5 @ 200	600	0.4	
PE5015	NPN Plastic	20 @ 100	4.0 @ 100	300	0.5	–30 @ 100
PE5031	NPN Plastic	22 @ 200	4.5 @ 200	600	0.4	
SE5315	MOSFET	20 @ 100	4.0 @ 100		.04 (C_{rs})	–50 (typ) @ 100

AFC/TUNING VARACTOR DIODES (FM only)

	MINIMUM CAPACITY	C_3/C_{20} (min)
DIO 108*	5 pF	4
RF400	7 pF	2

*Developmental device

VIDEO IF AMPLIFIERS

	DIODES	TRANSISTORS	
FIRST IF AMPLIFIER		SE5055 PE5013	NPN Metal can NPN Plastic
SECOND IF AMPLIFIER		PE5029 PE5013	NPN Plastic NPN Plastic
SOUND DETECTOR	DIO 104* Hot carrier diode BV = 50 V (min) V_F = 0.45 V @ 1 mA	PE5030B	NPN Plastic
THIRD IF AMPLIFIER		PE5030B PE5025	NPN Plastic NPN Plastic
VIDEO DETECTOR	DIO 104* Hot carrier diode BV = 50 V (min) V_F = 0.45 V @ 1 mA A		
AUTOMATIC FINE TUNING DETECTOR	FD700 Detector diode BV = 20 V (min) t_{rr} = 0.7 ns (max)	PE5030B	NPN Plastic

*Developmental device

PG (min) dB @ MHz	NF (max) dB @ MHz	f_T (min) MHz	C_{cb} (max) pF	AGC (min) dB @ MHz
27 @ 45	5.0 @ 45	300	.22	−50 @ 45
25 @ 45		300	.40	
28 @ 45	6.0 @ 45	500	.40	
25 @ 45		300	.40	
28 @ 45		600	.40	
28 @ 45		600	.40	
25 @ 45		300	1.0 (C_{re})	
28 @ 45		600	.40	

INTEGRATED CIRCUITS

μA3068 Monolithic integrated circuit performing video IF amplification, video detection, sound carrier detection, IF and tuner AGC functions. μA3068 also provides AFT circuit drive.

Typical performance:

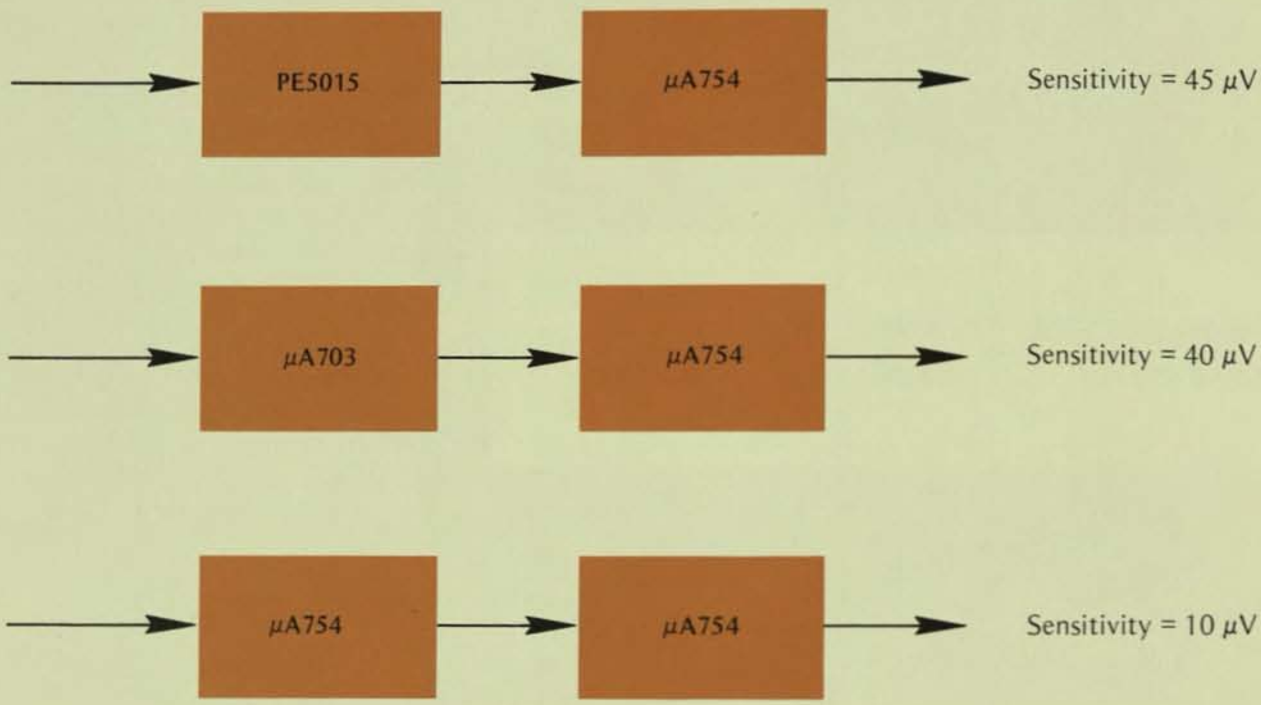
- IF gain = 85 dB
- Video output = 5.0 V
- Sound carrier output = 300 mV
- AFT voltage output = 20 mV

μA3064 Monolithic integrated circuit providing control voltage to the varactor diode in an automatic fine tuning system.

Typical performance:

- Sensitivity = 18 mV @ 45 MHz
- Control = 200 μV/Hz

FM IF AMPLIFIERS



PE5015: NPN Plastic IF amplifier
Power Gain = 20 dB (min) @ 100 MHz

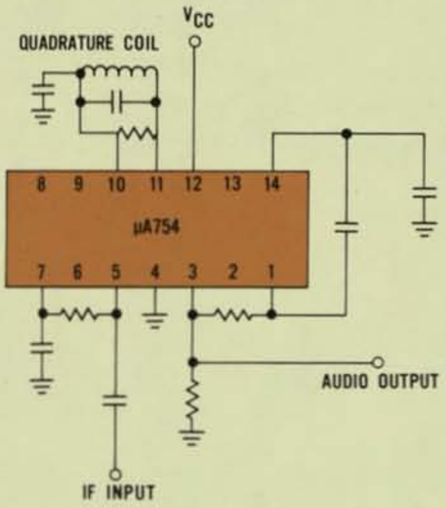
μA703: Differential IF amplifier (integrated circuit)
Power Gain = 27 dB (min) @ 10.7 MHz

μA754: Monolithic integrated circuit containing

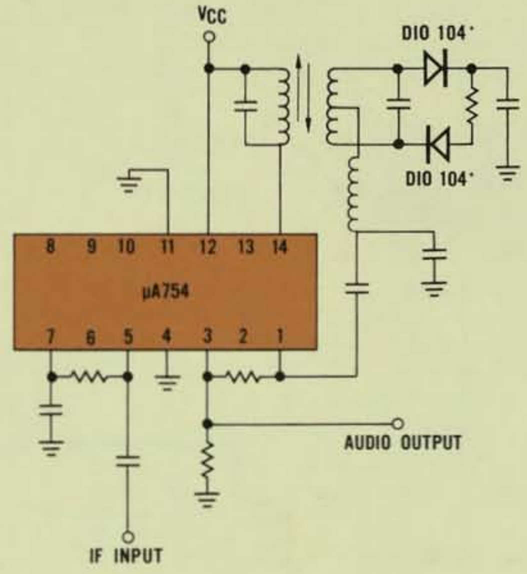
- a four stage limiting amplifier
- a balanced quadrature detector
- an audio pre-amplifier
- a voltage regulator

IF amplifier gain = 55 dB (min) @ 10.7 MHz
Recovered audio from detector = 200 mV (min) @ 75 kHz deviation
AM rejection = 45 dB (min) @ 30% AM, 100% FM
Audio amplifier gain = 22 dB (min) (open loop) @ 1 kHz
Regulated supply voltage = 11.8 volts to 13.5 volts

DETECTORS



QUADRATURE DETECTOR



RATIO DETECTOR

DIODES:

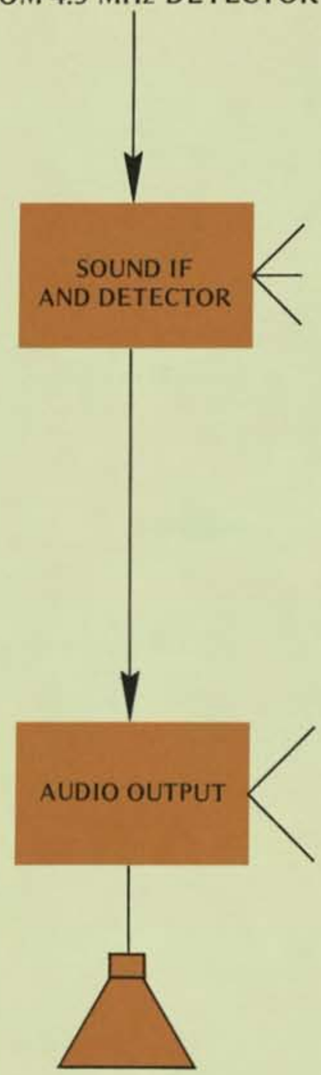
If an AGC function is required, the **DIO 104*** hot carrier diode, because of its superior rectification efficiency, is an excellent device for detection of the low level IF signal.

The same device also makes an ideal discriminator diode, offering increased efficiency and lower noise.

*Developmental device

TELEVISION SOUND SYSTEMS

FROM 4.5 MHz DETECTOR



TYPICAL DEVICE PERFORMANCE

Sound IF and Detector	SENSITIVITY µV	AMR dB	AUDIO OUTPUT Volts
µA754	80	40	3.5
µA3065†	200	40	2.5
µA784†	100	40	1.6

Audio Output	Type	Device
Class A	Line Operated (1 Watt max)	SE7066
Class A	Low Voltage (up to 5 W)	2N6121
Class B	Complementary Darlingtons	MPSA12 MPSA65
Class B	Integrated Circuit (5 W @ 24 V)	µA791

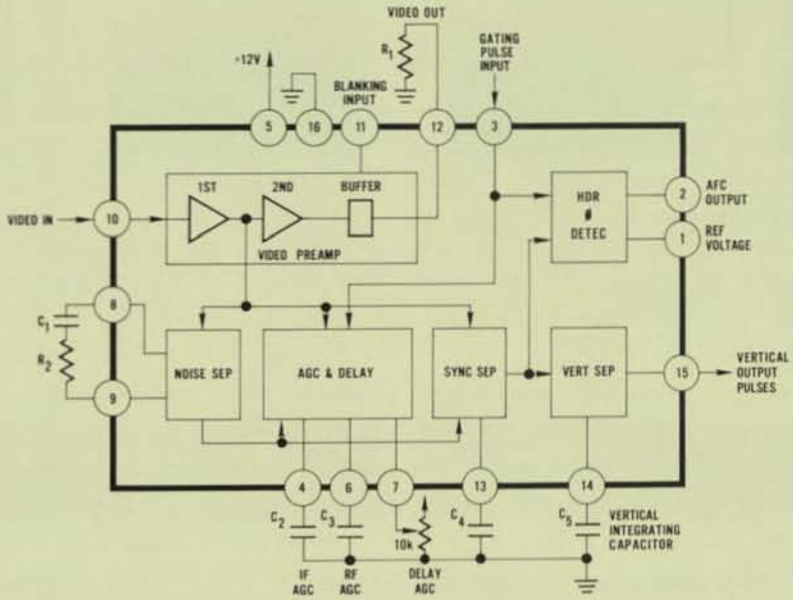
Ask about CMS105* and CMS113* Hybrid TV Sound Systems

*Developmental devices.
†Includes DC Volume Control

TELEVISION SIGNAL PROCESSING

The μA785 is a monolithic integrated circuit performing the following functions:

- Video Amplification
- Noise Cancellation
- AGC Generation
- RF AGC Delay
- Sync Separation
- Horizontal AFC Generation
- Vertical Sync Pulse Separation



Some Fairchild discrete plastic transistors suitable for Signal Processing functions are:

DEVICE	POLARITY	LV_{CEO}	h_{FE} (min) @ I_C mA	I_C (max)	C_{cb} (max)
2N4403	PNP	40 volts	100 min @ 150	600 mA	8.5 pF
2N5400	PNP	120 volts	40 min @ 10	600 mA	6.0 pF
2N5550	NPN	140 volts	60 min @ 10	600 mA	6.0 pF
MPS6531	NPN	40 volts	90 min @ 100	600 mA	5.0 pF

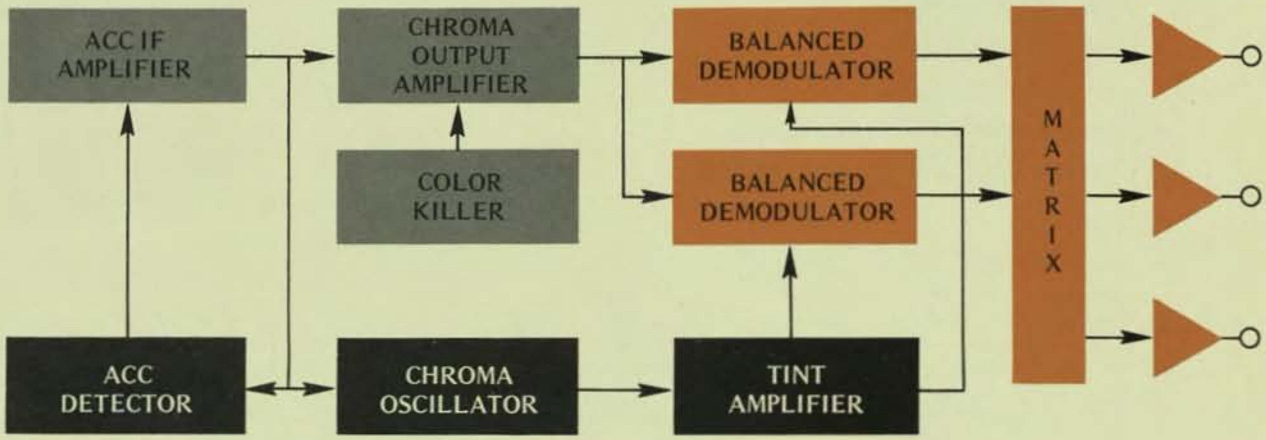
CHROMA SIGNAL PROCESSING SYSTEMS

μA781 Chroma IF Amplifier

- Balanced ACC amplifier
- DC chroma level control
- Killer switch
- Output current limiting
- 24 volt operation

μA746 Chroma Demodulator

- Doubly balanced demodulators
- Internal matrix
- Emitter follower outputs
- Stable DC performance
- 24 volt operation



μA780 Chroma Oscillator

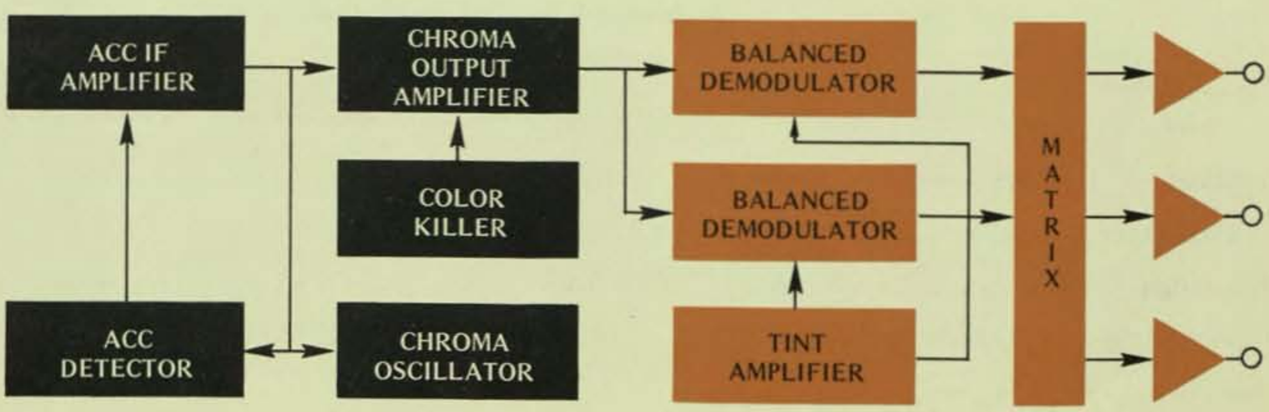
- APC loop
- Synchronous ACC detection
- DC tint control
- Internal regulator

μA3066 Chroma Processor

- Injection locked oscillator
- Peak ACC detection
- DC level control
- External regulator

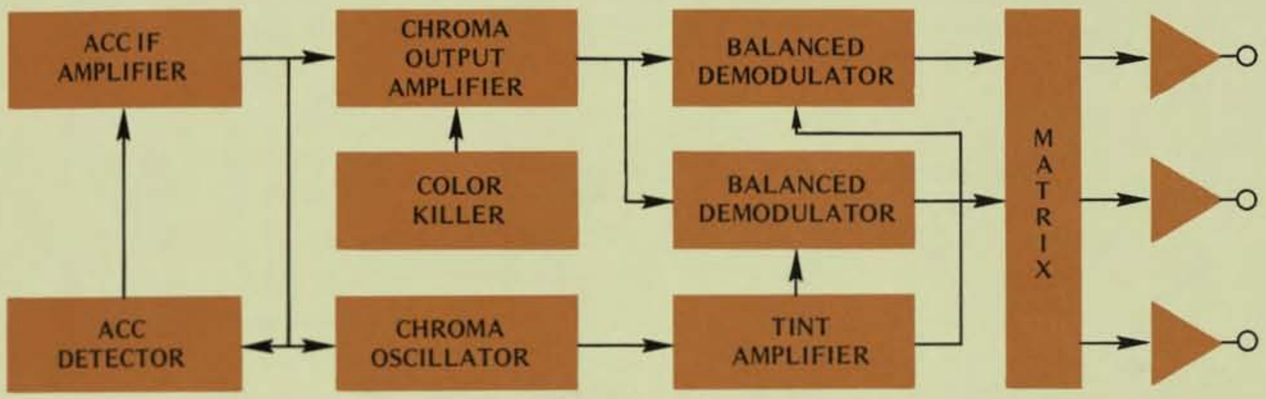
μA3067 Chroma Demodulator

- DC tint control
- Low impedance outputs
- Internal matrix
- Color difference output drives
- Fully balanced demodulators
- External regulator



μA782 Chroma Processor

- Doubly balanced demodulators
- Emitter follower outputs
- X and Z demodulation
- APC loop
- Synchronous ACC
- 18 volt operation



TYPICAL SYSTEM PERFORMANCE			
PARAMETER	μA780/781/746	μA3066/3067	μA782
ACC Figure of Merit	$\Delta V_{out} = -3$ dB for $\Delta V_{in} = -20$ dB	$\Delta V_{out} = -3$ dB for $\Delta V_{in} = -20$ dB	$\Delta V_{out} = -3$ dB for $\Delta V_{in} = -20$ dB
Static Phase Error	18 deg/kHz	30 deg/kHz	15 deg/kHz
Chroma Input Resistance	2.4 kΩ	50 kΩ	1.8 kΩ
Demodulator Output Resistance	300 Ω	5 Ω	50 Ω
Max B-Y Output	10 volts	3.6 volts	7 volts
Chroma Input for Max Demodulator Output	200 mV	200 mV	20 mV
Number of External Components	77	62	42
Number of Alignment Adjustments	4	7	5

DEFLECTION SYSTEMS

Plastic NPN : **2N4400**
LV_{CEO} = 40 volts
I_C max = 600 mA
h_{FE} = 100 min @ 150 mA

Metal Can NPN : **SE7055**
LV_{CEO} = 220 volts
P_D = 1 Watt max @ 25°C ambient temp.
f_T = 50 MHz min
C_{cb} = 3.5 pF max
h_{FE} = 40 min @ 30 mA

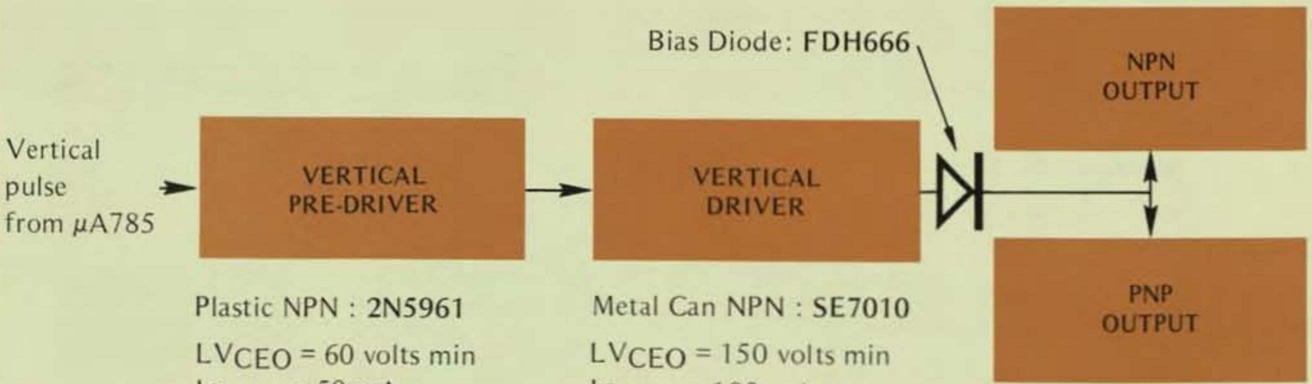
SE7075
V_{CBO} = 1400 V,
I_{CBO} = 1 mA max
h_{FE} = 2.5 min, I_C = 4.5 A
V_{CE} (sat) = 5 V max,
I_C = 4.5 A, I_b = 2.0 A
Fall Time = 0.7 μs typ

Metal Can

TO–66	TO–3
80 V, 5 A	100 V, 10 A
2N3054	**SCE321**

Plastic TO–66

80 V, 3 A	100 V, 5 A
2N6123	**PWR102***



Plastic NPN : **2N5961**
LV_{CEO} = 60 volts min
I_C max = 50 mA
h_{FE} = 600 min @ 10 mA

Metal Can NPN : **SE7010**
LV_{CEO} = 150 volts min
I_C max = 100 mA
h_{FE} = 40 min @ 25 mA
C_{cb} = 3.5 pF

Metal Can

TO–66	TO–3
80 V, 5 A	100 V, 10 A
2N3740	**SCE421**

Plastic TO–66

80 V, 3 A	100 V, 5 A
2N6126	**PWR103***

*Developmental device

VIDEO AMPLIFIERS

The SE7066 is a high voltage video output amplifier with the following electrical characteristics:

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
C_{cb}	**Collector to Base Capacitance**		**2.5**	**3.0**	**pF**	$I_C = 0$	$V_{CB} = 20$ V
h_{fe}	High Frequency Current Gain	2.0	2.5			$I_C = 3.0$ mA	$V_{CE} = 270$ V
	(f = 20 MHz, $R_L = 9.0$ kΩ)	2.0	4.0			$I_C = 30$ mA	$V_{CE} = 30$ V
h_{fe}	**High Frequency Current Gain**						
	(f = 20 MHz)	**2.5**	**4.0**			$I_C = 15$ mA	$V_{CE} = 150$ V
h_{FE}	DC Pulse Current Gain	40	100			$I_C = 30$ mA	$V_{CE} = 20$ V
h_{FE}	DC Pulse Current Gain	40	100			$I_C = 10$ mA	$V_{CE} = 20$ V
h_{FE}	DC Current Gain	20	50			$I_C = 1.0$ mA	$V_{CE} = 20$ V
$V_{CEO(sus)}$	**Collector to Emitter Sustaining Voltage**	**300**			**Volts**	$I_C = 5.0$ mA	$I_B = 0$
BV_{CBO}	Collector to Base Breakdown Voltage	300			Volts	$I_C = 100$ µA	$I_E = 0$
BV_{EBO}	Emitter to Base Breakdown Voltage	7.0			Volts	$I_E = 100$ µA	$I_C = 0$
I_{CBO}	Collector Cutoff Current		1.0	100	nA	$I_E = 0$	$V_{CB} = 200$ V
$I_{CBO(125°C)}$	Collector Cutoff Current		0.2	5.0	µA	$I_E = 0$	$V_{CB} = 200$ V
I_{EBO}	Emitter Cutoff Current		1.0	100	nA	$I_C = 0$	$V_{EB} = 6.0$ V
C_{eb}	Emitter to Base Capacitance		45	70	pF	$I_C = 0$	$V_{EB} = 0.5$ V
$V_{BE(sat)}$	Pulsed Base Saturation Voltage		0.74	0.85	Volts	$I_C = 20$ mA	$I_B = 2.0$ mA
$V_{CE(sat)}$	Pulsed Collector Saturation Voltage		0.35	1.0	Volts	$I_C = 20$ mA	$I_B = 2.0$ mA

The device is assembled in a TO-5 metal can package with a heat radiating flag available.
This gives a dissipation rating of 1.5 Watts at 70°C ambient temperature.
The SE7056 is the same device in a standard TO-5 package with a dissipation rating of 1 Watt at 25°C ambient temperature.

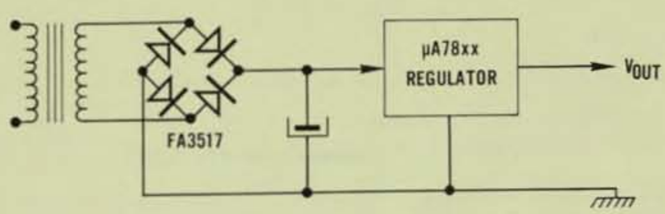
POWER SUPPLIES

FA3517 Bridge Rectifier

$I_{out} = 1$ Amp DC @ T_A 75°C
$V_{in} = 420$ V, RMS input voltage
PIV = 600 V

1N4001-5 1 AMP Rectifier

$V_F = 1$ V @ 1 AMP
PIV = 50-600 V min



µA78XX*: Monolithic three terminal voltage regulator which will supply the following output voltages at load currents up to 1.25 Amps:

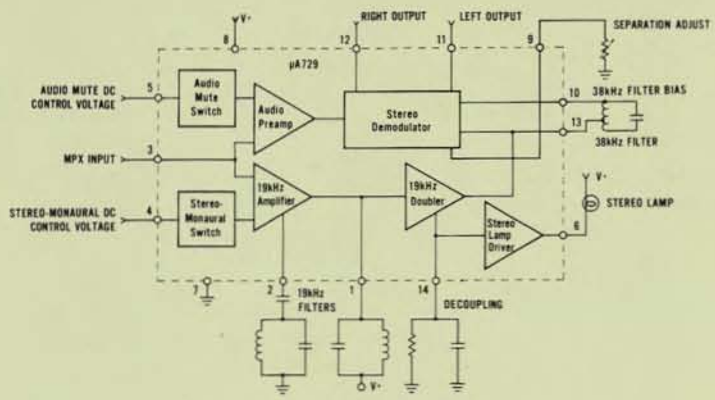
5, 6, 7.5, 8, 9, 12, 15, 18, 24 and 30

The device incorporates short circuit protection and thermal shut-down.
It is available in Metal TO-5 and TO-3 and in Plastic TO-66.

*To specify an output voltage, substitute voltage value for "xx".

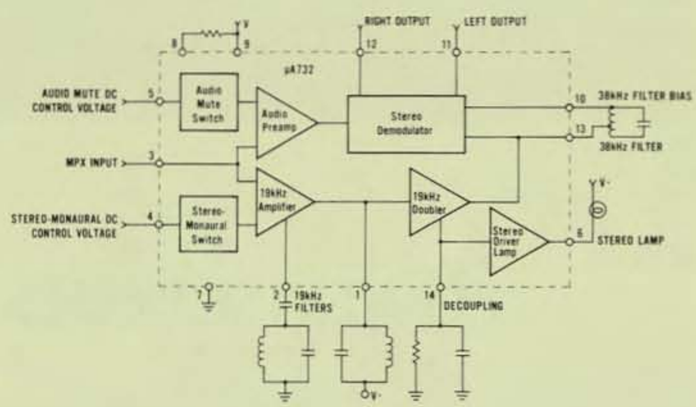
STEREO MULTIPLEX DECODERS

The μA729, 732 and 767 are monolithic integrated circuit multiplex decoders featuring 100 mA stereo lamp current and a variety of functions as depicted below.



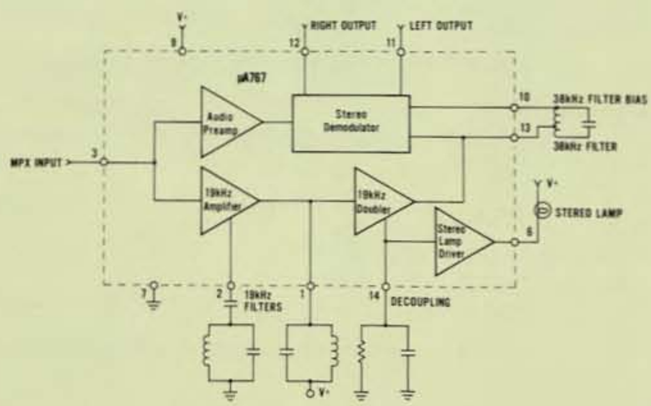
μA729

Audio Mute Switch
Stereo Switch
Audio Preamplifier
19 kHz Amplifier
19 kHz Doubler
Stereo Lamp Driver
Stereo Demodulator
Separation Control



μA732

Same as μA729 but has no separation control.



μA767

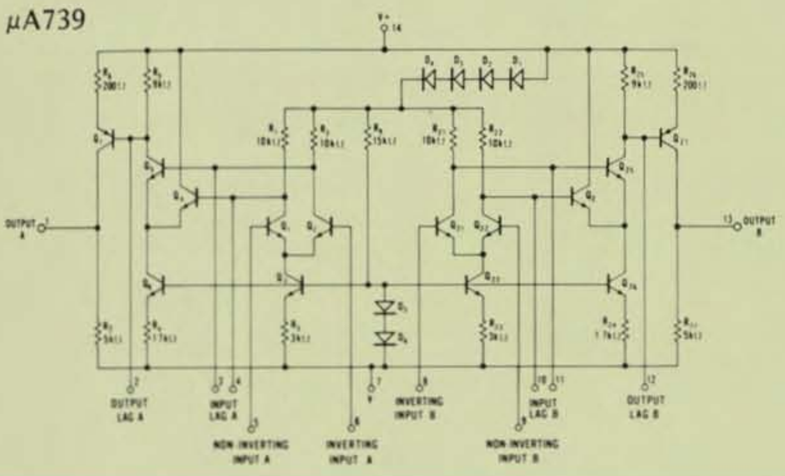
Same as μA732 but has no audio mute switch or stereo switch.

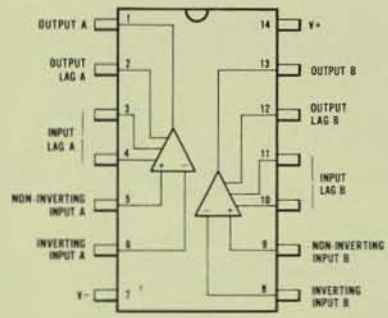
AUDIO PREAMPLIFIERS

INTEGRATED CIRCUITS

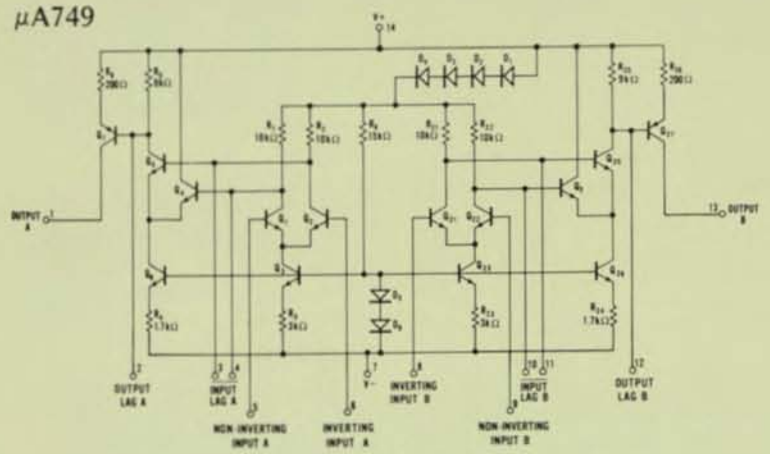
The μA739 and μA749 are dual, low-noise audio preamplifiers designed specifically for stereo applications. The μA749 has uncommitted collector outputs; the μA739 has internal 5 kΩ output collector loads.

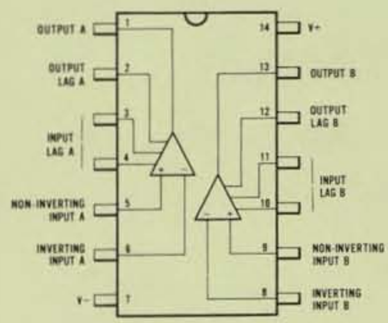
μA739





μA749





DISCRETE DEVICES:

	TRANSISTORS		DARLINGTONS	
	NPN	PNP	NPN	PNP
DEVICE	2N5963	2N5087	MPSA12	MPSA65
Noise figure, (max) dB	3.0	2.0	2	2
$h_{FE(min)}$ @ I_C, mA	900 @ 10	250 @ 10	20 k @ 10	50 k @ 10
$LV_{CEO(min)}$ Volts	30	50	20	30

AUDIO POWER AMPLIFIERS

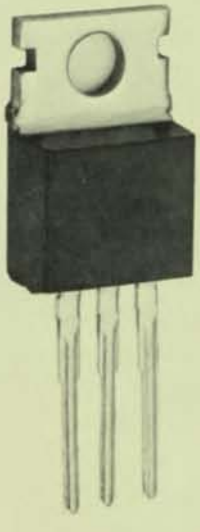
The μA791 is a monolithic integrated circuit suitable for use as an audio amplifier at power levels up to 10 watts.

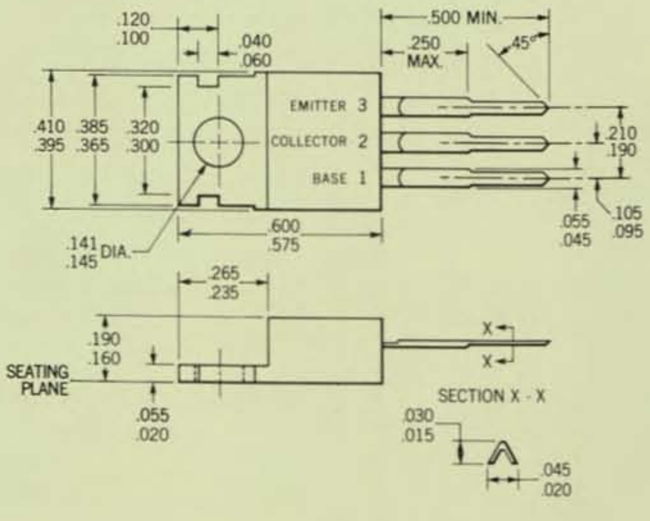
The discrete transistors listed below are recommended for power amplifiers up to 50 watts RMS output.

RMS Power Output Into 8 ohms	OUTPUT TRANSISTORS		DRIVER TRANSISTORS			
	Complementary or Quasi-Complementary Output		Class A Driver	Complementary Drivers		Active Current Source
WATTS	NPN	PNP	NPN	NPN	PNP	PNP
10	2N6121	2N6124	2N6121	*2N4400	*2N4402	2N6124
12	2N6121	2N6124	2N6121	*2N4400	*2N4402	2N6124
15	2N6121	2N6124	2N6121	*MPSA05	*MPSA55	2N6124
20	2N6122	2N6125	2N6122	*MPSA05	*MPSA55	2N6125
30	**SCC321	**SCC421	2N6122	*MPSA05	*MPSA55	2N6125
50	**SCD321	**SCD421	2N6123	2N6123	2N6126	2N6126

*TO-92 plastic
**TO-3 metal can

The devices listed are available in TO-66 plastic packages with the exceptions as noted.





HOME VTR SYSTEM

VIDEO TAPE RECORDER

SIGNAL PROCESSING

- **MODULATOR** — 1N270, 1N995, 2N5131, 2N5132, 2N5128, 2N3565, μA795, μA796, μA7812, μA7815
- ↓ **RF AMPLIFIER** — 2N3642, 2N3643, 2N3646, 2N3693, 2N3250, 2N3251 μA7812, μA7815
- ↓ **VIDEO HEAD** — FPM100 (Photo Transistor)
- ↓ **TAPE**
- ↓ **PRE AMP** — 2N4220, 2N3646, μA733, μA757
- ↓ **DEMODULATOR** — 1N914, 2N3565, μA795, μA796, μA7812, μA7815, μA109
- ↓ **COLOR PROCESSOR** — 1N914, 2N5086, 2N3962, 2N3565, 2N3646, 2N4402, 2N3569, μA795, μA796, μA757, μA733, μA785, μA780, μA781, μA746
  - — **DISPLAY**

TAPE TRANSPORT

- **CAPSTAN SERVO** — 2N3565, 2N4402, 2N3648, 2N720A, μA741, μA747, μA7812, μA7815, 9002, 9601, 9024
- ↓ **SCANNER SERVO** — 2N4402, 2N720A, μA741, μA747, μA7812, μA7815, μA785, 9024, 9601, 9602
- ↓ **TENSION SERVO** — 2N4402, μA7805, μA109, μA7812, μA7815, μA741, μA747

POWER SUPPLY

- **VOLTAGE REGULATOR** — 2N4402, 2N6121, 2N6124 μA7815, μA7812, μA723
- ↓ **MOTION CONTROL** — SCE321, 9601

SOUND

- **AUDIO AMP** — 2N3569, 2N5135 μA796, μA7812

μA747	Dual internally compensated operational amp
μA741	Internally compensated operational amp
μA733	Differential wideband video amp
μA757	Gain controlled AGC amp
μA795	Four quadrant multiplier
μA796	Balanced modulator/demodulator
μA785	Video signal processor
μA780	TV phase locked loop
μA781	Gain control IF amp
μA746	Color TV chroma demodulator
μA78XX	Three terminal voltage regulator
μA723	Precision voltage regulator
μA739	Dual low noise, high gain amp
9601	Monostable
9602	Dual monostable
9024	Dual flip-flop

RELIABILITY

The increased popularity of semiconductors in the consumer market place has accelerated the demand for improved product reliability. At the same time, price competition within the semiconductor industry has intensified. The consumer product manufacturer is concerned with quality and reliability for a very basic reason — cost. Line rejects are expensive to rework. Repair of field failures is even more costly and is an important consideration when warranties are involved.

Fairchild meets this challenge with designed-in reliability and strict process control. A major investment has been made in facilities and personnel: a separate life test and environmental laboratory, a complete failure analysis laboratory and a reliability engineering group specifically designed to monitor, investigate and institute corrective action required. Typical stress tests performed on Fairchild devices are:

- operating life at ambient temperature of 125°C
- storage life at 150°C ambient temperature
- temperature cycling from −65°C to 200°C
- thermal shock from 0°C to 100°C
- moisture resistance for 10 days
- salt atmosphere for 24 hrs
- lead fatigue
- solderability
- centrifuge at 30,000 G's
- mechanical shock at 1500 G's
- vibration at 20 G's

The key to any consumer reliability program is the corrective action phase. Fairchild has three reliability coordinators for immediate, direct factory contact by customers. Each has access to the failure analysis laboratory and outgoing quality control data. Fairchild will supply a complete failure analysis report together with suggested corrective measures to be implemented.

The preceeding brief description should give some indication of Fairchild's dedication to consumer reliability. Full details of Fairchild's reliability and QA program are available on request.

FAIRCHILDS "CARE" PROGRAM

A Reliability Clinic for Manufacturers of Consumer Electronic Systems

Fairchild Semiconductor has introduced an exciting new concept in customer service: the CARE Program. CARE stands for Component Application and Reliability Evaluation.

For the manufacturer of consumer electronic systems, this unique program provides valuable insights into the reliability of system circuitry and the proper selection of solid state devices. Fairchild is prepared to make a thorough evaluation of a customer's consumer equipment and give suggestions for improving system performance and reliability.

How does the CARE Program operate?

Systems manufacturers are invited to submit chassis models for evaluation in Fairchild's CARE facility. For the best results, the models selected should be engineering prototypes or units from a pilot production run. Once in the CARE facility, the chassis are subjected to all the normally anticipated variations of line voltage, temperature, signal inputs and other pertinent conditions. Every part of the circuitry is carefully monitored by experienced applications engineers. Life test data is provided whenever it is needed. Upon completion of the evaluation, an extensive CARE report is compiled and furnished to the customer.

What does a CARE report contain?

The report provides data on overall unit performance. This covers all the key parameters that add up to an acceptable consumer unit – AGC action, cross-modulation performance, picture quality (for a TV chassis), sound quality, etc. The report also considers each solid state device separately and examines factors such as power dissipation, incidence of transients, dynamic range, and voltage stress. Strip-chart records and oscillographs are included where necessary.

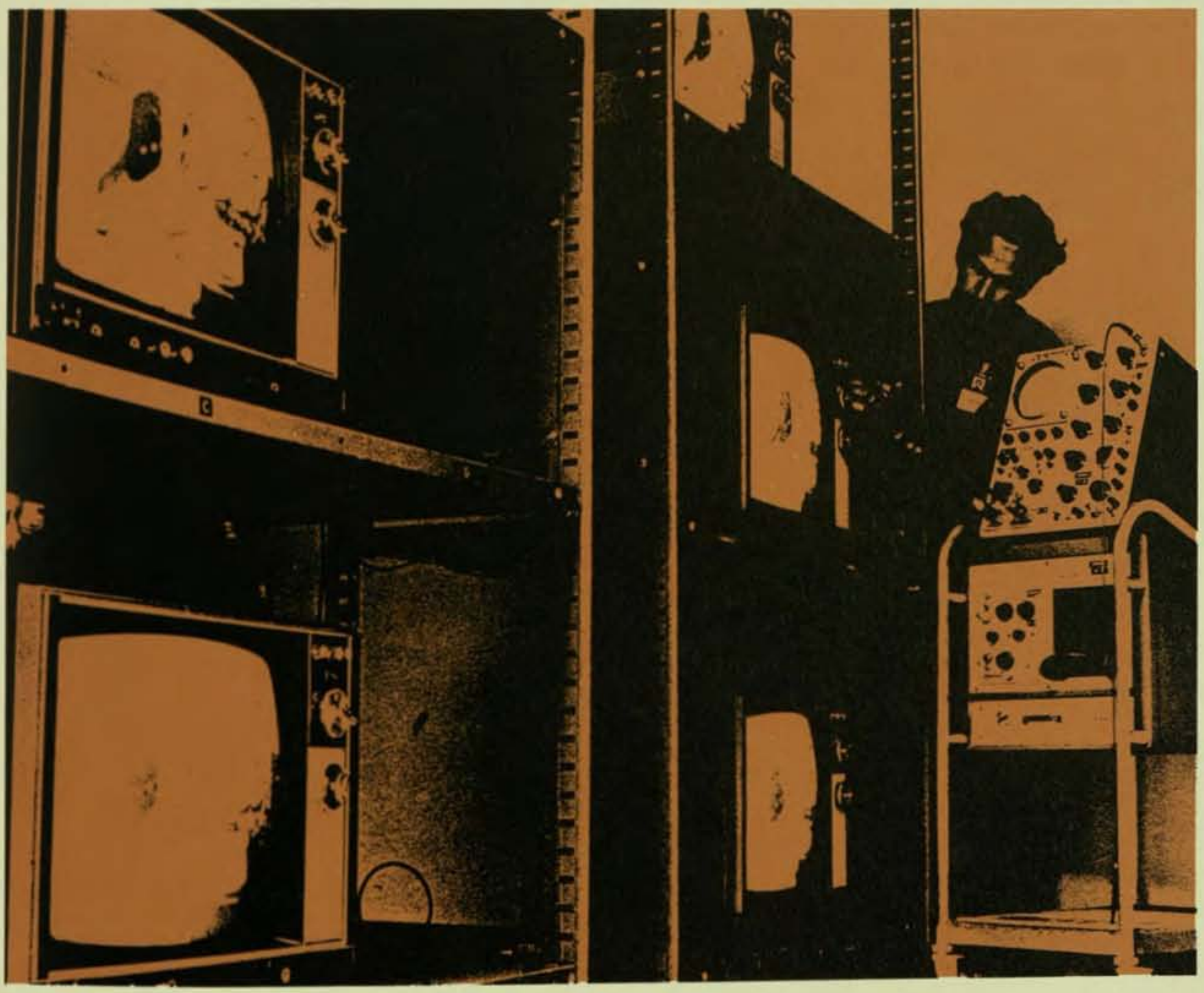
Most importantly, the report recommends circuit or device changes that could result in improved performance or enhanced reliability.

What does the CARE facility consist of?

The facility is located in a security area of Fairchild's Application Laboratories at Mountain View, California. It is arranged so that visitors see only their own units and not those of other customers.

Test equipment includes oscilloscopes, vectorscopes, XY recorders, strip-chart recorders and thermal probes. A complete spectrum of test signals is available, including UHF, VHF, FM, FM Stereo and AM. Also available are three independent 7KVA power supplies, each of which can be varied from zero to 140 AC and cycled over any duty cycle by means of automatic time switches. The environment is controllable over the normal consumer range.

Arrangements for the service can be made through any Fairchild field sales engineer or marketing representative.



APPLICATIONS LITERATURE

The following application papers contain detailed information on most of the applications described in the preceding pages, as well as many others not covered there. For free copies of any of these papers, fill out the attached reply card and send it to us. Your request will be filled immediately.

I TV (GENERAL)

- APP 174 — A Low-Cost Hybrid Color TV Receiver
- SB 4 — Television Receivers

II RF/IF SECTION (TV)

- AB 80 — A Color TV Video IF Amplifier with a Novel AGC Circuit
- AB 95 — A High-Quality Video IF Amplifier for Color TV
- AB 106 — Applications of the SE5030
- APP 166 — A Low Noise AGC Silicon Transistor Useful From LF to UHF
- APP 177 — The Hot Carrier Diode
- APP 189 — RF Applications of the FT0601 Dual-Gate MOSFET
- APP 200 — TV Receiver Tuning Systems of the Future

III TV SOUND SECTION

- AB 152 — Quadrature FM Detectors Using Ceramic Filters
- AB 153 — Applications of the μA754 TV/FM Sound System

IV VIDEO SECTION

- AB170 — Application on the μA785
- APP 194 — Semiconductor Video Amplifiers for Monochrome and Color Receivers

V CHROMA SECTION

- AB 105 — Uses and Abuses of the Chroma Demodulator
- AB 124 — The μA746 Color TV Chroma Demodulator IC
- APP 145 — Color Television Chroma Reference Systems Using the μA703
- APP 203 — A Comparison of Solid-State Sub-Carrier Oscillators for Color TV Receivers
- APP 210 — The μA780, μA781 and μA746 Integrated Circuit Color TV chroma processing system

VI CCTV

- AB 102 — Vidicon Head Amplifiers
- SB 3 — CCTV Systems Bulletin

VII DEFLECTION SECTION

- APP 143 — A Horizontal Oscillator for Transistorized TV Set

VIII AM/FM SECTION

- AB 150 — The μA729 and μA732 Integrated Circuit Stereo Multiplex Decoders
- APP 147 — Characterization and Application of the μA703 in a Four-Stage FM IF Amplifier
- APP 151 — High Performance FM IF Amplifiers using μA703
- APP 201 — A Digital Frequency Synthesizer for an AM and FM Receiver
- APP 204 — An Integrated Circuit AGC IF Amplifier

IX AUDIO SECTION

- AB 107 — Utilizing Bimesar TM Complementary Power Transistors in Class A Driven Power Amplifiers
- AB 108 — 15W and 30W Complementary Amplifiers Featuring Bimesar TM Power Transistors
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- APP 180 — A Low Noise Tape Preamplifier

ORDERING INFORMATION

For pricing and other details on specific products, contact the Sales Office nearest you. They will be glad to supply you with the information you need, and the name of the Fairchild distributor in your area.

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GERI HADLEY

FAIRCHILD
SEMICONDUCTOR

Printed in U.S.A./20-10-0001-051/75C

rude rose 7 cents, to $18.37, on the Merc after gaining
el on Thursday. [28.]

Columns

l cooperatives offer substantial savings for mem-
fuel oil dealers say regular customers end up subsi-
o purchasers. Your Money. [20.]

rs at Merck were honored this week for the invention
e anti-cholesterol drug. Patents. [20.]

Air Planning to Trim uent Flier Program

.PUKAS

d yesterday that its frequent flier st attempt in re- r airline to hold cost of such pro-

which will be ly 1, United said uld have to fly free tickets but be much more ate. The carrier bonus programs ers are credited they travel to a n being promot-

Lines

to succeed, its ust go along, or itself at a com- ge. The initial nes was mixed. Delta Air Lines, esterday: "We ny change in our program. We don't see any need to make changes."

Mike Gunn, the senior vice president of marketing at American Airlines, said that American had been studying the implications of rising benefits of frequent flier programs and had been considering what steps to take.

Airline executives and industry analysts have expressed concern that the liberal awards would force airlines to give seats to frequent fliers that would have gone to paying customers.

Restrictions on Flights

Another dramatic shift at United involves restrictions on which flights passengers can choose when they turn in their mileage credits for tickets. The goal is to force such passengers to travel at times outside of peak travel periods when they fly to such popular destinations as Hawaii.

The aim is to prevent frequent fliers from taking up seats that could

Continued on Page 29

didates, something that he has re- kets. "But from a deal viewpoint,

Continued on Page 21

The New York Times/Terrence McCarthy

Founders of the Fairchild Semiconductor Corporation who gathered Thursday evening, from left: Victor Grinich, Jay Last, Jean Hoerni, Julius Blank, Eugene Kleiner and Sheldon Roberts. Seated, Robert N. Noyce, left, and Gordon Moore.

Fathers of Silicon Valley Reunited

By ANDREW POLLACK

Special to The New York Times

PALO ALTO, Calif., April 14 — When the eight men stepped onto the stage here, the crowd erupted into applause. The men, now aging and gray, had, in their day, been among the first of their kind — young technological whizzes who started a company, became fabulously wealthy and helped spark the electronics revolution.

The men were the founders, in 1957, of the Fairchild Semiconductor Corporation, a company that, more than any other, gave birth to what is now known as Silicon Valley. Last year, after a proposed sale to Japan's Fujitsu Ltd. caused a controversy, Fairchild was sold to the National Semiconductor Corporation.

With Fairchild now disappearing as a separate entity, the former employees gathered in a hotel ballroom here this evening for a final farewell, a celebration that was part reunion, part wake. More than 1,000 "Fairchildren" showed up.

"If you look back and see what has happened because of what you folks did, it is absolutely astounding," Robert N. Noyce, Fairchild's first leader, told the crowd.

"Like many people here, Fairchild changed my life," said Lyle Ronalds, a former salesman who came from Australia.

Fairchild was the first major company in the area

Continued on Page 21

pany. One of the four, waging a proxy battl members to Texaco's nual meeting on June seats belongs to Mr. K

The package of acti

Continued on

7 to Lea First Bo To Form

By BARNABY J.

Seven executives wh a leading role in the Fi poration's leveraged b including two manag are leaving to set u firm, First Boston said

Their departures ar dramatic talent drain the influential Wall S year. By itself, the exo blow to one of the firm businesses. The impac however, because it heels of the depart Wasserstein and Jose the former co-heads banking at First Bos formed their own firm tures of top executives tions as mergers and ternational operations curities, capital marke

"The departure hu area that's probabl more profitable than the firm," said Paul H follows First Boston's Warburg & Company political environment tled."

Expansion Still Planne

James Maher, the c Boston's investment tions, said in a written the bank still planned commitment to mer and would transfer e

Continued on

Fathers of Silicon Valley Reunited

Continued From First Business Page

south of San Francisco to make semiconductors, the silicon chips that are used in computers, robots, missiles and all other electronic gear. Its founders, led by Robert N. Noyce, invented a key process that is still used to make such chips. Because of that invention Dr. Noyce is considered the co-inventor of the integrated circuit.

Fairchild served as a training ground for many of the leaders of today's electronics industry, who then went off to start their own companies. The companies include such stars as Intel, Advanced Microdevices, National Semiconductor and LSI Logic.

'Exploded Like a Seed Pod'

Fairchild "exploded like a seed pod and scattered the germs of new firms throughout the valley," Michael S. Malone wrote in his 1985 history of Silicon Valley, "The Big Score." Indeed, if one were to draw a family tree of Silicon Valley today, there would be hundreds of companies that had Fairchild at their roots.

To many here, Fairchild meant a hearkening back to simpler times in the 1950's and early 1960's when engineers wore crew cuts, technology was primitive and American know-how reigned supreme. It was a time of great hope.

"People really didn't know what it was going to amount to, but everyone knew that I.C.'s were going to be really big," said Robert K. Waits, referring to integrated circuits. Now an engineer at the Digital Equipment Corporation, he worked at Fairchild from 1960 until 1973.

Symbol of Decline as Well

Today the semiconductor industry is international, with huge sums of money and politically negotiated trade agreements meaning as much as technological innovation. And if Fairchild symbolizes the birth of the American semiconductor industry, it also symbolizes its decline. By the time it was sold last year, Fairchild had become a technological also-ran, its strength having been depleted by poor management and by numerous defections of its top engineers to new companies.

By 1968, virtually all the top management had left, and new management was brought in from rival Motorola Inc. The new management, headed by Lester Hogan, became known as "Hogan's Heroes." The most ambitious of these heroes, Wilfred C. Corrigan, ousted Mr. Hogan in 1974 and ran Fairchild until 1979, when he sold it for $425 million to Schlumberger Ltd., a French oilfield services concern.

Fairchild continued to decline under Schlumberger, losing hundreds of millions of dollars and earning the nickname "Schlumchild." In 1976, Schlumberger tried to bail out by selling most of its stake to Japan's Fujitsu Ltd. The agreement collapsed after protests from American industry and Government officials, who feared transferring key technology to Japanese competitors, and National then bought it last October for $122 million.

To keep the name alive, National today named a new corporate laboratory the Fairchild Research Center.

"Fairchild's spirit lives on within National," Charles E. Sporck, National's president and a Fairchild alumnus, said in dedicating the building.

Loss Projected On Farm Debt

WASHINGTON, April 15 (Reuters) — The United States farm lending agency expects to lose $8.8 billion in the next several years because of bad debt accumulated during the farm crisis, Farmers Home Administration officials said. The projected losses are more than double the estimate made last month by the agency's administrator, Vance Clark.

The new estimate, released Thursday, reflects a growing tally of long-term delinquent farm loans and the effects of farm credit legislation passed last year, said an Administration spokesman, Ron Ence. The legislation ordered the agency to be more lenient toward delinquent borrowers and to restructure more debt, a move that will add $2.1 billion to the losses, he said.

The agency has a farm loan portfolio of $26 billion and 242,000 farm borrowers.

COMPANY BRI

• **Atlantis Group Inc.**, Mia sified company with ope sidiaries engaged in plasti niture manufacturing, an had received a written c from Southeast Bank N.A. $65 million of the $81.6 funds needed to complete offer for all of the outstan of Linear Films Inc.

• **Borden Inc.**, New York, acquired Storeys Decora ucts Ltd., a British wa company, and Wrapping Ltd., an Australian printe film products. Terms we closed.

• **Days Inns Corp.**, Atlanta ary of CBD Enterprises runs motels and restau stockholders would meet o vote on the company's me ment with Reliance Cap L.P.

• **Echo Bay Mines Ltd.**, gold mining operation, Muscocho Explorations L gan McAdam Resources McNellen Resources Inc., A-9

Sports

r. McColl: from 49ers o operating room

D-1

Business

rought's effect on oastside crops

E-1

Tomorrow

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Inside

U.S. OSHA pilot program

Silicon Valley chip checkers

By Jeff Brazil
Times Tribune staff

The U.S. Occupational Safety and Health Administration has launched a special pilot inspection program to determine if California's semiconductor manufacturers protect workers from hazardous materials.

"This is long overdue," said Michael Eisenscher, director of the Association for Workplace Justice in Burlingame, after he heard Thursday's announcement from OSHA. "We've been demanding an unannounced inspection program for a long time."

The announcement came nearly a month after hundreds of workers and residents in San Carlos were evacuated from homes and businesses while authorities transported 55 cylinders of gas used in making semiconductors to a disposal site and exploded them. The cylinders, filled with silane gas widely used in the semiconductor industry to coat silicon wafers in processing microchips, were linked to an explosion in New Jersey that killed three people.

Frank Strasheim, OSHA regional administrator in San Francisco, said the inspection program had been in the works for a while but was hastened by the Peninsula's silane gas disposal.

"The semiconductor industry is generally considered to be very safe and has one of the lowest

Please see CHECK, A-12

ing in excess of $1 million in fines against Putnam.

Putnam has contributed to Duplissea's campaign treasury and one of the attorneys representing Putnam, John Guheen, is Duplissea's campaign finance chairman and a major campaign contributor.

Duplissea said on Tuesday that the idea for the bill came from Putnam and Guheen.

He introduced the bill in February "because they pointed out the problem to me," Duplissea said.

Asked if he thought the bill might appear to be unduly favorable to a campaign contributor, Duplissea said, "That's in the eye of the beholder, I suppose. It couldn't be further from the truth."

Fairchild bid fond farewell by its family

By Rob Hof
Times Tribune staff

The creator of a $10 billion industry passed away Thursday night — but not without one last, loud wingding.

The founders and about 1,100 former employees of now-defunct Fairchild Semiconductor Corp. — a Who's Who of the U.S. chip industry — gathered in Palo Alto to bid a mostly fond farewell to the company that started the Silicon Valley.

"This is the party to end all parties," said Fred Hoar, the event's emcee and an 11-year Fairchild public relations man. "This is a gathering of eagles."

The bash, the hottest ticket in town, commemorated the passing of Fairchild, which started making the world's first computer chips in Mountain View in 1957 and ended

Please see FOND, A-12

Times Tribune photo by Vern Fisher

In a historic moment, all eight founders of Fairchild Semiconductor Corp. gather on stage Thursday at a farewell party for the one-time computer-chip-industry leader. Kneeling are Robert Noyce (left) and Gordon Moore. Standing are (from left) Victor Grinich, Jay Last, Jean Hoerni, Julius Blank, Eugene Kleiner and C. Sheldon Roberts.