tek talk

The Tektronix Employees Magazine Summer 1967

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COVER—Like many other steps in the production of a high-performance oscilloscope, tool grinding requires great precision and patience. Ben Brazauski (left), Tool Grinding manager in the Metals and Plastics plant, and Geoffrey Burkhart inspect a setup. Grinders remove metal in tenths of thousandths of inches.

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Tek Talk will be sent regularly to persons outside Tektronix who request it.

PART TIME ALL THE TIME

Tektronix instruments, intricate and sophisticated, each require thousands of components, parts and pieces. We obtain most of them from over 2100 "active" (or regular) suppliers.

And the biggest single supplier to Tektronix is Tektronix itself.

Our Metals & Plastics plant produces, in a year, parts whose value would exceed $10 million if marketed elsewhere.

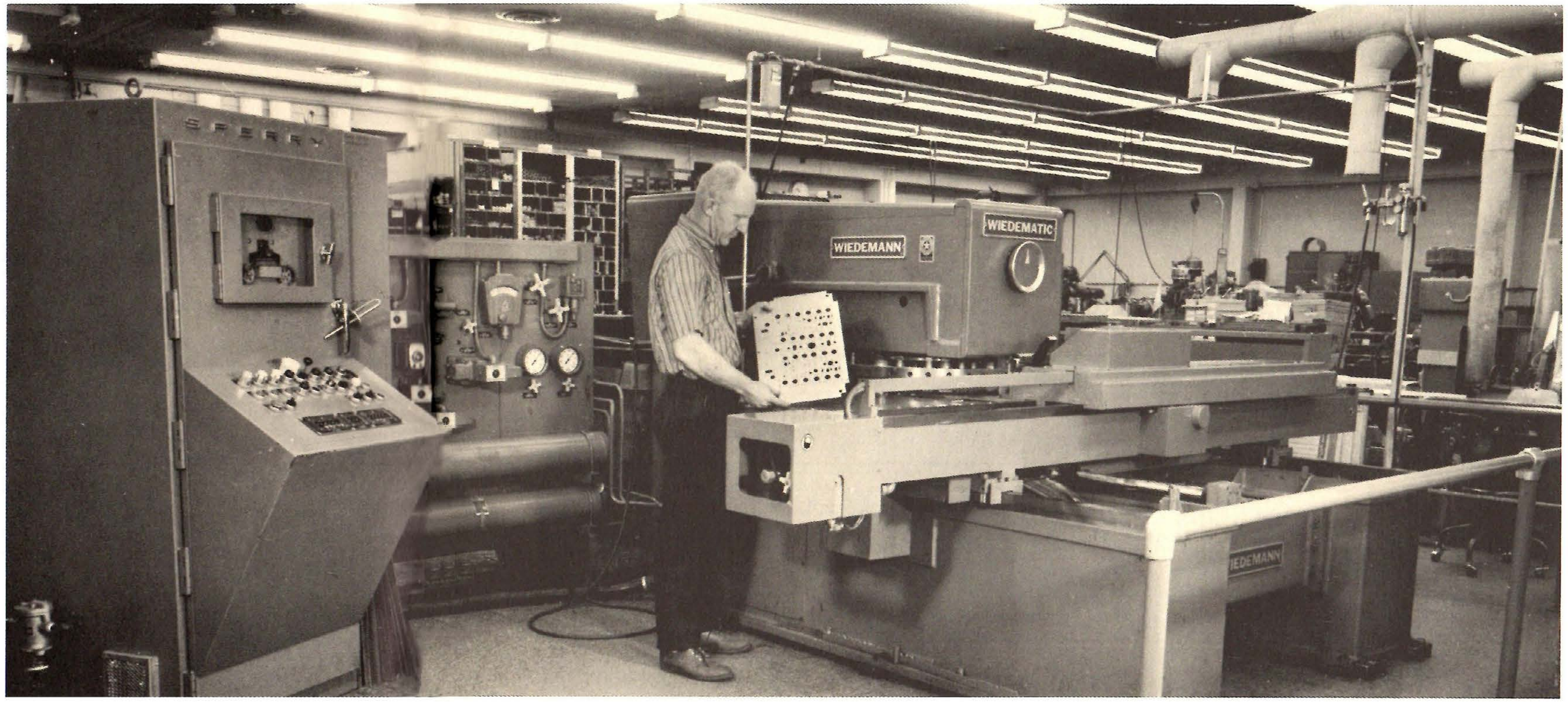
The plant, a decade or so ago, probably would have been called just "The Shop," but that name no longer evokes the image it did—an image of tedious, largely manual processes.

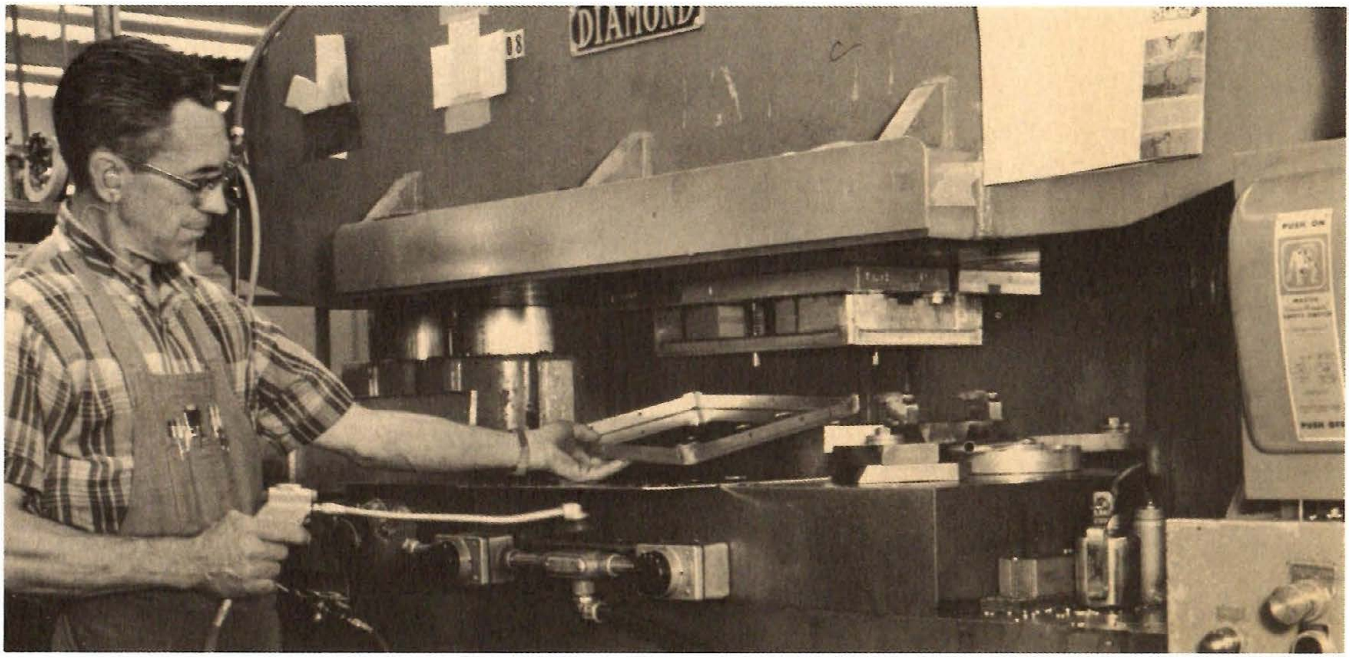
For the Metals & Plastics plant at Tek is a place not only of great productive volume but also of great productive sophistication—a finesse in processes matching that of our instruments themselves. Here you'll find the latest in semi-automated techniques abetting and enhancing a wide diversity of highly refined individual human skills.

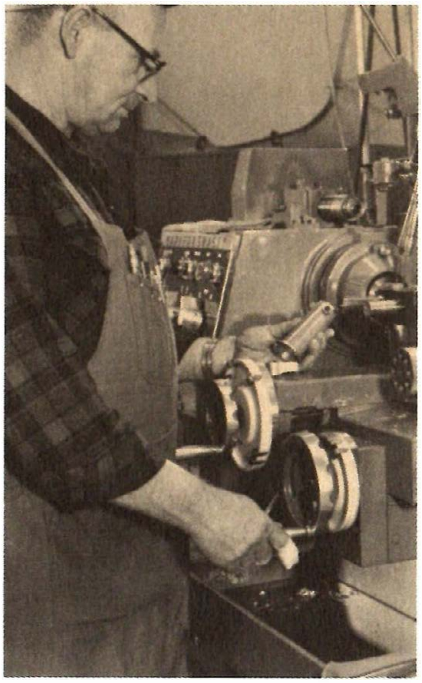
Among the many advanced tools, one of the most important is hardly in evidence. That is the electronic computer, which—in addition to printed parts information and detailed drawings—produces tapes that drive complicated numerical-control machinery. This equipment turns out parts in far less time, at lower cost, with less tooling and to closer tolerances than did the manual processes it has superseded. In addition, the advent of semi-automatic processes has greatly upgraded the job of the operator; a good right arm is no longer his main requisite.

Continuing progress in the electronics state of the art, typified by Tektronix oscilloscopes, can not occur in isolation; it must be accompanied, and often preceded, by an advancing state of the art in The Shop.

The following summary, describing the changing look of Metals & Plastics, was provided by Scott Reekie, Plant Manager, and Ray Stevens, Plant Engineering Support.







Every work day of the year, trucks carry many thousands of plastic and metal parts for Tektronix instruments from the Metal & Plastic components plant. In a year's time, 35 million individual plastic components and more than 45 million metal components find their way into Tektronix warehouses for eventual assembly into instruments and accessories, both at home and overseas.

To get this volume of work out takes the combined efforts of 550 people, using many of the latest innovations in manufacturing methods and equipment.

The 550 people include sheet-metal workers; plastics processors; plastics molders; punch-press, numerical-control and screw-machine operators; tool and die makers; tool and cutter grinders; quality control experts; process, production and industrial engineers; managers, and people with many other skills.

Somehow, through all these people, a constant flow of work is established to get the job done.

Every man and woman is blessed with a fertile brain. So every individual, in every area of activity, is urged to look for better ways of planning the best way to work. The result: A constant flow of improvements.

For instance, the need for faster reaction in producing prototype and pilot parts for new instruments brought the introduction of numerical-control equipment. In hours, through use of the computer, programmers now can program new parts for the Wiedematic turret punch presses and the Burgmaster turret drill press, to fabricate parts in substantially less time than had been required. The equipment continues to pay healthy returns by speedy production of parts for which annual requirements are so small a specialized tool would be too expensive to build.

Manufacture of the millions of parts for instruments and accessories in regular production is no small task. It consumes most of the effort of the people in the plant. The balance of effort goes into new-product introduction and into mechanical support to other areas of the company.

By the time processes reach regular-production status, the dies, jigs, fixtures, manufacturing sequences, quality control and operations have been established so that turning out the parts becomes a matter of routine.

But development of processes, tools and manufacturing methods for **new** Tektronix instruments is **not** a routine matter. Getting parts from prototype into pilot production requires a speedy assessment of manufacturing capabilities within the plant, as well as often-ingenious efforts of process engineers, tool designers, tool and die makers, production managers and production workers. Working with these people are production planners and schedulers, to see that tools are completed so parts can be punched, sanded, formed, etched, cleaned, molded, assembled and shaped in time.

In 1966, the plant responded to 27 new-instrument introductions. Of them, eight were major instruments; seven were plug-ins; the balance were accessories.

The extent of the problem may be illustrated by the work surrounding the 453 scope. A total of 109 new part designs were introduced with the instrument; this required 286 separate pieces of tooling which had to be ordered, designed, built or purchased; all within the prescribed time schedules.

Each part gets its fair share of attention. It becomes the problem of process engineers and technicians to lay out a sequence to manufacture the part. At the same time, tool designers and tool

VETERAN TEK employee Nile Thayer (bottom left) operates a precision turret lathe, called a micro-cut, in the Screw Machine department. Metal punching, blanking and forming are done (top left) by Vern Hughes on a 200-ton punch press, turning out a front subpanel for a Tek oscilloscope. At right, a molded acrylic light pipe for a CRT faceplate is inspected by Milt Devine, Plastics Molding.

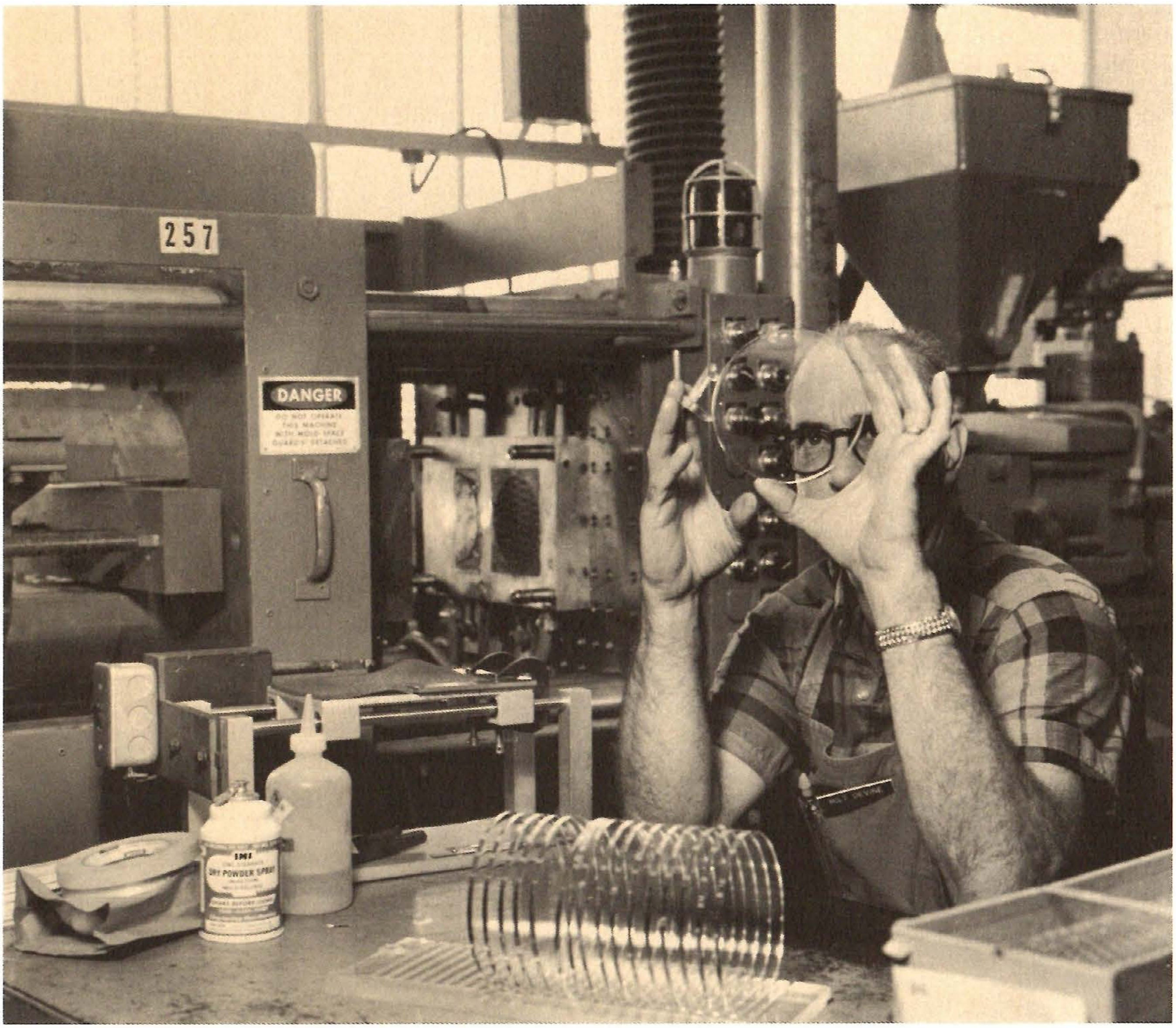
and die makers are studying the drawings of the new part so they can feed in load-building requirements to planners and schedulers. Planners and schedulers, meantime, assist these groups with information that often helps determine the kind of tooling to be built for the initial runs of parts.

For high-production items, such as the 453, the decision may be made to build long-life tooling. The decision in that case proved a good one.

And, while planning and tool building and designing continues, quality control personnel work closely with designers, tool and die makers and production people to assure that proper quality control procedures, and the necessary gauges and other measuring instruments are ready for production when the tool arrives. The maxim that "quality is built in" is not taken lightly.

All these people must know materials intimately. Plastic tooling demands a knowledge of the plastic materials to be molded, as well as the tool steels re-required to build cavity tools. They and plastic production molders and engineers are required to know the peculiar properties of delrins, urea, polyethlene, polypropylene, polystyrene, nylons, acetates, acrylics and many other materials. The same procedure won't work for them all.

A like demand for materials knowledge is required of people working with metals. Aluminum is the primary material, but it has many different alloys. In addition, metal workers make millions of parts from other materials—brass, copper-beryllium, phosphor, bronze, zinc, steel and stainless steel. All react differently when shaped, punched, drilled, milled or blanked into parts.



All these materials are required to make approximately 10,000 different parts, each of which is manufactured several times a year.

Then comes the actual fabrication of parts. The first run through pilot production (usually about 150 parts) gives enough information about the new tools so that any change that will improve production can be "fed back" before the regular production phase.

Even after parts go into regular production, the effort to upgrade the work methods continues. People in the plant, like Genevieve Brink of Plastics Processing, may grab a manager or engineer and tell him that a certain job is going too slowly: "There ought to be something done about it." Or it could be Erwin Voss, who operates a metal saw, wondering out loud about the best use of material. Talk to a production worker in the Metals & Plastics plant, and you'll find him thinking about his job as well as doing it.

For others, improving the flow of work through regular production is their job. Plastics Production Engineering and Metals Production Engineering work closely with production managers to evaluate established processes, equipment and tooling. They also work with Plastics Cavity Tooling and Sheet Metal Tooling for equipment evaluations. Such studies result in the purchase of such equipment as the electrical discharge machine for Cavity Tooling. This machine gives tool makers the ability to carve intricate, close-tolerance design into hardened or unhardened steel, thus increasing design parameters and lowering tooling costs.

Production people long have been concerned about their ability to respond under tight deadlines. Once again, Production and Production Engineering worked together to evaluate the feasibility of numerically controlled equipment.

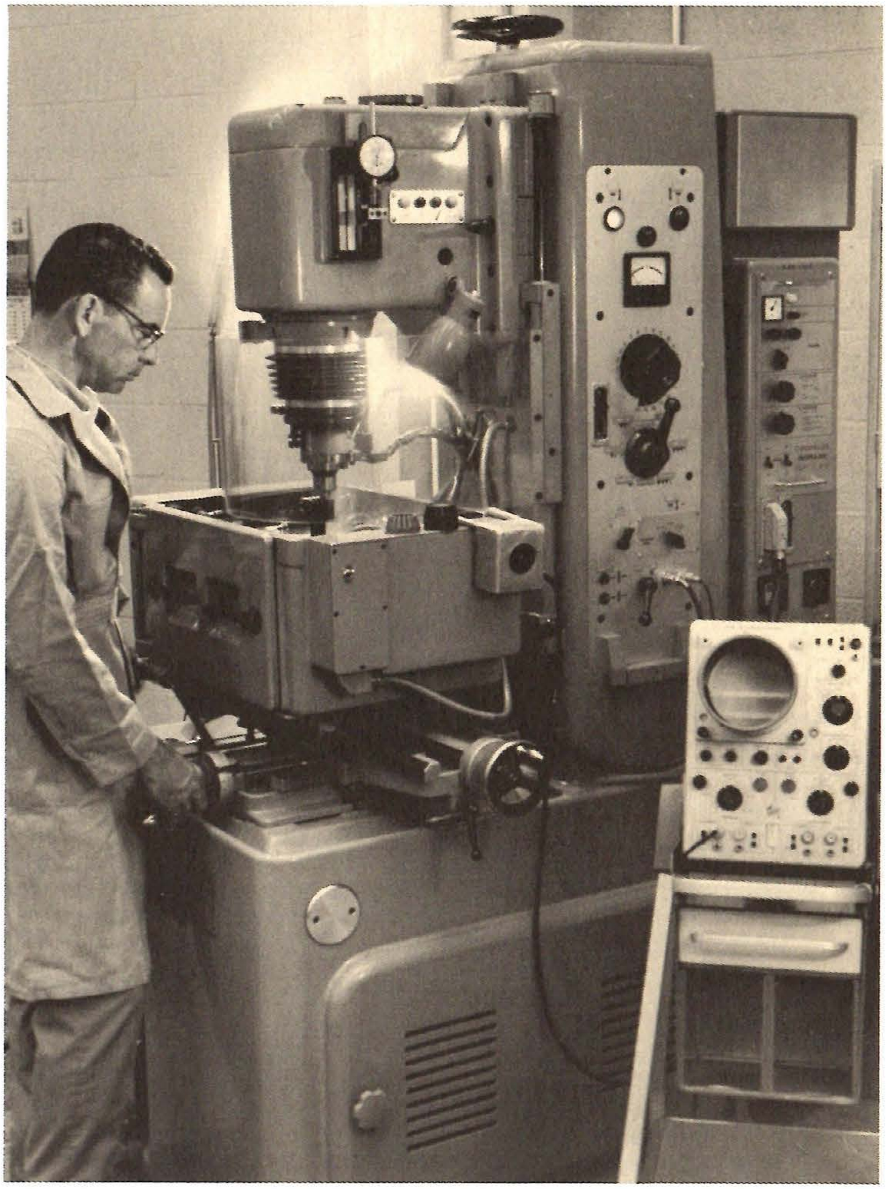
While the equipment is expensive, the tools to run it are not. A punched tape, which carries instructions through an electronic tape reader, operates the turret punch press automatically. As few as 10 hours are required to program taped instruction. A tool to do the same job often requires from 50 to 100 hours. As a byproduct, the tape-controlled equipment provides an ideal method to manufacture short-run items.

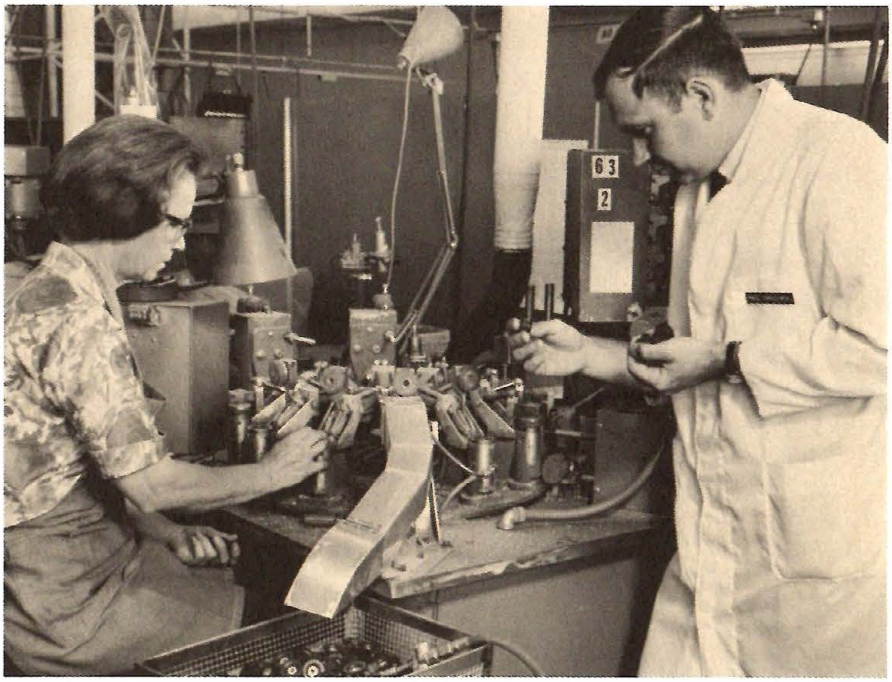
Studies to improve regular production have drastically changed the methods of producing plastic parts. Today, twice the number of people can turn out three times the number of parts, and still meet closer tolerances than dreamed of five years ago. Once again, this was done with close cooperation of Production Engineering and Production personnel. Not only did this group get better equipment to do the job, but they have also researched materials and introduced new production techniques.

The Metals & Plastics plant is made up of four major departments. The Plastic Products department is managed by Cal Smith. Metal Products manager is Ernie Annas. Loran Trumbo manages the Engineering Support group, and Bill Capps is manager of Production Planning.

Part of the secret of effectively working together is to organize and plan the work load into definable and coordinated elements of responsibility, and

A TEKTRONIX OSCILLOSCOPE is an essential ingredient (below) in this electrical discharge milling setup. The EDM machine erodes material with an electric spark. At right, a Tek-built machine, operated by Edra Howison, can drill, tap and insert set screws in 450 to 500 knobs an hour. Paul Zakrzewski, Plastics Machine Processing, inspects the knobs. At bottom right, Tom Cole, operator of the numerically controlled Burgmaster machine, prepares to set it up. The versatile Burgmaster can mill, drill and tap from programmed instruction, repeating close tolerances throughout a number of production runs.





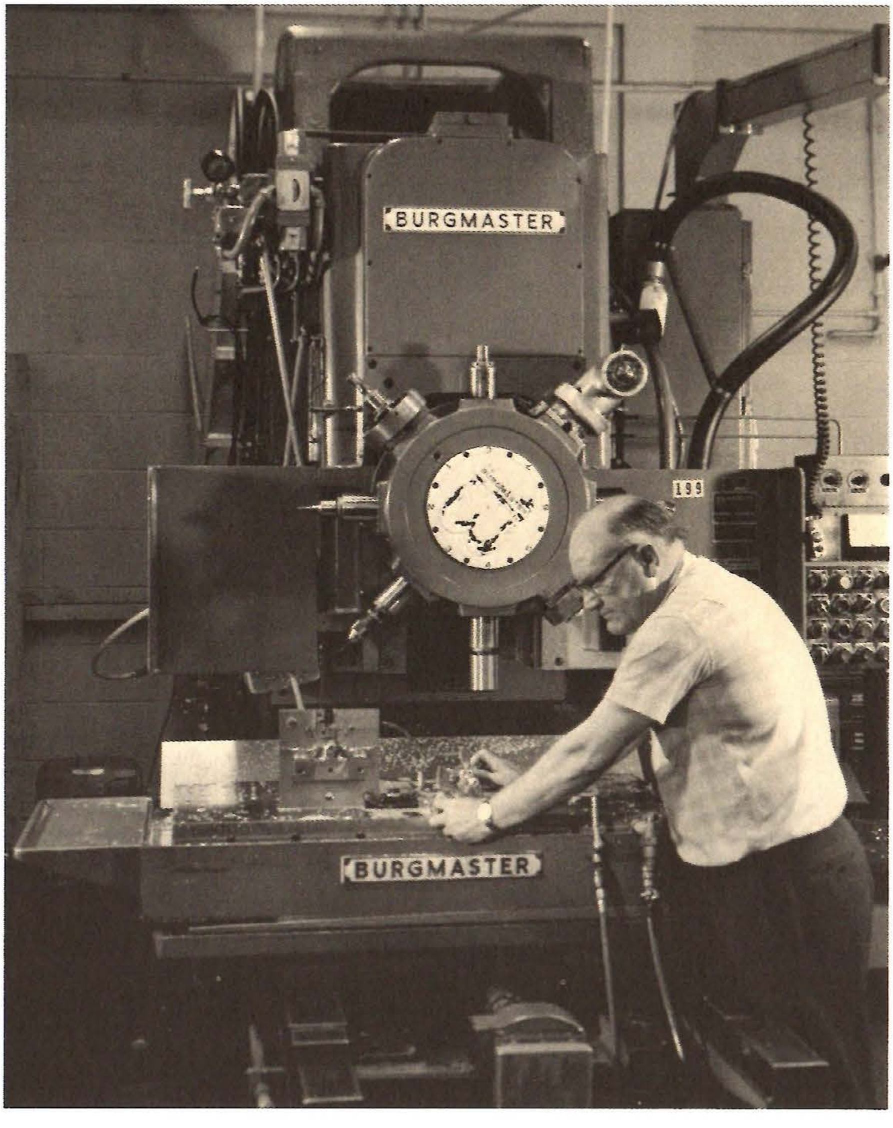
It's hard not to believe, after watching the plant's 550 employees at work, that they see more in their jobs than just the manufacture of precise components.

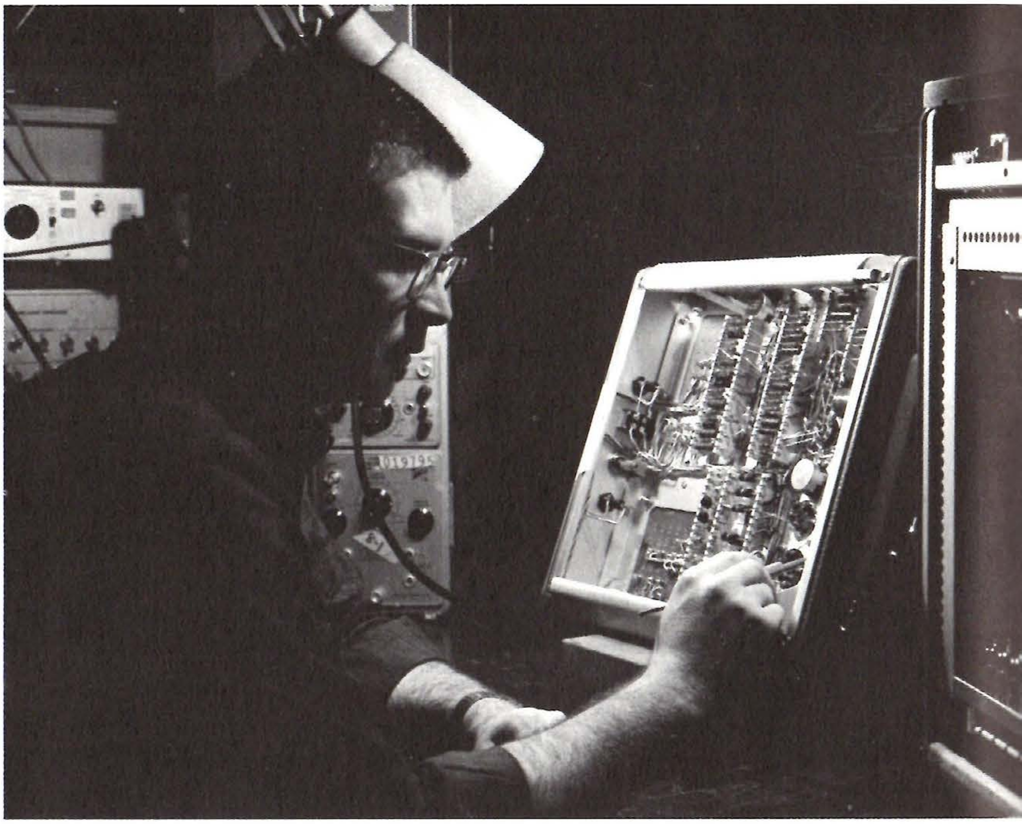
As one individual put it: "When I look at one of Tektronix' instruments, I dont think of the parts I build. I just think 'that's part of me'... and I'm proud."

still to be flexible enough so each person can contribute ideas freely. The four departments are carefully organized in the same manner. Bill Capps's Production Planning department is charged with long-range planning affecting both Metals and Plastics production. Engineering Support is devoted to manufacturing research and developing new manufacturing methods and materials.

Organizationally, the Metals & Plastics plant carries out its work between Instrument Engineering, which designs the company's instruments, and Product Manufacturing, which assembles parts into the finished instruments. To maintain a close working relationship with Engineering, six project engineers in the Metal & Plastic Components plant are assigned to work with specific design groups in the introduction of all new instruments and accessories. These groups also maintain liaison with Production Manufacturing to assure that components manufactured in the plant fit in the finished product as they are supposed to.

The Metals & Plastics building covers 132,000 square feet. An additional 5000 square feet are occupied at the Sunset plant for assembly of Scope-Mobile carts. Camera assembly, cable and delay-line manufacture, spectrum-analyzer oscillator manufacture and assembly and certain metal-finishing processes got their start in the Metals & Plastics plant; because of growth, these operations have moved to other areas of the company.





Your Job: Being Effective

What is industry like? The young graduating engineer may wonder.

However comprehensive his academic training has been, he is probably unsure exactly what to expect of the engineering environment into which he is moving.

Lang Hedrick, Instrument Engineering manager, in a speech to the Student Dinner meeting of Portland's IEEE chapter, offered comments helpful to the young man about to enter that environment.

Lang not only stressed the dynamic nature of today's engineering environment, which offers both pitfalls and promise, but also laid down the broader obligations which the engineer of today must accept.

Further, he recommended the particular attitude he feels is most likely to result in ultimate job effectiveness—and personal satisfaction. This attitude need not be restricted to the new engineer, or even to engineers only, but may well be worth consideration by anyone, in any responsibility.

To that end, Tek Talk offers this abridged version of Lang's presentations:

If you canvassed the nation's technically based companies, you'd find there is no such thing as a "typical" engineering environment.

My career includes experience in half a dozen engineering organizations. No one bore much similarity to the others—beyond the fact that engineering was being done there.

This characteristic, the differentness of successful engineering environments, was aired at a round-table discussion in Boston last year. Each participant, the president of a leading electronics industry, painted a picture of his company's engineering environment; each picture was unique.

I have emphasized this matter of differences for two reasons:

First, you should not be agonized when you find yourself in an engineering environment very different from what you had expected.

Second, **differentness** is a background against which to discuss some elements that are **common** to **every** engineering environment. The first of these elements is people; the second is machines; the third is change.

First, **people.** Your engineering environment is largely the product of the people who comprise it. Some of them will—like you—be charming, brilliant and able. Others will seem to be dull, incompetent, empire-building parasites.

However, people are the most important resource in the environment. You should resist passing judgment on them —**any** of them—and divert your energy to developing meaningful relationships.

People undoubtedly will cause your greatest frustrations; but meaningful relationships with them will give you some of your greatest satisfactions, also.

You'll need to learn some things through your own work and experiments, but you can learn faster through **people.** (Or else, why are you in school?) If you don't effectively use the resources offered by the people around you, you may well do a lot of unnecessary work. Figuratively speaking, reinventing the wheel is a common occurrence.

When **do** you ask for help? The engineering environment will let you get a lot of things done through people. However, you'll need to develop judgment in determining when to do it yourself.

With people in the engineering environment is the second common element, **machines:** Tools, calculators, computers, measuring instruments and so on. Proper use of machines can greatly expand your effectiveness. But, exercise judgment about when to ask the machines for help and when to do it yourself.

The engineer - computer relationship poses special problems. One, the computer does not work for free. Second, it's easy to become so enamored of exploiting the computer that you become diverted from your basic task: That is, generating a creative solution to an engineering problem.

Another element of the engineering environment is **change.** Change permeates technology—and technological change, in turn, has created new problems relative to "staying with the game:" Specifically, a demand for continuing education throughout your professional career.

The engineer certainly must concern himself with this narrow aspect of technological change—requirements it places on him for professional growth. But he also has a broader obligation: He must consider the impact of technological change as a major force in today's changing world. To achieve the Great Society, we must **rely** on changing technology.

Technological change affects social change; economic change; political, military, cultural and **any** category of change. And, in turn, these categories affect technology. For example: Changes in concepts of warfare have pulled a vacuum on the state of the art in a number of technical areas, involving weapons, weapons systems and communications. Also, society's demands that human suffering be reduced and human life extended have called forth dramatic changes in biology and medicine.

On the other hand, the technology of TV will continue to enable vast changes in education; computer technology has produced a dramatic change in management of business data; automation and control technology is generating a revolution of far-reaching social, economic and political consequences by at once reducing the drudgery and hard physical labor in man's work life and, at the same time, rendering unemployable the largest single segment of the work force.

It's a foregone conclusion that life (of some sort) soon will be created in a test tube; that computers will act as translators of the spoken word; that through automation we will be able to raise the standard of living of the entire world to our present level—or beyond.

The impact of these and other changes will be very great. It will so threaten many people that they will fight the changes; but all they can hope for is a holding action. Changes **will** come. Change will prevail over no change.

You, in your engineering environment, help generate technological change. You have another responsible role: To tell the world the probable impacts of technology on all of society. This is to say that your "engineering environment" must **by no means** be restricted to the laboratory. It is society at large.

You've heard about the demands that will be placed on you for communication skills, technical competence, creative output, community service and professionalism. However, the thing that will determine how effective these attributes are in **any** environment is your attitude—toward your associates, your boss, your job, your company's products and policies.

If you have a poor attitude toward your environment, not only will it bite you in the pocketbook (because your company won't be able to fully use your capabilities) but — what's worse — you will be working in a minor hell of your own making, because your attitude will deprive you of recognition—and thereby of any sense of achievement.

As you probably have never been in an environment totally to your liking, it seems to follow that you will never find a utopian engineering environment either. The question is: How do you deal with those elements of the environment that you dislike?

1. One solution is to flee. This is allowable—provided you don't expect to flee to some utopian environment. Because you'll never get there.
2. Another solution is to stay and fight—fight to change the things that annoy you. This solution is **not** acceptable. The environment may put up with your fighting for a while; but only for a while.
3. Another solution is to change your attitude in such a way that the elements you dislike don't debilitate you, and that you can exploit the favorable elements, to your company's benefit—and your own.

The heart of my message is this:

The burden is on **you** to be effective—in **whatever** environment you find yourself. After, and only after, you have demonstrated the ability to be effective will the environment yield to your nudging, and the world become the better place you want it to be.

The 529 and Its Very Special Job

Many Tektronix oscilloscopes are designed for utmost versatility, so the customer can get the widest possible use from them. These **general-purpose** instruments are the mainstay of our product line.

To supplement them, and to meet certain unique measurement requirements of specific users, we also provide a number of **special-purpose** instruments. Taken together, they amount to a good part of our business; but it's highly unusual for any single special-purpose instrument to be a major source of income.

Yet, in the past two years, one of the biggest contributions to our strong growth has been an instrument with an extremely specialized function.

The Type 529 is a television waveform monitor. If it is an oscilloscope at all (and engineers can carry on a technical debate here), it is one with a very specialized job to do.

What it does is analyze the quality of television picture signals.

Monitors are among the most essential equipment in the television industry —they're found in all studios, at all networks, at all transmitters and at each of the many key points in the sending of TV signals.

Sometimes those "key" points are in unusual locations. For instance, to obtain live TV coverage of US astronaut splashdowns, vans of TV equipment—including many, many monitors

LIKE ALMOST ANY television studio you might walk into, Portland's KGW-TV relies on Tektronix instrumentation to help insure the quality of the transmitted video signal. Here a Channel 8 studio engineer operates a panel of picture monitors and Tektronix type 529 waveform monitors.

—were placed on board the recovering aircraft carrier. Such worldwide, win-or-lose disclosure of our space efforts—the one essential difference between ours and Russian space programs—would be impossible without the presence of video-monitoring equipment.

Charlie Rhodes (TV and Conventional Oscilloscopes) makes this point:

Despite competitors, some of whom were in the market ahead of us, Tektronix has produced most of the waveform monitors installed in North America in the last six years.

The 529, since its introduction in 1965, has rapidly become the standard for both network and studio use. In doing so, it has pretty well superseded the preceding industry standard—which just happened also to be a Tek monitor, the Type 527.

Tek has long and diligently attended to the needs of the TV industry to solve measurement problems unique to it. As that industry has grown into a giant, the economic value of TV instruments to Tek has grown also.

Our concept of the TV industry also changed, Charlie says, as we came to realize this was indeed a worthy market for a producer of sophisticated instruments—a market requiring true state-of-the-art measuring capability.

As an example, waveform monitors are among Tek's most elaborate instruments—containing special circuitry, line selectors, time-base field selectors and frequency-response filters.

They also must meet Tek's strictest accuracy specs—±1 per cent (compared to ±3 per cent on most of our scopes) for amplifier, frequency and transient response.

Two laboratories using Tek scopes normally have no need to correlate their data; but two operators in different parts of a TV system must have **identical** data, because of the contractual relationships among networks, stations, telephone companies and so on. Thus the need for extreme accuracy.

Monitors also must be very reliable. Some of them operate in remote locations, such as on mountaintops. What's more, many monitors run 720 hours a month—that is, continuously; someone mans them 19 hours a day. Ten thousand hours operation per year is common.

Another requirement for a monitor is a very bright trace (the 529 has the highest visual writing rate of any Tek instrument). Another is compactness. They are often used in cabinets together with **picture** monitors—high-quality TV sets that give the operator a visual quality-check of the picture being transmitted. Often they're used in mobile studios for remote broadcasting (such as for sports events). Here space is at a real premium.

Tek's first TV instrument was the Type 524, introduced in 1950, a special-purpose scope that also could be used as a monitor. It was universally adopted by what then comprised the TV industry.

Our first monitor was the 525, a superior instrument but not a roaring success; other companies by then had introduced their own lines of both waveform and picture monitors—marketing them as master-monitor combinations.

But master-monitors had disadvantages. They were bulky, and the distance between picture monitor and waveform monitor gave the operators, literally, a pain in the neck.

In early 1960, one major network, seeking a smaller waveform monitor, asked us to develop a prototype. Our prototype emerged in April, and was tentatively approved in June. The first 50 were delivered by mid-December. Tek then was small and flexible enough to make such a decision and give that decision fast and vigorous support.

The need for a compactness in a waveform monitor, and the requirement for a five-inch screen, led us to develop our first rectangular cathode-ray tube, the first rectangular oscilloscope CRT ever built in volume. (We've since added rectangular display to many general-purpose instruments.)

The 527, "publicly" introduced in March 1961, monitored the first live coverage of an astronaut launching.

Later, many mods were made to it, to keep pace with the development of high-performance TV cameras, the advent of color broadcasting and the adoption by networks of the new concept of vertical-interval tests (very fast test signals sent **in between** the transmitted TV pictures). Also, reliable transistors had by then been developed to the point that they were the logical choice for most circuits.

The need seemed clear to Tek for a "deluxe" instrument, with increased brightness, extra circuitry and more measurement capabilities. Thus evolved the 529, which was designed to look and operate like the 527, to make user conversion easier.

The 529 was introduced just about four years after the 527. Response to it was immediate, and sustained. Its first two years of sales—partly reflecting the revamping of much studio equipment as TV bloomed in color—exceeded our expectations and were, Marketing personnel admit, "chaotic."

That chaos has subsided, and the 529, now in a period of more orderly growth, must be listed as one of the most successful of our varied special-purpose instruments.

What a Monitor Monitors

Every picture you see on your television set has gone through dozens—or maybe hundreds—of Tektronix instruments.

On its way from the TV studio to you, the video signal passes into and out of many Tek waveform monitors. They check the signal for any distortion, and thus help assure that the image on your set will be sharp and clear.

To understand what a monitor monitors, it helps to know a bit about television:

I. Changing Light into Electrons

The TV picture starts when a camera photographs a scene. Unlike still or motion-picture cameras, which record the entire image at once, the TV camera records it only a tiny piece at a time.

It does this because the television picture—unlike a still photo or a movie—must be electrically transmitted.

Each separate picture contains about 400,000 "bits" of black and white information. To send them all at one time would require 400,000 separate circuits, which is an impossibility. The alternative is to send one bit at a time, over a single electrical circuit. That's what the TV camera does.

It scans the scene, bit by bit, and transmits this picture information at the rate of about four million bits per second! In your home, your TV set will reassemble these bits into the picture on your screen.

The TV camera is a sort of cathode-ray tube in reverse.

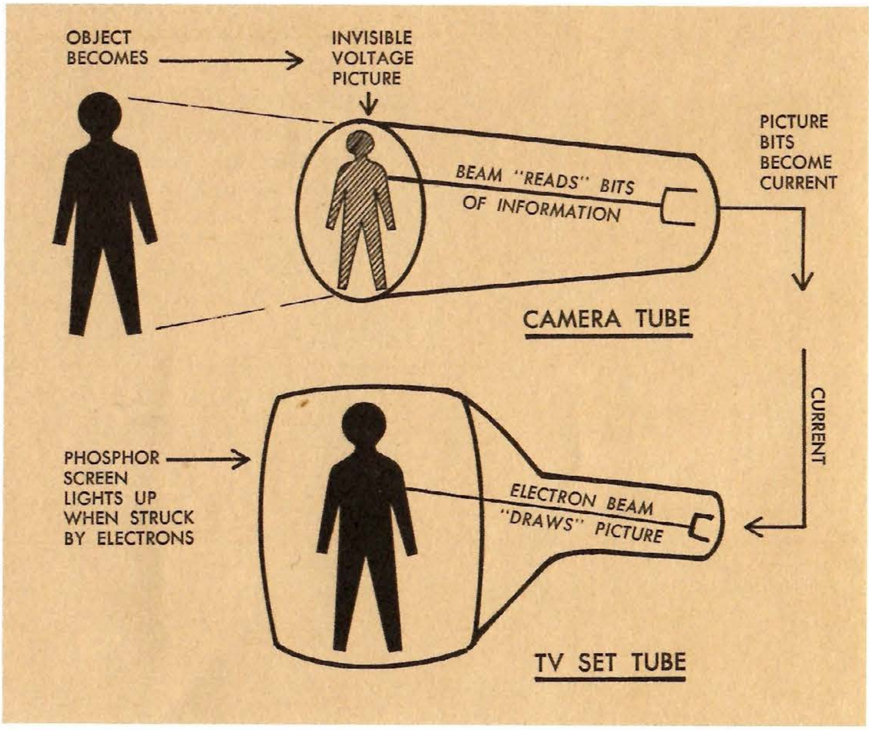
In an oscilloscope, the electron beam in the CRT "draws" a waveform on the screen. (Similarly, in your TV set, the CRT beam "draws" a picture on the screen.) By contrast, the camera tube beam **"reads"** information **from** its screen.

That is, whereas an oscilloscope CRT changes electrons into visible light, a TV camera tube changes light into an electron flow.

It works about like this:

The tube's target (or "screen") is light-sensitive. On it, the darks and lights of the scene being photographed are registered as a charged image—an invisible voltage "picture" of the scene.

The tube's electron beam then "reads" this picture information from the target, bit by bit, and changes it into an external current. That current, in a pattern corresponding to the darks and lights of the scene, becomes the video signal that controls the TV set in your home.



To the signal, the studio adds some special coded "operating instructions" to your set, so it can reconstruct the scene. Otherwise, your TV picture would be like a jumbled jigsaw puzzle—with 400,000 pieces.

The audio, or sound, information is transmitted as a separate signal.

II. Changing Electrons into Light

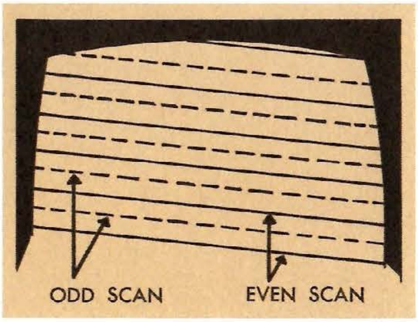
Your TV set, an intricate device, decodes the transmitted information. It amplifies the weak signals it receives, separates the "operating instructions" from the picture bits and feeds the video signal to its cathode-ray tube. The CRT draws the picture you see by bombarding the phosphor screen with its electron beam.

The TV picture requires three kinds of controls: **Intensity,** to govern the amount of CRT beam current, and thus the brightness of each bit of the screen; **horizontal sweep,** to trigger the passage of the beam from left to right across the screen—15,750 times each second; and **vertical scan,** to return the beam to the top of the screen after each picture.

All of these controls are going all the time, so they must be synchronized. The controls are run from the studio.

Looking at the TV set in a bit more detail:

Each complete picture is made up of 525 lines. Each line contains about 320 bits of black or white (or gray) information. The lines are drawn in what's called "interlace scan;" each even vertical scan draws half the 525 lines; each odd scan fills in the intervening lines. This odd-and-even approach prevents "flicker"—while giving smooth portrayal of motion.



The studio's "operating instructions" to your TV set are of two kinds:

One signal makes sure the CRT beam starts each new line of the picture in synchronization with the transmitter. The other returns the beam properly to the top of the screen after each vertical scan. These "instructions" are called the **horizontal** and **vertical sync pulses.**

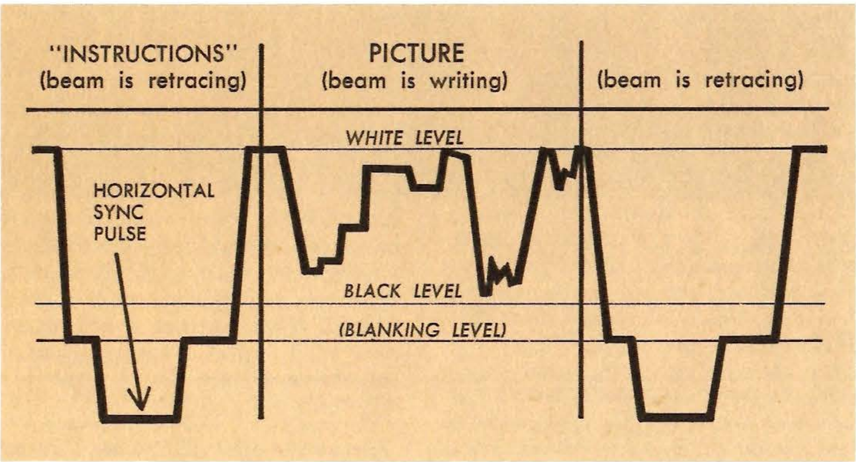
The amount of video signal **modulation,** or deviation from the signal carrier, determines how bright each "bit" of the picture will be. Slight modulation produces strong CRT beam current, and a white spot on the phosphor screen. Greater modulation gives less current, and a black spot. Even greater modulation results in what's called **blanking**—so to speak, a "blacker than black" spot.

Blanking is necessary after each horizontal line, so that the beam, as it returns to the left to start the next line, won't scrawl on the screen.

During this blanked-out time—at current levels too low to light up the phosphor—the studio sends the **horizontal sync pulse,** triggering the TV set sync generator to start the next line.

Each single line, of the 525 lines that make up the television picture you see, is made up of about 320 black, white and gray bits.

On a Tektronix monitor, the waveform corresponding to this picture line—and including the coded instructions sent at below the blanking level—would look something like this:



The waveform monitor is able to look at any one of the 525 lines, and check it against industry transmission standards. For instance, a white signal may not be less than 12½ per cent modulation; black, not more than 75 per cent.

The second studio "instruction" to your set is the **vertical sync pulse.** This signal is included in what's called the "vertical packet" of information. The packet is sent at below the blanking level, while the beam is returning to the top of the screen. It insures that the beam will be in step when it starts the next vertical scan.

If you adjust the "vertical hold" control on your TV set, you'll see a black bar moving slowly up the screen. On this bar, representing 18 to 20 blanked-out lines, the vertical packet is being sent. So is another kind of information:

Recently, networks have devised a way to **continuously** check transmission quality. It's called vertical-interval testing (VIT). Finding that the vertical blanking period contained some "waste time" (about 1/15,750 of a second), they decided to sneak some test information onto one horizontal line.

One kind of VIT information is a stairstep of gray signals, from white to black. Another set of signals tests high and low-frequency resolution. (These VIT signals show up on the black bar as a line of dots).

The waveform monitor, besides checking VIT signals and monitoring individual lines of the picture, can also, for certain purposes, display the entire 525 lines at once.

In all its functions, in its many locations—at the camera, at the transmitter, at very many points along the line and in individual TV stations—the monitor checks the video signal for any degradation—and often is a basic tool in **correcting** these faults.

Children play a party game, in which someone whispers a story to another, who then whispers it to the next person, and so on. The fun is to see how much distortion occurs. If you were to listen to each whispered message and correct any errors, the story would be transmitted perfectly.

That function is essentially what a waveform monitor does—checking the picture signal for any distortions on its long trip from studio to you.

SMALL TALK

Tektronix oscilloscopes can measure electrical events less than 0.00001 volt in amplitude and events lasting less than a billionth of a second. To build these instruments, other measurements must be made, of physical dimensions and characteristics; measurements expressed in microinches.

The microinch, 0.000001 inch, is a basic unit in dimensional metrology. It compares to an inch as one foot compares to the distance from Portland to Seattle. A human hair is approximately 3000 microinches in diameter.

Tektronix instruments contain parts that must be measured within tolerances of plus-or-minus 10 microinches, and built with extreme precision to meet Tektronix instrument quality standards.

The Physical Standards department, headed by John Erhardt, is responsible for setting and maintaining our measurement standards. Under the direction of dimensional standards engineer Ed Morgan, the dimensional metrology section of Physical Standards monitors primary and secondary standards, calibrates and maintains precision measuring tools and instruments, instructs the users of these tools and instruments, and makes the numerous fine measurements that must be done in the lab.

Also in the department is an industrial instrumentation section, whose functions include measuring 3200F-degree temperatures in the ceramic kilns—but that's another story.

Measuring to an accuracy of plus-or-minus 10 microinches could be compared with trying to find your own height—exactly. You're an adult; you've stopped growing, you think. So you measure yourself first thing in the morning and find that you're 5' 8½". That's fairly exact. But, when you check yourself later in the day, you find you're only 5' 8¼". Then you recall that a person's height normally changes through the day. So you set a certain time of day as a standard at which you'll measure yourself. But, darn it, you can't stop breathing long enough to get the measurement exact. And, anyway, your heart keeps beating, which causes your scalp to expand and contract just enough to change the measurement slightly. So you'll never know exactly how tall you are.

This is the sort of problem metrologists face. Matter changes—subtly and almost imperceptibly at times. Even when using the finest precision devices, that measure with beams of light, the heat of a technician's fingers placing an article in the device could change the article's size or distort the device—grossly, by modern metrological standards. The measuring tool itself can compress or dimple the item being measured—ever so slightly to us, but drastically to the metrologist.

Measurement becomes a question of technique even more than of equipment. And technique is what makes Tek's metrology lab outstanding. Its reputation is such that vendors send us prototypes of their newest measuring equipment for evaluation—not a common practice. Ours is one of the few metrology labs on the west coast that can make measurements as small as .5 microinch.

John comments that our stature in the field has its disadvantages—someone's always trying to lure his technicians away. And a good technician is worth more than all the complex instruments in the lab. Metrology, like playing the piano, is largely a matter of "touch." Comparing a skilled metrologist to one who doesn't have the touch is like comparing Van Cliburn's piano playing to the average schoolboy's.

Not only do our technicians have the magic touch, they also have the ingenuity to devise special equipment and techniques to meet needs unique to Tektronix. Some of their inventions have attracted the attention of metrology-equipment manufacturers; although designed to solve problems for Tektronix, they could be adapted for use in other labs.

Some measurements made by our lab, and their present limits, are: Angle, accuracy within ½ second of arc; flatness, resolution to one microinch; height, accuracy within plus-or-minus five microinches per inch of height; inside diameter, resolution to 10 microinches; outside diameter, repeatability to 10 microinches. More complex measurements, such as the pitch diameter of screws and threaded holes, can be made to 10 microinch accuracy.

To a metrologist, "accuracy," "repeatability" and "resolution" have definite meanings. Accuracy describes correctness, closeness to a standard, and refers to a quality of both technician and instrument. Repeatability is a technician's ability to measure the same object again and again, and always get the same reading (more difficult than it sounds

ED MORGAN (left) and John Erhardt calibrate a set of gage blocks. Equipment pictured includes a set of master gage blocks; a block-comparator system that can measure a half-millionth of an inch, and a temperature indicator.

because the permissible variations are so minute). Resolution refers to the limitations of the measuring instrument, and is expressed in terms of the smallest graduation on its scale.

Instruments in the lab range from the most basic—gage blocks—through elaborate and exotic. The super-micrometer and the autocollimator measure height and parallelism; the Product-o-Ron, a real Rube-Goldberg device, measures roundness, diameter, relationships between inside and outside diameters, and location of holes in an item. An impressive-looking two-sided piece of steel, measuring about eight inches across, turns out to be an optical polygon that's essential for a number of highly precise angle measurements.

The lab's master set of gage blocks goes from 0.010 inch through 4.000 inches. Different sizes of blocks are combined to equal the length to be measured. The technician removes the measurable layer of air from between the blocks by a technique called "wringing," sliding them together to press out the air. Their mirror-smooth surfaces then cling together as if magnetized; if left wrung together long enough, the blocks would become almost inseparable.

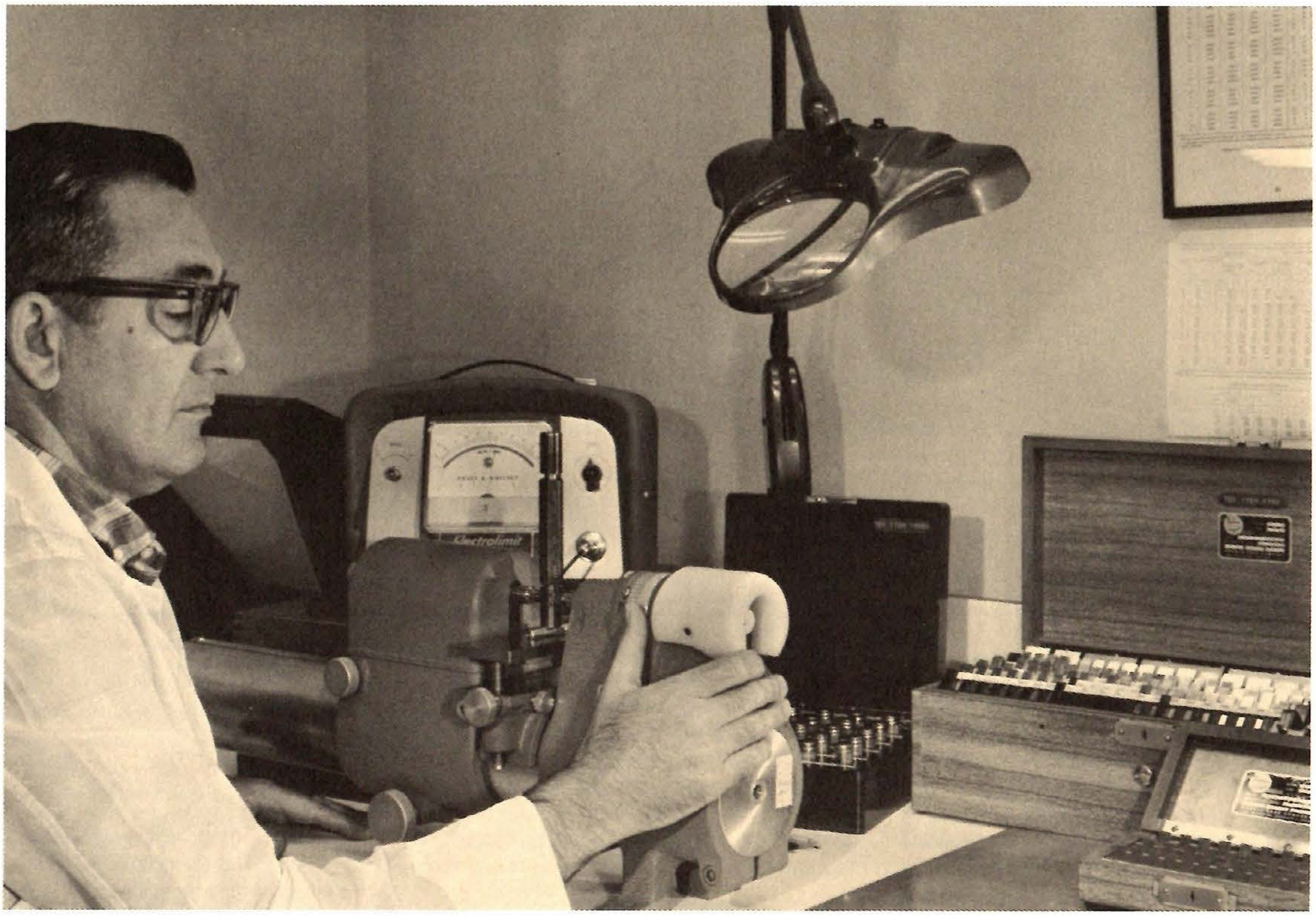
Lab technicians calibrate and maintain 5330 measuring devices, throughout Tektronix, at intervals ranging from one week to one year; the average number of devices processed per week is around 400, including some 200 micrometers. Technicians carry out on-site inspection and calibration of equipment too large or immobile to be brought to the lab. They inspect new equipment for conformance to manufacturers' specs; the manager making the purchase may reject their recommendations. They certify measurements and standards throughout the company to provide traceability to the National Bureau of Standards. (Traceability, in effect, means that our measurements would be identical if checked by NBS because our primary standards are calibrated to NBS master standards.) Instruction classes, conducted by lab staff for instrument users throughout the company, average at least one a week.

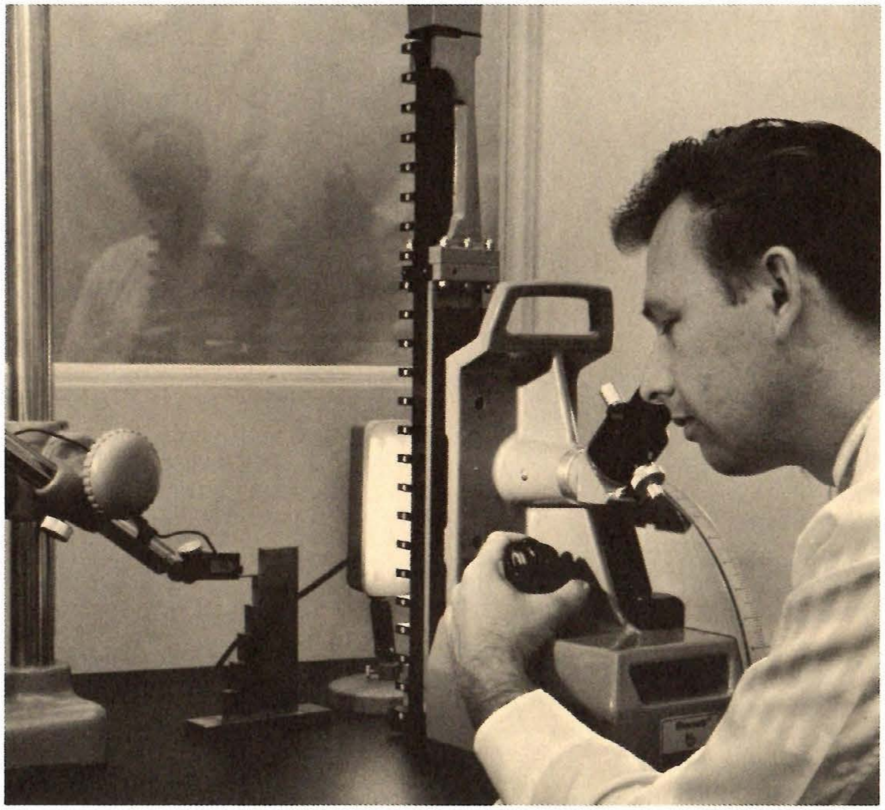
By continually improving technique and making the best use of equipment, the lab staff has handled a work load that doubled in the past two years, without adding even one extra technician.

When possible, they carry out measurements in the "clean room" environment of the lab, located among the mazes of the Metals building. Even there, the air filters can cope with dust particles down to only 40 microinches, but measurements must often be made in the one-to-five microinch range. Part of the technique requires setting the reference points of the measuring instrument flat on a microscopically smooth and level work surface. Those 40-microinch dust particles between instrument and work surface are like loose gravel on a table top where you're trying to set a water glass flat. Painstaking cleaning and instrument-handling techniques help reduce the inaccuracies that dust could cause.

To get 99.2 per cent accuracy, a measuring device used must have 10 times the capability of the device it calibrates. A device with four times the capability would produce about 97 per cent accuracy. Tek uses the 10-times ratio as a standard.

Applying this to specifics, say that an engineer's drawing calls out a part with a 0.001 inch tolerance. This means that the tool-and-die maker who builds the die to make the part, and the QC inspector who later checks it, must have instruments accurate to 0.0001 inch, just to get the part through production. So, to check their equipment, the metrology lab would use instruments accurate to 0.00001 inch. And the master instruments used to check the lab equipment would be proportionately refined—until the limits are pushed as far as people can.





SUPERMICROMETER gage blocks and thread wires help Clancy Payne (left) calibrate a thread-plug gage and establish traceability to the National Bureau of Standards. Using an optical height gage and an electronic comparator, Jerry Palfenier (top) calibrates a step gage.

In metrology as in electronics, the state of the art grows, and instruments could become obsolete overnight when the science takes a big step forward. The problem of obsolescence proves the value of technique and ingenuity that can prolong the usefulness of a piece of equipment by using all the potential built into it—and sometimes potential no one realized it had.

Another possible cause for obsolescence is a movement in the scientific and commercial community toward a world standard of metric measurement —eliminating such ideas as inches and microinches. In the US alone, this could make millions of dollars in measuring equipment suddenly become obsolete; but mathematical conversion could solve the problem until normal attrition and replacement substituted metric-measure equipment for inch-measure. Considering that a set of gage blocks with certification and microinch increments could cost $750, this form of obsolescence must be weighted against the desirability of a world standard. Some opponents of a change to metric standards hasten to say that this wouldn't be the only problem—who can picture a Miss America measuring 96-58-91?

Metrologists over the centuries have survived worse problems. In ancient Egypt, the legal measurement standard was the cubit—the length of the Pharaoh's forearm. Since it wasn't convenient to have the Pharaoh measure every construction job, scientists devised the royal cubit, a rod of the exact length, divided into smaller "working cubit" measures. This rod was checked and calibrated every full moon, on pain of death if not done properly and on schedule. It must have worked—the pyramids stand as a monument to precise measurement in heavy construction. Who knows what those fellows might have done with a supermicrometer?

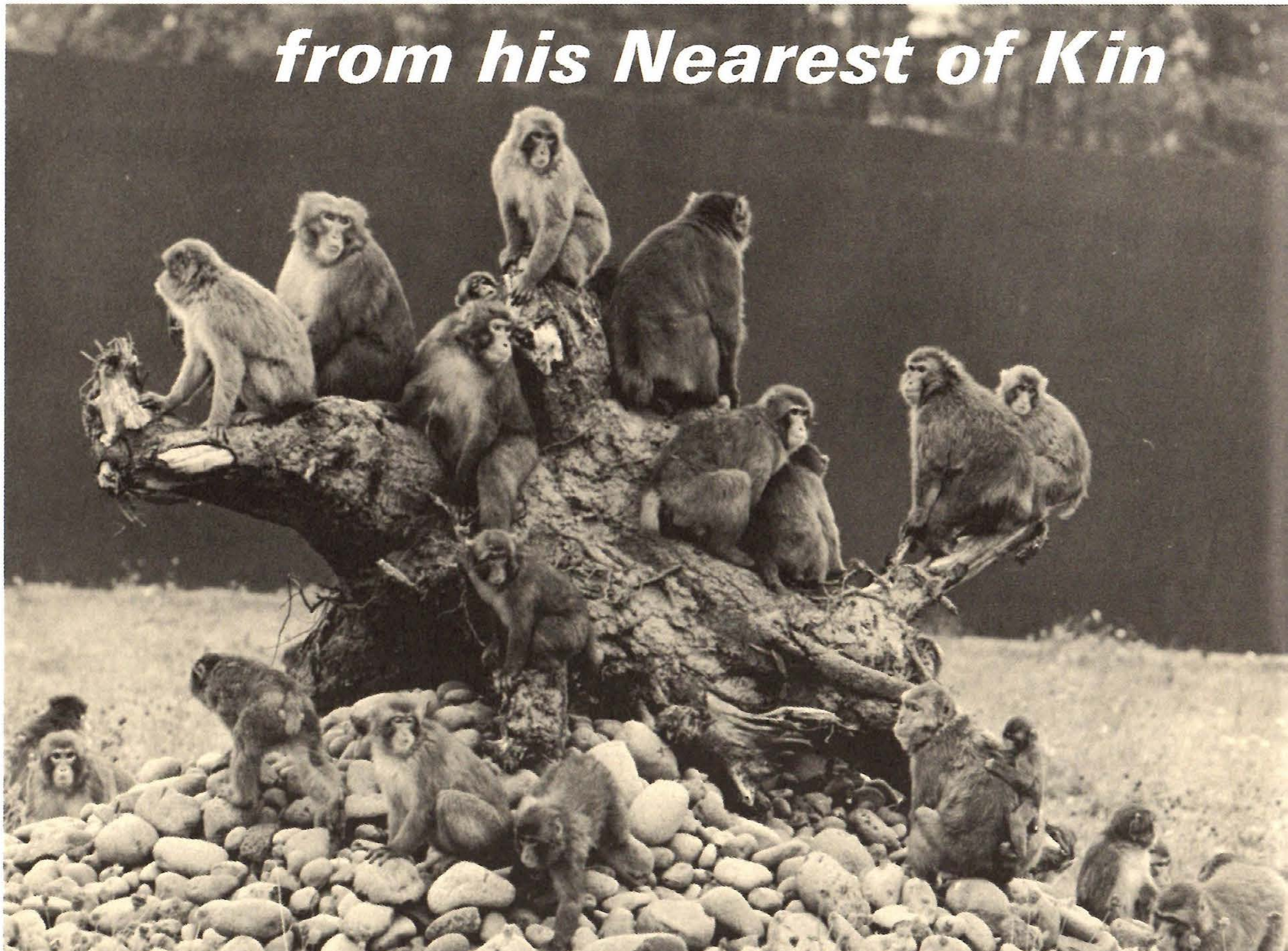
The science of physical measurement has progressed to the point that we now can say, for example, a meter is exactly 1,553,164.13 wave lengths of cadmium-red light. Where kings, pharaohs (and Indian chiefs) once set their own standards of measurement within their nations' tiny boundaries, now international agreements define standard dimensions to a level of precision unimaginable to a layman. Our industrial world of interchangeable parts couldn't exist otherwise.

This precision is reaching a point where the physical nature of matter itself sets the limit; beyond that point, further precision is impractical, impossible or both. It goes back to the analogy of being unable to measure your height because you keep changing. Even in a cold, dense block of finely polished steel, molecules are racing madly around and continuously changing its size. (Those same molecules are part of the problem of deciding what really is the surface of a smooth plane—the best of scientists are finding this question puzzling.)

Even by saying the standard for measuring steel will be an environment of 68° F. at a maximum of 50 per cent humidity; even by having the technician wear insulated gloves to avoid heat transfer or corrosion from his touching the steel, and even by using light rather than physical touch as a yardstick to avoid compressing the block of steel—no matter what standards and safeguards are set, you can't beat the changefulness of nature.

But we're still trying.

Learning about Man from his Nearest of Kin



JAPANESE MACAQUES (left), alone of the Primate Center's animals, live outdoors the year around, in a climate similar to that of their native home. At right, Dr. William Montagna, the center's director, engages in animated conversation with a visitor. In the background is the Research building.

The potto, the lemur, the tarsier, the cynomolgus and the galago are as strange to look at as their names are to read. They belong to the Order Primates, as do about 300 other species, ranging from the marmoset to the gorilla.

These animals vary in size and weight, from bare inches and ounces to 300 pounds or more; in diet; in temperament, and in social interests. But they share one characteristic: They are the closest animals, biologically, to Homo sapiens.

Thus, knowing more about how they tick is a vital investment in the future of Man.

When you consider further that primates have always been plentiful, it seems strange that only very recently have they come into extensive use for biomedical experimentation.

More typical laboratory animals have been the cat, rat, mouse, dog, rabbit and guinea pig. The reasons are that they're cheap as well as plentiful, and easy to keep in good health. What's more, man has centuries of knowledge about their physical characteristics, to build upon.

The first US regional primate research center was set up in 1960. Situated on a 250-acre forested tract west of Beaverton, it's now the largest in staff—and probably also in scope of research—of the seven US primate centers.

Russia established a center for primate study in 1927. Japan also has one. Most countries do not. Thus the activity at Beaverton is of great interest to scientists the world over. Although the center operates largely on grants from the US government, the knowledge gained becomes the property of **all** nations.

The staff is international also. You may hear any of 23 languages spoken there: Serbo-Croatian, Arabic and Finnish, as well as less exotic ones. The center has sought the top scientific specialists, wherever in the world they were to be found.

Scientists from abroad, singly or in small groups, visit the center at the rate of over 1200 a year. Some may stay, under grants or other special arrangements, to work in areas of interest to them, for a few weeks to over a year.

But there are **no** public tours—for three reasons: First, tours impede the research being done; second, they excite the animals; third, and most important, they jeopardize their health.

Primates are susceptible to many human diseases; the greatest fear is of tuberculosis, an epidemic of which could very quickly wipe out an entire colony.

Primates are costly to start with; an importer might charge from $30 for a young squirrel monkey to $800 for a ring-tailed lemur. An out-of-stock item—an animal to meet strict specifications as to species, age and sex—may run much higher.

Add to this initial cost the extra investment in those animals selected for continuing experiments, and you can see why the great concern over disease.

Employees' health is closely watched. The center has its own health officer; complete physical checkups, inoculations and regular X-rays are mandatory—most often for the 35 animal handlers.

Because good animal health is essential, great effort is placed on maintaining it.

"Not a flea in the place," insists Jack Warren, Colony director. Jack, with two degrees in zoology, is responsible for the management and husbandry of the center's animals—which totaled about 1340 at the moment he answered the question.

Research at the center focuses on reproductive biology—over the entire lifetime of the animals, in sickness and health. Thus, animals are selected partly because of their ability to reproduce in captivity. The main one is the rhesus monkey.

The center's research is not necessarily clinical—aimed, say, at solutions to specific medical problems; its goal, rather, is to add to basic knowledge about human biology—a knowledge that is surprisingly scanty.

A mechanic can't fix your car if he doesn't know how automobiles work; nor can the clinician cure human ailments until he fully understands basic biological processes.

The various primates are much like man—just **how** similar is a question. The center's researchers seek to determine which animals will make the best laboratory "models," in one or more desired areas of study, from which to learn more about human biology.

The center was begun in 1960, with

funds appropriated by Congress in May 1959. Some primate colonies existed earlier, on college campuses. But the centers have great advantages, among them that they provide thorough interdisciplinary programs. The Oregon center offers research opportunities to all qualified scientists whose interests jibe with the center's objectives. Its integrated research effort—of independent but coordinated projects—includes the work, among others, of surgeons, psychologists, biologists and biochemists, neurologists . . .

Its eight buildings include a 35,000-square-foot Research building, with laboratories, surgery and most of the research instrumentation; a Central Services building, housing the library, offices, cafeteria, and photography and automatic-data-processing facilities; two buildings for animals (plus an outside corral, year-around quarters of Japanese macaques), and a number of physical support buildings. Total value is estimated at $3 million.

Funds come about 90 per cent from the National Insitutes of Health, a division of US Public Health Service. The operating grant, given to the center itself and guaranteed seven years in advance, is about $1.5 million a year. Project grants, to individual staff members, now total about $1 million a year, and are obtained from a variety of agencies as well as private donors. (The new Colony annex, housing the world's largest collection of prosimians, and the macaque corral were both built with private funds.)

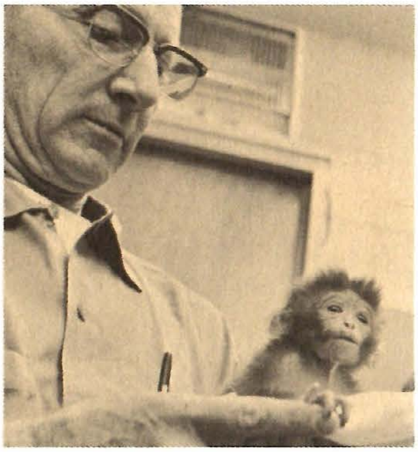
Director of the Oregon Center is Dr. William Montagna, for 18 years professor of anatomy at Brown University, a specialist in skin biology and, his associates maintain, "one of the couple dozen good primatologists in the world today."

Dr. Montagna, outgoing and personable, is a man of diverse interests: Proficient on the French horn, an expert in ornithology, he is also a landscape designer; the center's own grounds attest to his ability.

It is his job to coordinate all research projects, determine whether proposed studies are suitable and maintain information exchange with other institutions.

A private donor may specify the area of research to which the money is given; however, the center has no obligation to accept those provisions.

Dean D.W.E. Baird of University of Oregon Medical School, Portland, is administrator of the grants, which are given through the Medical Research Foundation of Oregon. The center's connection with the medical school extends to time-sharing; that is, many researchers also have appointments at the school. But interchange of ideas between the two institutions is largely informal and on a personal basis. There is no organizational tie-in.



RHESUS MONKEY (left), one day old, peers from the hand of "Red" Fuqua, in charge of the animal nursery. At right is the Colony, where most of the breeding animals are kept. Eddie Duro (bottom right) is in charge of the care and feeding of prosimians, animals resembling monkeys but lower on the evolutionary scale.

The center, although listed as a private institution, submits regular progress reports to the National Institutes of Health, its "parent" agency. In addition, its research becomes worldwide public knowledge, partly through publication of the results—which is done largely as a matter of course.

The center employs about 200 people: Forty-five scientists, all with doctorates; about 60 research assistants, associates and technicians, all with bachelor's or master's degrees; a varying number of graduate students, and pre- and post-doctoral visiting scientists from other countries.

In addition, the center has 35 animal handlers. They are mostly from farm backgrounds, and their overriding job requirement is that they are kind to animals.

Support personnel include secretaries, librarians, medical illustrators, photographers and maintenance crews.

Among the areas **not** under study at the center is contagious disease—although noncontagious ones are investigated, such as arteriosclerosis and some kinds of cancer.

But the research is far-ranging. A sampling indicates the broad scope of the center's efforts.

Studies of the **birth process,** and of possible means of birth control; **social behavior,** in the center's troop of Japanese macaques; **sex differences** from birth through old age, and resulting changes in social behavior; improved **surgical techniques;** the effects of addition or subtraction of chemicals in **animals' diets;**

Induced **skin cancers.** Not only do primates seldom have naturally occurring cancers, but they also are resistant to those agents that induce cancer in other animals. The goal, of course, is to determine what bodily mechanisms cause this resistance.

Research is as current as today's headlines. There are "hippies" among the animals at the center; studies have been begun to test the effect of LSD and other drugs on monkeys. A Tektronix 564 oscilloscope is used in this activity.

Other research investigates computer simulation techniques in mathematical biology; the chemical composition of cells; the effects of ultrasonic waves on macro-molecules; the dietary effects of vegetable and animal fats; the natural occurrence of arterial disease in free-ranging primates (here the "laboratory" is a South American jungle); bone growth and maturation; baldness; sweating; wound healing . . .

The process of adding to basic knowledge goes on, one unspectacular bit at a time. Some findings, however, have interesting implications. For instance, Dr. Charles Phoenix, assistant director, cites this finding: Animals' sex characteristics can be changed by hormones injected into the pregnant mother. That is, a male hormone given the mother will cause a genetic female offspring to resemble and act more like a male than a female—not only in social but also reproductive behavior.

"This, of course, is a controversial area," Dr. Phoenix admits; it suggests that sex characteristics may depend on the hormone level of the mother.

(Other studies, at the Primate Center in Wisconsin, on the other hand, show the great importance of social and environmental conditions on sex and reproductive behavior.)

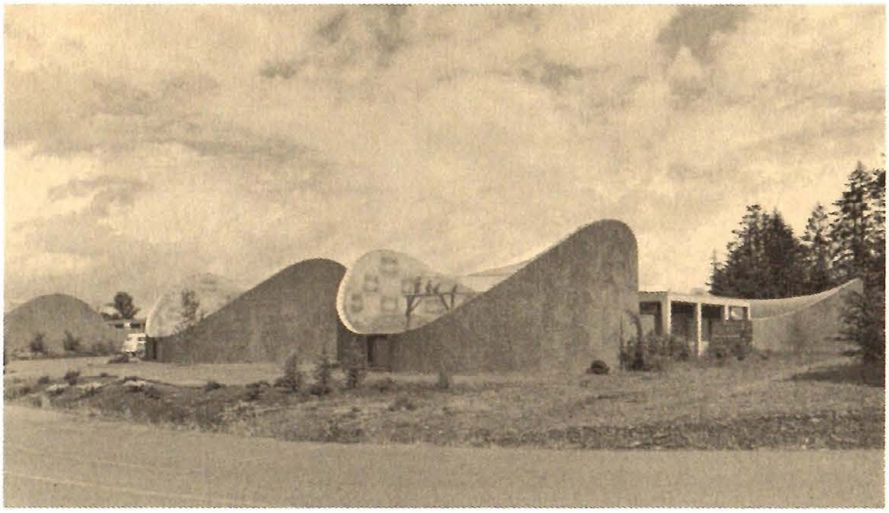
In studying the unborn animal, one new technique is to implant a tube in a blood vessel of a fetal monkey 30 days before birth, then take blood samples at specific intervals. By injecting hormones and drugs into the mother, researchers can determine when they reach the fetus, and observe the effects. The fetal heart rate also can be monitored, and read out on Tektronix oscilloscopes.

Some of the studies are of social behavior; some are psychological; some entail dietary experiments. But many require surgical procedures. And, to some people, this idea will seem abhorrent. It is a human sort of reaction.

In this regard, two things must be said:

One is that the Center's treatment of its primates is both **extremely** humane and scientifically very advanced.

A primate chosen for surgery is better off than a human being about to be operated on. In the first place, he's in excellent health; the person enters surgery in something less than peak condition. Second, the center's surgery-monitoring procedures are more advanced than those in many hospitals. Third, animals are anesthetized in all cases; fourth, as to the thoroughness of post-operative care—people should have it so good.



The second point is that the alternative to such experiments is an intolerable one: Continued ignorance about basic physical processes—ignorance that could result in millions of unnecessary deaths or stunted lives.

"Fifteen hundred Americans die daily from heart attacks," says Dr. M. Rene Malinow bluntly. "One hundred twenty six thousand males were killed in World War I. One hundred **fifty** thousand males, under 55, die—**each year**—from arteriosclerosis."

Salk polio vaccine, he notes, was developed and proven effective by using monkeys—and many were sacrificed in the program. But, for each animal life curtailed, a giant multiple in human lives has been extended.

"Until you've actually seen an epidemic, you can't appreciate the value of such successful research," he says. "I was in Buenos Aires during a severe polio outbreak. I got used to reading the morning paper each day just to see which ones of my friends had died . . ."

Dr. Malinow's work includes a pilot experiment to learn what happens during a coronary occlusion. In arteriosclerosis, lipids (fats) accumulate in the arteries, occluding the arteries nourishing the myocardium, which in effect "dies." Through use of a radio transmitter, he is able to induce a myocardial infarction—an artificial heart attack. A pressure transducer, implanted in the heart of a young rhesus monkey, measures the resulting changes in ventricular pressure. The reaction is monitored on a Tektronix 535 and other equipment.

Dr. Malinow helps catch some of his own monkeys — something not every scientist can say for himself. He's now planning a three-day field study in Argentina's Corrientes province—a careful preparation that requires about six months.

Studies of spontaneous arteriosclerosis on monkeys require freshly-caught animals. These studies, using howler monkeys, can be made 48 hours after the animals are roaming the jungle.

Dr. Malinow is interested also in developing more humane trapping procedures, most of which now are "barbaric." In addition to deaths during the actual trapping, further loss and exposure to disease occur during shipping.

In 50 years, there will be monkeys only in zoos, he believes. The world's primate population is declining. (About 100,000 rhesus monkeys are shipped each year to the US alone.) Civilization continues to make inroads into primates' habitat, as well as to kill them for food.

But his concern, again, is only how much good can come to humanity through wise use of these primate resources.

Because the center's research is so far-ranging, Tektronix instruments are common there. A type 535A is used in surgery; the Electronics department has a 575 and 545A, to test and maintain (and occasionally design) lab equipment; Psychopharmacology, in its LSD studies, uses a 564 storage scope; another 564, plus a 561, 565 and 321, is used in Neurophysiology.

Among the neurophysiological uses, says department head Dr. John Roth, is that of the 564, with a high-gain preamp, to record brain waves during surgery.

Among Dr. Roth's activities is "mapping" areas of the monkey's brain.

The activity of the brain is recorded by placing an electrode at various points on a wide area of the brain surface, testing for evoked potentials. The 564's storage feature allows comparison of up to six traces at once. "Otherwise, it would be difficult to eyeball a brain wave," Dr. Roth notes.

He's trying to find an area of the brain that, from animal to animal, will have similar connections, or responses; then to use these "standard" areas as bases for controlled experiments.

The dual-beam 565 allows simultaneous recording of current and voltage, or of the slow and fast components of brain-cell response. One apparent finding is that brain-tissue impedance changes as current stimulating it is increased. This kind of information may help in learning more about epilepsy; in that disease, groups of neurons within the brain abnormally and suddenly discharge at one time.

We have some knowledge about individual neurons, Dr. Roth says, as to their similarity in biochemical function, voltage parameters and discharge. "But, when you get beyond single-cell action, you're in trouble. For example, we know **very** little about the interconnections of functional areas of the brain."

There are about 10 billion brain cells, and about 40,000 per square millimeter in the cerebral cortex. Add to this the belief that brain-cell attrition is about 100,000 cells per day, and the complexity of the "mapping" problem becomes obvious.

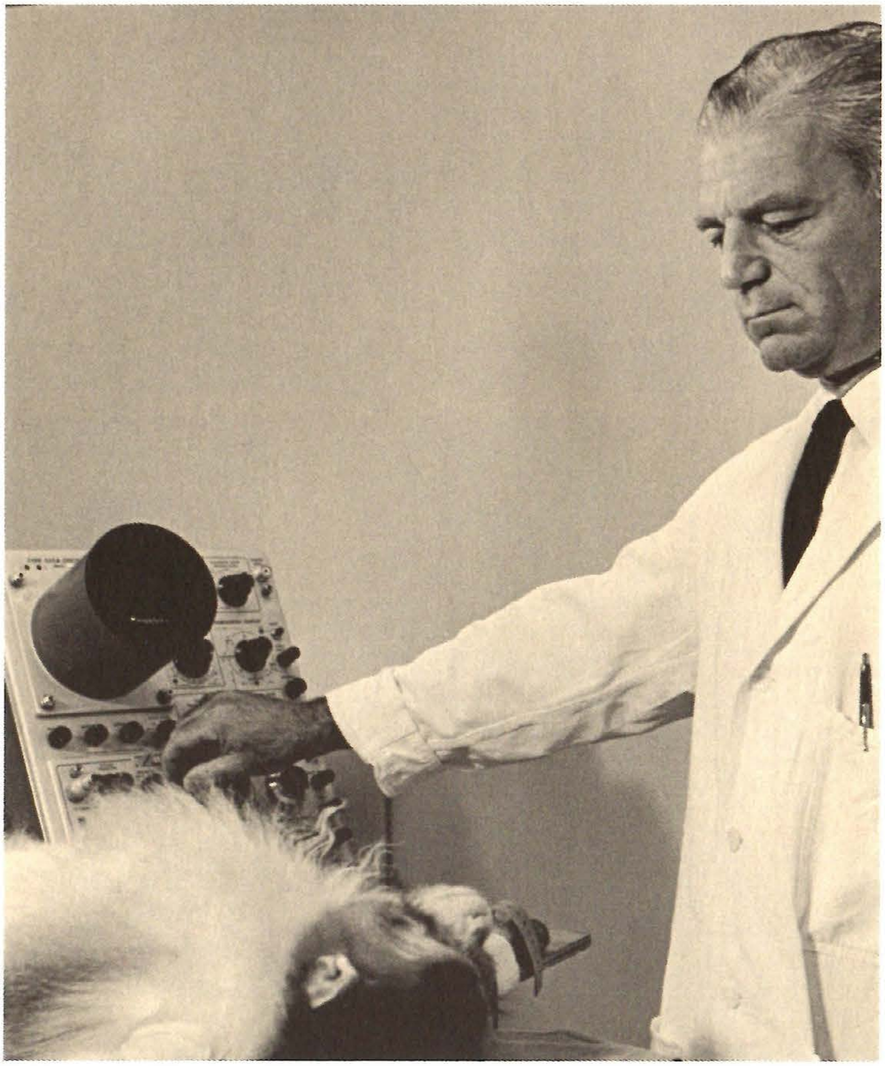
In other experiments, stationary electrodes are surgically implanted on the brain's surface, with external connectors. Although these fixtures, after implantation, are painless, subject animals need to be kept in restraining chairs or they tend to pick and paw at the connectors.

Dr. Roth uses rhesus monkeys, partly because a lot is known about them. Also, the rhesus will tolerate a restraining chair (at least 20 to 50 per cent of them will—all females.)

The chairs, restraining harnesses, arm-length gloves for animal handling and other special gear are not commercially available. They must be designed, and sometimes fabricated, by center people.

Monkeys bite. Any adult male is dangerous, Jack Warren says, so their canine teeth are routinely pulled; as a result, and because of the arm-length gloves, 99 per cent of the bites that occur are minor.

The animals that Jack and his two-shift crew tend include about 600 in the Colony building, mostly breeders. There are about 200 pregnancies a year. The ratio of male to female breeders is about 1:15 or 1:20.



DR. M. RENE MALINOW uses a Tektronix 535 oscilloscope in his studies of myocardial infarction. The scope monitors changes in the animal's ventricular pressure during artificial heart attacks. At right, Colony Director Jack Warren pokes his thumb playfully at a ring-tailed lemur in the Colony Annex, where the world's largest collection of prosimians is kept.

And, males are fussy; the process of matching compatible primates requires some savvy; a bad guess, and you may have to referee a vicious fight.

Of the center's 670 rhesus monkeys, 250 to 300 are breeders, and there are 150 to 180 pregnancies a year.

The center also may have the world's largest collection (about 200) of prosimians—animals resembling monkeys but less advanced on the evolutionary ladder. They include such odd types as the tarsier, lemur and loris, and require different diet, care and "climate" from other primates.

Environmental requirements vary. Prosimians need to be housed indoors, in 80-plus temperature. Japanese macaques, from a climate similar to the Northwest's, live outdoors all year.

Other primates studied at the center include Celebes apes, howler monkeys, several varieties of macaque, capuchins, cynomolgus and squirrel monkeys, all in smaller numbers than the rhesus.

Each new primate undergoes a two-month quarantine, and extensive testing. Diseased ones are not kept. Throughout their lives, animals are tested for tuberculosis monthly, because of their extreme susceptibility to it.

Responsibility for their physical well-being rests with Dr. Arthur Hall, veterinarian in charge of the Colony and clinical laboratories.

The two-acre corral for Japanese macaques, surrounded by an 11-foot fence, contains specially built superstructures on which the animals may climb. Two observation rooms above the fence look for all the world like stadium press-boxes.

The Colony building contains eight inside-outside units, which provide sun or shade in addition to roofed protection. The outside runs are 1250 square feet each, the inside areas 300 square feet.

Care and feeding of primates is quite a job—and absolutely vital to the center's function. Excellent health is a "must."

The animals—aside from some dietary modification for prosimians—are fed basically on monkey chow, a total-diet food, supplemented three times a week with apples. Pregnant mothers often get milk.

Infants likewise receive milk, and a somewhat more specialized diet. Those placed in the Colony nursery are the ones selected for some special continuing study. They're permanently separated from the mother shortly after birth; this is preferable—and easier on all concerned—than to pry mother and baby apart each time the youngster is needed, Jack explains.

To keep the primates as "typical" as possible, the staff tries not to make pets of any of them. (Some of the animals, however, somersaulting in their cages as a handler approaches with a handful of raisins, look suspiciously pet-like to an untrained observer.)

Attention given the animals is continuous. Each is weighed every two weeks. Blood chemistries are made regularly. Standards of sanitation, care and diet are high—and inflexible.

A diary is maintained for each animal, including medical and husbandry records and information on all the important events in its life. Background data is provided the investigator through a computer-based records system.

How long do primates live? The center hasn't been around long enough to say. Some primates over 30 years of age have been reported; no one seems to know how long a really healthy one can live. But one thing is sure: The longer the life, the more opportunity researchers have to gain beneficial knowledge.

So the work of the center goes on—an effort that is truly integrated, not only among the scientific disciplines but also between the researchers and supporting personnel—with as much attention given to the care of the primates as to the investigative effort itself.

And if the center doesn't often make headlines (its rural neighbors may still picture it as a kind of off-limits zoo), its contribution to basic knowledge nevertheless continues. The investigative effort is less likely to erupt in a startling breakthrough than to play an unsung but major role in the gradually improving health, longer life and more predictable well-being of, modestly, the greatest primate of them all—Man himself.

THE INDIVIDUAL

"If we draw our strength from the uniqueness of each individual, together we become more than the sum of our numbers"
—Tektronix philosophy statement, February 1962.

ANA HAAS
nothing exciting

Her real name is Anastasia. Her family lived in Russia before the revolution. A true cosmopolitan, she speaks several languages fluently, including Russian, German, Estonian and English.

But Ana Haas disclaims any other resemblance to a grand duchess. "There's nothing very exciting to write about me," she says quietly. "We try to work hard, be good citizens and earn the chance we got by coming here. That's all."

Her "not very exciting" life began in Russia. Her parents were Estonian, but her father was working in Russia when Ana was born. They returned to Estonia when she was six; she finished her schooling and was married there.

The Haases' first child, Aarne Taisto, was born in Estonia, in 1942. Just two years later, they left—the couple, their child and Ana's mother—only hours ahead of the entry of communist tanks and soldiers into the country. They knew what to expect when the Reds took over their homeland, and didn't stay to see it happen. The next six years were spent in displaced-person camps in Germany.

Their sponsor when they came to the USA was a former immigrant here whom they'd met in Germany. They reached this country with two small suitcases and many large hopes, and set about realizing those hopes through old-fashioned hard work and thrift.

Ana's husband found a job in his own profession, civil engineering. After a year in New York, his work brought them to the Northwest, a move Ana has found most satisfactory. Along with other transplanted Oregonians, she's convinced that this part of the world is the loveliest anywhere.

In 1951, Ana came to work at Tektronix. She started in Assembly in the shop on Hawthorne. When Tek moved to the Sunset plant that fall, she was building little amplifiers from the initial steps on through to Test.

She went on leave in 1953; her daughter, Ingrid, was born in June, and Ana returned to work in October. This time she worked in CRT, then a brand-new department. A nervous disorder in her hands and arms made it necessary to change jobs, so she took a short leave and then started in Finals, where she worked until 1964.

By this time her son had finished college, so Ana "retired"—temporarily. She returned to work, this time in Accounts Payable, in September 1966. Currently, she's helping in Billing through an extra-busy period. She'd done accounting work in Estonia, but had hesitated to try it here until she felt more at home with English—which she now speaks precisely.

Ana and her husband have gone far toward the goals they set when they came to the USA. Their son was graduated from Beaverton high school as a National Merit Scholarship finalist, received his BS in physics from Reed College, volunteered for the Air Force and received additional training there. He's now a first lieutenant working with guided missile systems. Their daughter is a freshman in high school, excels in several subjects (including accelerated classes) and enjoys a variety of extracurricular activities.

"We try to work hard, to be good citizens," says Ana Haas.

BOB NEWBERRY

taxes, taxes

When Tektronix President Howard Vollum was visiting the Oregon Legislature at Salem, Speaker F.F. "Monte" Montgomery warmly praised the exceptional work done by one Tek employee at the legislature.

Bob Newberry (Tax manager) served the 1967 session as tax consultant to the House Taxation committee, at Monte's request, and on loan from Tek.

Bob's career in economics, however, began about eight years ago when he transferred from Personnel—where he was an Employment interviewer since he came to Tektronix in June 1956—to Finance, as a statistician. Three years later he was appointed Tax manager.

In that position, Bob keeps himself apprised of tax laws and pending legislation, and informs management about their effects on the company. Being chosen consultant to the House committee was a direct result of the impressions of his competence created by his many appearances before legislative and interim committees.

His job also involves coordinating tax returns and payments to all the states in which Tektronix has offices, the United States and foreign countries.

Bob came to Tektronix just one day after he recived his Bachelor of Science degree in economics from Lewis and Clark college. However, his college career—unsucessful at first—began in 1950, when he enrolled at the University of Vermont.

"I didn't work at it," he says. "And, after a year, I enlisted in the US Army."

He was commissioned a year later as a second lieutenant, and assigned to the 509th heavy tank battalion.

When he left the Army in the fall of 1953, he came to Oregon, where his father was a physician with the Bureau of Indian Affairs, responsible for health and medical care of the Indian tribes living in the northwest.

Bob liked Oregon and decided to stay here. But, unsuccessful in trying to get a job with a future without a college degree, he used the GI Bill to return to school, and enrolled at Lewis and Clark.

After transferring half a year's college credit from the University of Vermont, he graduated from Lewis and Clark in two and a half years by going to school nights and attending summer school. And, he held down a full-time job at the Beaverton post office besides.

Bob enjoys hunting, fishing and working around the house—although he doesn't have much time after working at Tektronix, in the State Capitol and on a number of committees.

He has limited his membership in outside organizations to four groups: Bob is president of the Portland Chapter of the Tax Executives Institute, a member of Washington County Public Affairs Forum and represents Tektronix on the Taxation Committees of Associated Oregon Industries and Portland Chamber of Commerce.

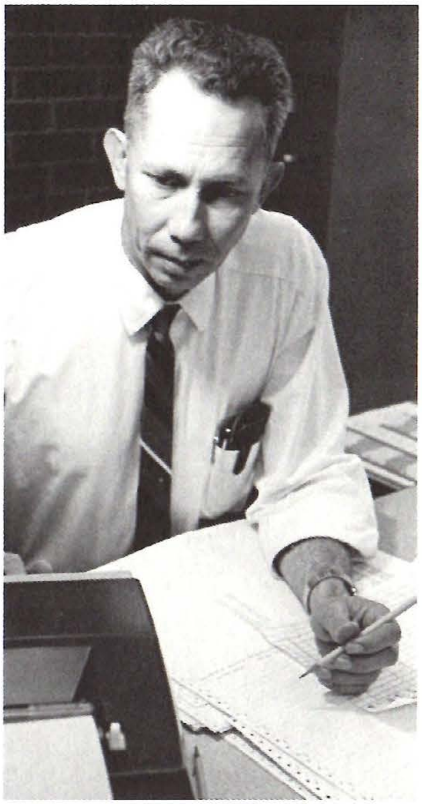
"I'm not a joiner," he says. "In most organizations, five per cent of the people do all the work. I don't have the time to be among the five per cent, and I don't want to be part of the other 95 per cent."

Born in Milwaukee, where he attended grade school, Bob is a graduate of Central high school in Washington, D.C. He attended two other high schools when he was living in Pennsylvania and Maryland.

Bob and his wife, Barbara (who was the Key Punch manager at Tektronix before they were married in May 1965), and her two children by a prior marriage live in the Cooper Mountain area, about four miles west of Beaverton.

BILL IDZERDA

close to heaven



On November 29, 1957, the United Nations rejected a proposal for new Dutch-Indonesian negotiations over West New Guinea, retained by The Netherlands after The Netherland-Indonesian Union dissolved in 1954. Indonesia's government, as a result, stepped up the seizure of Dutch properties estimated to total more than one billion dollars in plantations, shipping, banks, trading concerns and other investments. About 46,000 Dutch citizens left; among them were Bill Idzerda and his family.

Bill, now the Test/Final accountant, is a native of Indonesia. He was born in East Java, attended grade and secondary schools (which operate on a European basis) there, and graduated in 1941. As a result, he is proficient in Dutch, Indonesian, French and German.

Soon after he graduated in 1941, World War II began. He, like almost everyone else in his age group, went into the Dutch army. When the Japanese overran Indonesia in 1942, Bill was taken prisoner. Later, when he was in a PW camp in Singapore in late 1943, Bill says, the one thing he remembers most was that an American plane flew over the camp and dropped book matches that read "I shall return," signed by General MacArthur. Bill said this gave him hope that someday the war would end.

He was liberated in 1945; only about 50 per cent of the camp's prisoners survived.

Bill reenlisted in the army, returned to Java and, after a time, found his family. He left the army in 1948.

He went to work for Borneo-Sumatra Trading Company, which was primarily engaged in importing and exporting. "It wasn't hard to find a good job in Indonesia at that time, if you had finished school; you were on top. It was sort of like if you had one eye and everyone else was blind."

Bill worked for the company 10 years as a salesman, assistant sales manager, division sales manager and, finally, manager of the central sales division. (He points out that these jobs, impressive-sounding to Americans, were just ordinary opportunities for anyone who had schooling.) He left when the company was nationalized.

In 1958 he went to The Netherlands, along with thousands of other refugees. He worked for the city of Amsterdam in an agency similar to our state unemployment service.

By 1960 the refugee problem was becoming acute in The Netherlands, due to both job and housing shortages; Bill and his family were living with his wife's parents. The refugees were asked if they would like to emigrate; Bill chose to do so. At first he thought about Australia, but his church was connected to the Church World Service, which had a plan to bring refugees to the US; also, the US gave an extra quota to The Netherlands.

He was asked **where** in the US he preferred; he said, "Anywhere that's not too hot or too cold." They asked, "How about Portland?" So Portland it was, although Bill had never heard of Portland.

He and his family arrived here April 15, 1960, after a long boat and train trip. The family has lost most of its personal belongings in the January 1960 flood in Holland.

Bill was willing to accept any kind of job; so he got one sweeping floors at Emanuel Hospital in May 1960. He also took an aptitude test, which indicated he was very good with math. In the fall of 1960, he started taking night courses at Portland State in accounting, and continued for two years. (He later took one year of speech there. Also, he has taken 14 Tektronix Education Program courses.)

In the meantime he kept hearing about a place called Tektronix. Everybody was saying it was a good company and a good place to work—even people who didn't work here, or even know what Tek made.

He came to work here in June 1961 as a janitor, but shortly got into accounting in the Manufacturing area.

Since Bill arrived here, about 50 members of his and his wife's families have also settled in the Portland area. His main problem, he says, is remembering birthdays.

Bill, his wife, Maud, and three older children, Zeno, Xenia and Yves, are now all naturalized citizens. Zeno and Xenia were born in Jakarta, Indonesia, and Yves in Amsterdam. The youngest boy, Warren, was born here; Bill calls him "the real American."

Bill is an avid fisherman, and will prove it with impressive pictures of his catches. He is also active in Boy Scouts and Toastmasters.

He says Oregon has about everything you could want — woods, mountains, rocks, fresh air, water—everything: "A lot of people say Oregon is as close to Heaven as you can get."

And he looks like he agrees.