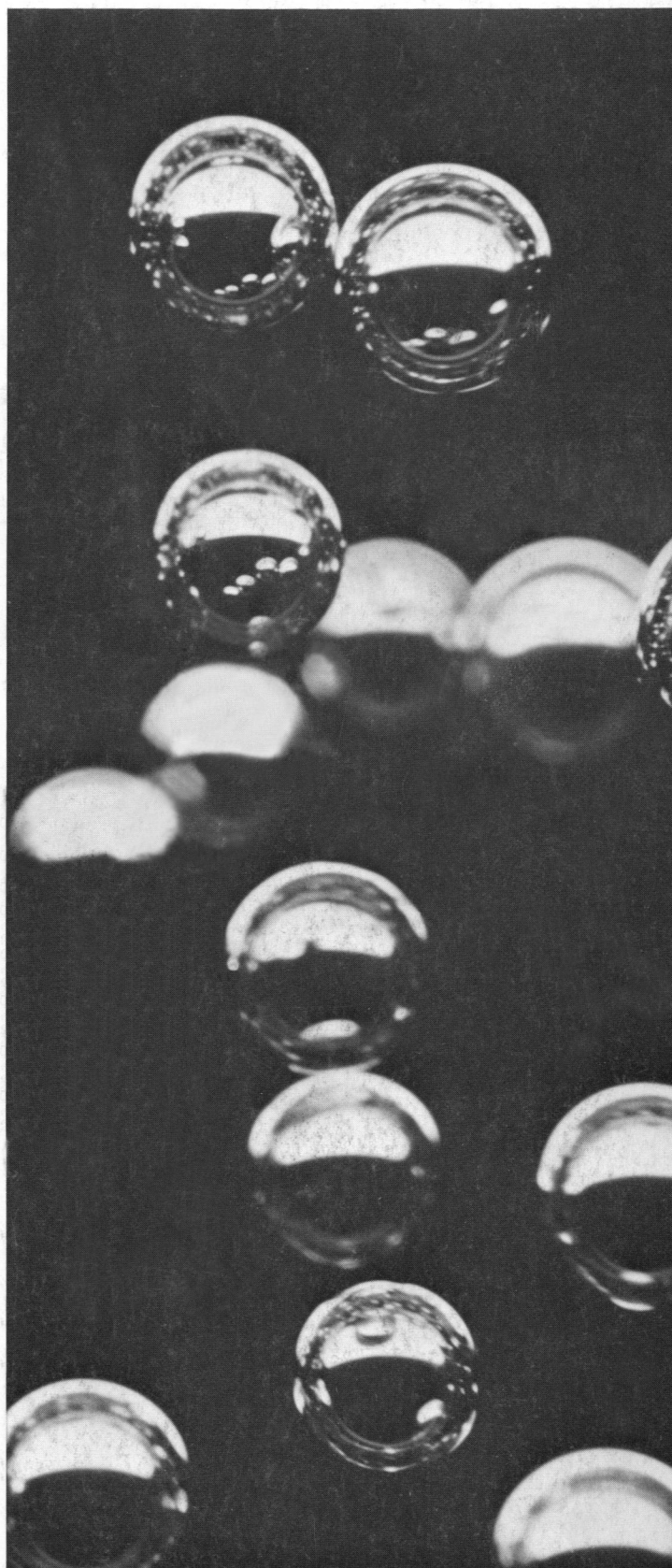
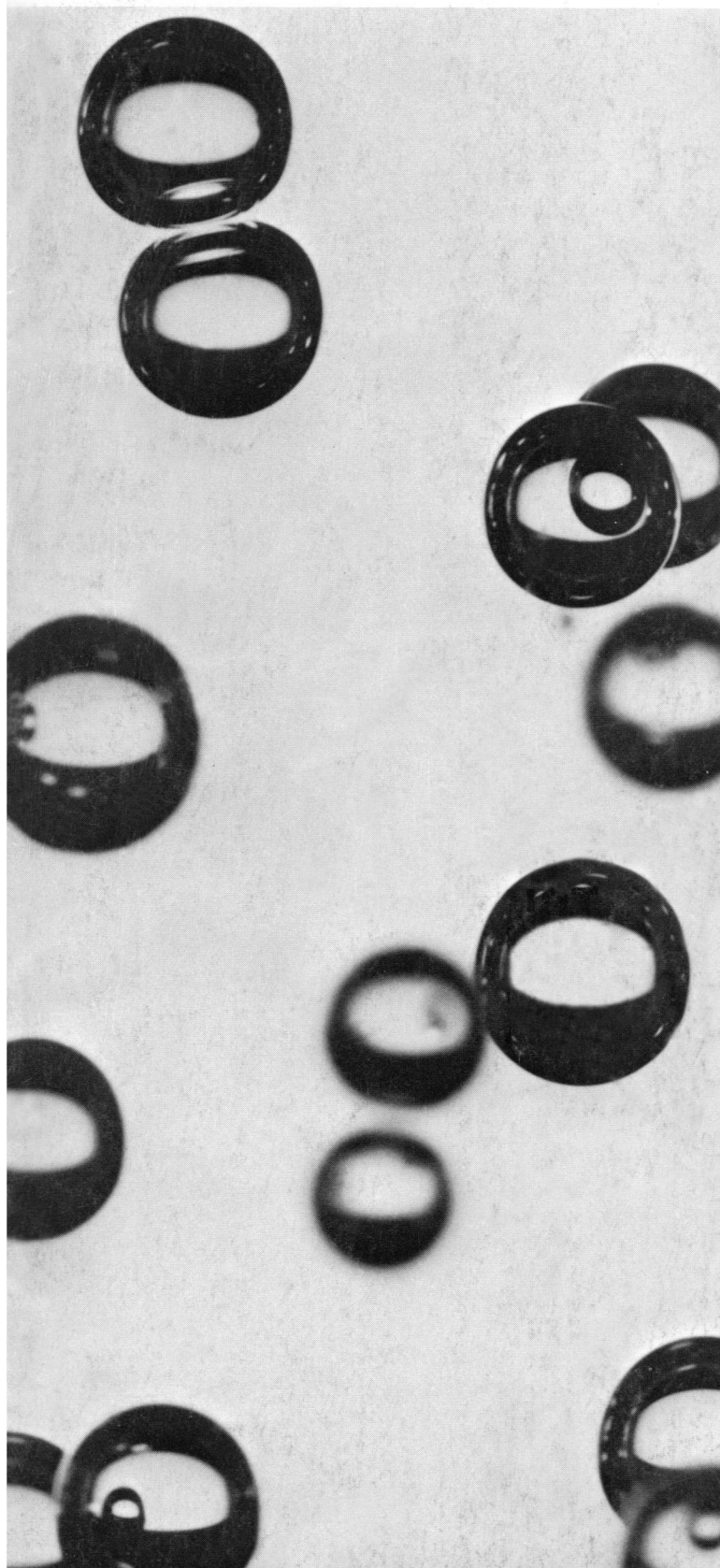


SCIENCE

1 November 1974

Vol. 186, No. 4162

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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Oil on the water

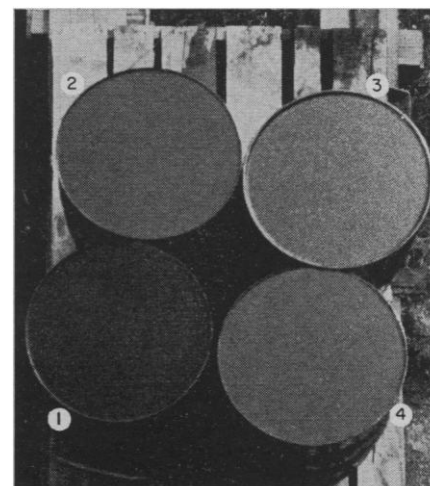
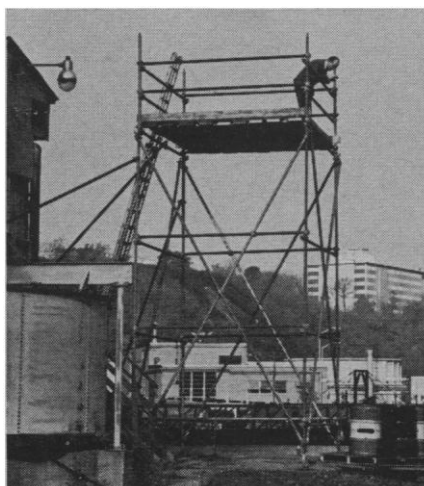
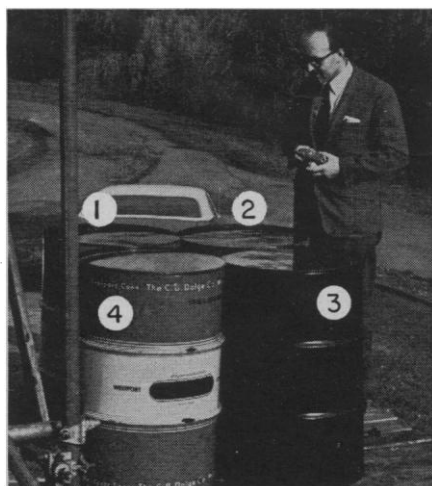
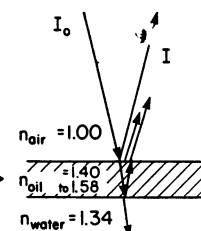
Visually it was not detectable. But you don't need special film. We used ordinary KODAK PLUS-X AEROGRAPHIC Film 2402 (ESTAR Base) with an ordinary KODAK WRATTEN Filter, No. 39. The camera lens should transmit down to about 340 nm. Some do, some don't.

It was only a few gallons of diesel fuel that got away from someone up the Genesee River. The Coast Guard had declared it properly cleaned up, and indeed it was. No tale of horror, no villain. The oil-on-troubled-waters bit did not apply. To create a conspicuous oil slick that smooths the ripples requires a certain deplorable thickness. Far less thickness is required for this —

Normal reflectance from an oil-free water surface runs around 2%; from an oil surface of refractive index 1.44, around 3%. If the oil layer contains heavier components at its bottom, reflectance from the second surface could run as high as 0.7%. Fluorescence from benzenoid components in the oil, added to the reflections from the two surfaces, can bring up the return radiance to 4% of incident, if viewed at the right wavelengths. That's twice as much as from oil-free water.

And there we are, well within the ability of conventional photography to discriminate.

And there it was, slipping into Lake Ontario past the river mouth, not long after we had completed some studies with a set of internally blackened drums of river water bearing (1) nothing, (2) diesel fuel, (3) gasoline, (4) spent lubricating oil:



We have some indication that plots of density difference between oil and no-oil as a function of solar angle are characteristic of the kind of oil, but we are not sure enough to blow bugles (or whistles). We are, after all, only photo technologists. Other technologists who want to try confirming, denying, or extending are invited to correspond with E. G. Tibbils, Technical Photography Markets, Kodak, Rochester, N. Y. 14650.

Not all oil on water is of man's doing. Sometimes it might just encourage man to start probing around.



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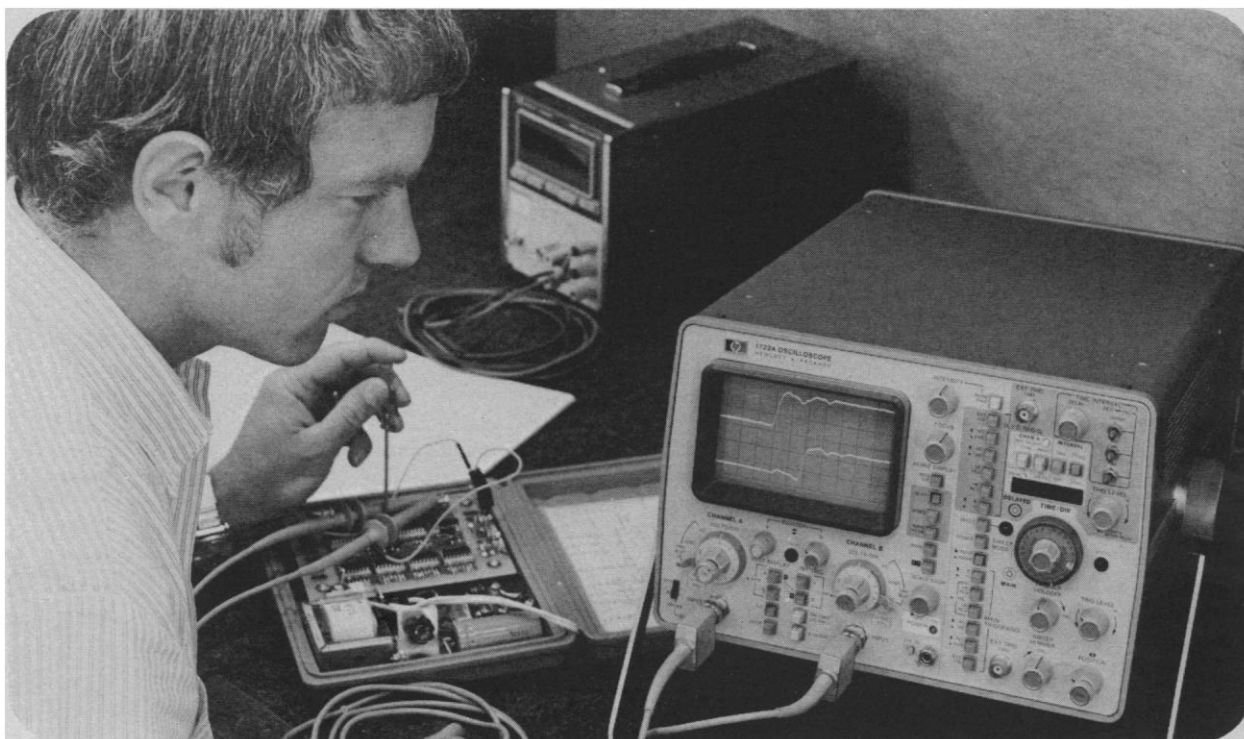
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The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER

Bubble formation and growth in ordinary gelatin is used as a model for decompression sickness (the bends). Results suggest methods for improving the safety and efficiency of diving. (Actual size of bubbles is about 0.8 millimeter in diameter.) Within the bubbles (right) can be seen images of adjacent bubbles. See page 443. [Theodore L. Bell and Richard H. Strauss, University of Hawaii School of Medicine]



The first smart oscilloscope: an introduction to the “new measurement” technology.

Hewlett-Packard’s “new measurement” technology radically changes the traditional relationship between man and machine. It does so by giving the machine some of the intelligence previously supplied by the human operator. It creates “smart” instruments that can monitor their own operations, detect and avoid procedural errors, perform all the necessary computations, and directly produce the desired final answer.

As a leading manufacturer of both measurement and computation instruments, we know that it’s possible to make many kinds of “smart” instruments—right now—through a marriage of separate measurement and computation instruments. And we know that such a marriage results in unique advantages that far outweigh its cost.

The new HP 1722A oscilloscope is the most recent case in point. Its development started, typically, with a choice of candidates for the marriage. For measurement, we chose our 1720A scope, a 1.3 nanosecond rise time, 275 MHz bandwidth, dual-channel instrument; and for computation, the digital microprocessor originally developed for the HP-35 pocket-sized calculator.

It was clear from the outset that the proposed instrument could not realize the full potential of microprocessor control if the scope were limited to state-of-the-art single delayed sweep capability. So the marriage was put off while our designers developed the technology for *dual* delayed sweep. In the 1722, this new two-dot system operates under microprocessor control to keep track of any two events automatically, whether they originate on the same or different channels.

With its combined measurement and computation capabilities, the 1722 is clearly in a class by itself, the first of a new generation of “smart” oscilloscopes. It can make time interval measurements more accurately than has ever before been possible with an oscilloscope. The 1722 also avoids the numerous errors that can creep into conventional scope measurements: it never misreads control settings, never misses events, and its automatic lock-out systems prevent most wrong interpretations.

The 1722’s built-in computation provides final answers—directly, digitally, and automatically—for frequency, instantaneous voltage, and relative amplitude measurements as well as for dc voltage and time interval.

Priced at \$4500*, the 1722A is ideally suited for clock phasing measurements in large computer systems. It also easily qualifies for less demanding applications where its speed, convenience, and automation more than justify its moderately higher cost.

“New measurement” technique completely characterizes telephone circuits in two minutes.

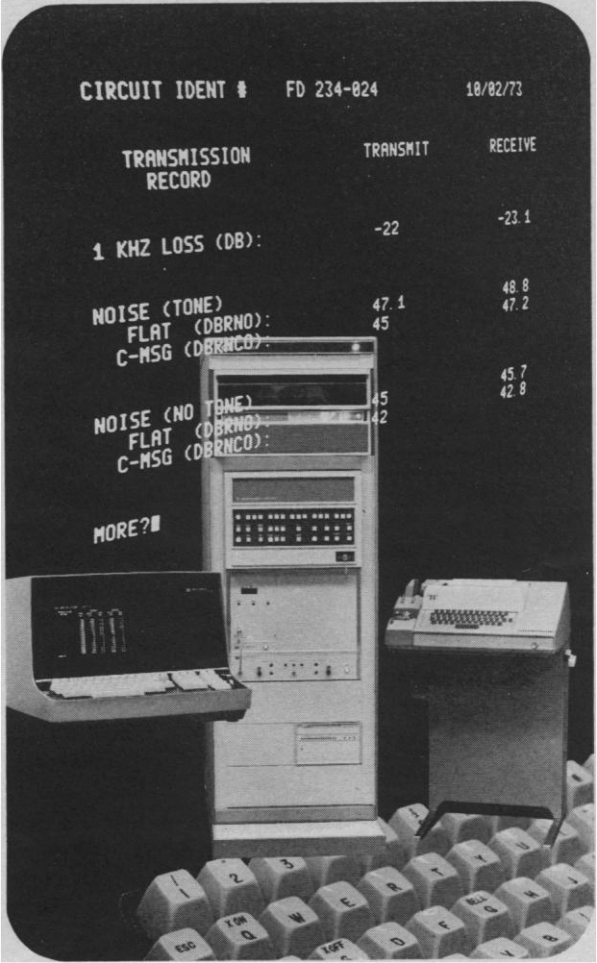
Time was when human operators kept a day-to-day, even minute-to-minute appraisal of the transmission quality of the voice channels maintained by the nation's telephone companies. In those days a transmission test was simply a matter of saying “Can you hear me?”

With the advent and increasing use of voice-band circuits for data communication, the human ear no longer provides an adequate test. And with the increased use of direct distance dialing, operators rarely observe, much less report on, the condition of channels. Attempting to assure the day-to-day quality of these circuits by manual tests is an extremely expensive and nearly impossible task for the telephone companies, since there are thousands upon thousands of circuits in daily use and each manual analysis can take hours of several skilled craftsmen's time.

The new HP 5453A Transmission Parameter Analyzer substantially eases this problem. A computerized measurement system, the TPA provides comprehensive characterization of the two-way performance of a voice channel in less than two minutes. Operating without any of the complex analog devices usually associated with test systems, test personnel need only minimal training and experience.

Computer-generated test signals are transmitted over a channel; distortions that occur to signal frequency, phase, amplitude, and spectral content are measured, and from these the voice-band circuit quality is automatically calculated. Results are displayed by CRT terminal or hard-copy printer, and can be optionally stored on magnetic disc memory for later recall and analysis. They can be compared automatically with stored criteria to detect changes in transmission quality. The speed, simplicity, and data handling ability of the TPA make scheduled maintenance procedures technically and economically feasible, and result in improved data communications.

The TPA will not soon become obsolete. Since its ability to adapt to changing requirements is not tied to hardware, new tests and analyses can



be added simply by changing software. TPA is priced at \$59,500*.

This system is a recent example of Hewlett-Packard's “new measurement,” which combines computation with measurement. For users, the “new measurement” makes a profound difference. It gives answers you really need; not just intermediate data.

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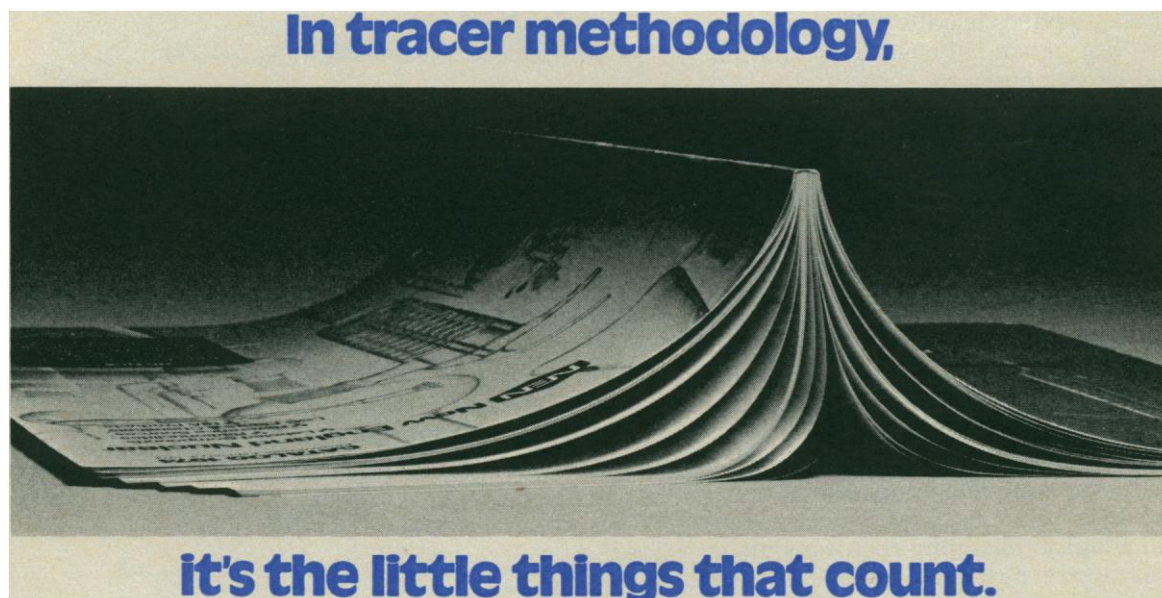
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Whither the New Public Urban University

Since World War II several state universities have established major urban campuses. These institutions are destined to differ markedly from the older state universities predating the urban crisis.

These new public urban campuses were designed by the faculties of established institutions as near replicas of the older campuses. The organizers recruited faculty members who, like themselves, had solid credentials in the liberal disciplines and professions and expected to participate in productive scholarship and strong graduate programs. The designers erected libraries, union buildings, and classrooms in proportions similar to those on existing campuses. In acknowledgement of the urban locations, they sometimes appended colleges of urban affairs or departments of ethnic studies onto otherwise familiar patterns.

That design has not proved adequate to the urban challenge partly because the students on these new public campuses represent different strata of American society than do the students on the parent campuses. The family incomes of students on the urban campuses are less than those of students on the established campuses. The urban students spend more time in remunerative employment and in commuting and have little remaining for athletics or production of student newspapers. The cultural environments of the two kinds of campuses differ accordingly.

Urban campus students are primarily commuters, usually living with parents, whereas those on the established campuses live in dormitories, fraternity houses, or other quarters away from parents. Typical residential campus opportunities for interactions with peers (extracurriculars, dormitories, fraternities) rarely are available to urban students who seriously overcrowd the available union buildings. But for commuter campuses, where students would spend only part of a day, the designers must have felt that union buildings of conventional size would be more than adequate.

Urban undergraduates evince little interest in urban studies or other nontraditional curricula. Far fewer of their parents attended college and many, if not most, arrive on campus with a limited view of the options of higher education. They come to college not seeking a liberal education but to enter conventional careers—to become accountants, physicians, teachers, lawyers, architects.

In addition to other important and significant obligations of the new public urban institutions, they must meet the current needs of this different study body. Can today's faculty members with a strong commitment to traditional higher education and a strong affection for residential campuses provide the requisite leadership for the reorientation of the public urban universities?

I think the answer is yes. A little more than a century ago faculty members with a strong commitment to theological and classical studies participated effectively in developing pragmatic agricultural and engineering programs with noteworthy, though different, standards of excellence. The public urban universities' potential contributions are no less important. For those potentialities to become realities, a reassessment of strategies and goals is imperative. To recognize that the public urban universities of tomorrow will differ as much from their progenitors as the land grant colleges of the 1860's did from theirs is an important ingredient in that reassessment. The successful leaders of these new urban campuses will be those who understand the legitimacy of that difference and are prepared to encourage the requisite fundamental changes.—ARNOLD B. GROBMAN, *Special Assistant to the President, University of Illinois, Box 4348, Chicago 60680*

Western Electric Reports:

Laser drilling. We do it with mirrors.

Thin-film circuit boards in high capacity telephone transmission systems often require hundreds of connections to power and ground sources.

Plated through-holes have proven an efficient way to make these connections. Coated with conducting material, they connect the circuitry carried on one side of a ceramic substrate with power and ground on the other side.

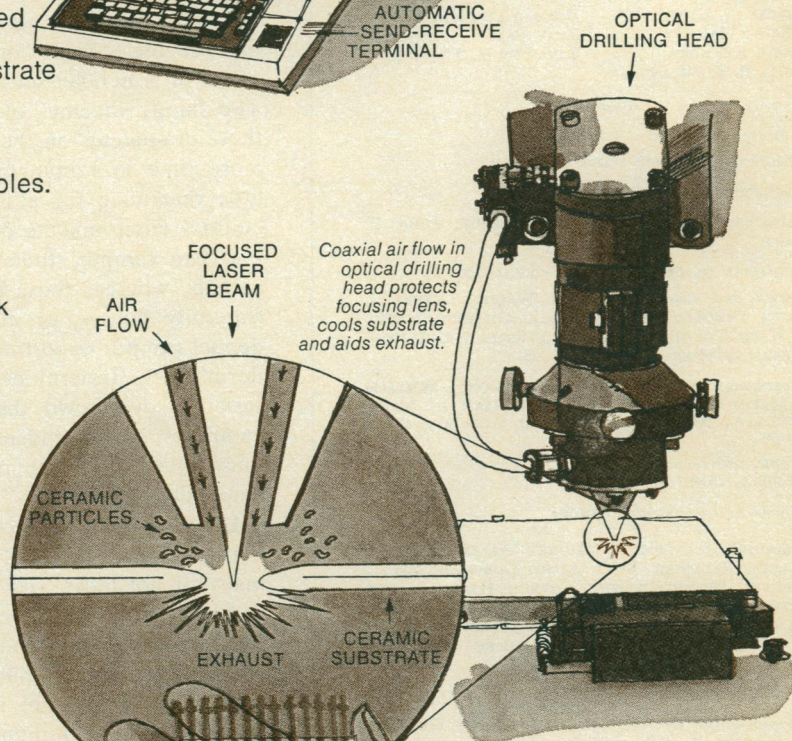
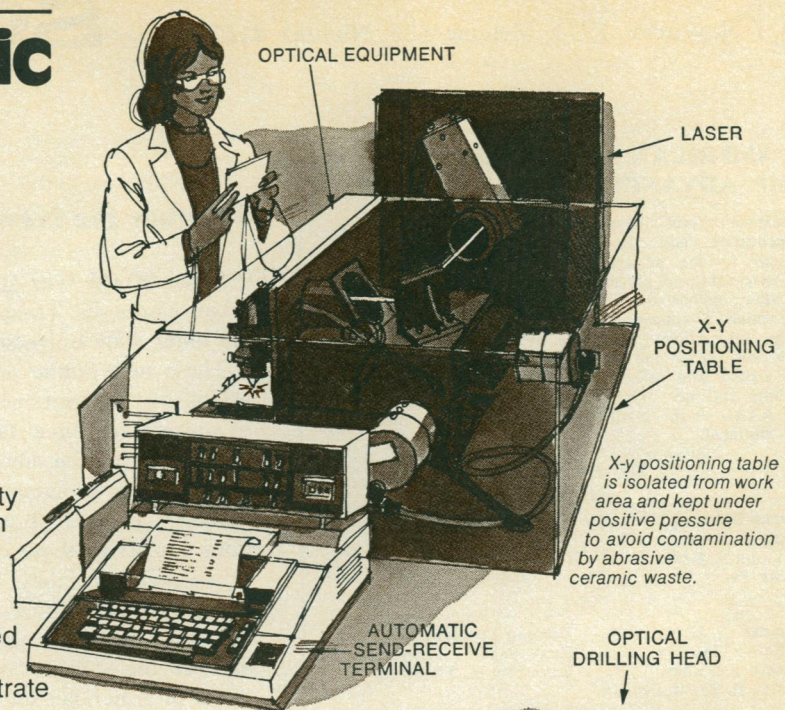
These holes could be punched in the ceramic before it is fired. But shrinkage during firing can move the positions of the holes.

And because of component density, the precise placement of each hole is critical. It can't be more than two mils off.

Engineers at Western Electric's Merrimack Valley Works in Massachusetts recently developed a high-speed method of drilling these holes *after firing* by using a conventional CO₂ laser.

A complex of mirrors on an x-y positioning table is shifted to play the laser beam across a stationary ceramic substrate in a predetermined pattern. The mirrors direct the beam from the laser head enclosure to the positioning table and manipulate it in the x-y axes. An optical drilling head coupled to the table focuses the beam onto the ceramic. The system is controlled by a mini computer coupled with an automatic send-receive terminal. Pattern storage on a cassette tape allows easy changeover and storage.

Benefit: Laser drilling of ceramic substrates after firing has greatly improved positioning accuracy of plated through-holes. And computer controlled laser drilling has doubled the production rate over conventional laser systems—up to five holes a second in closely spaced patterns.



Laser drilled through-holes supply power and ground to active devices on completed hybrid integrated circuit.



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