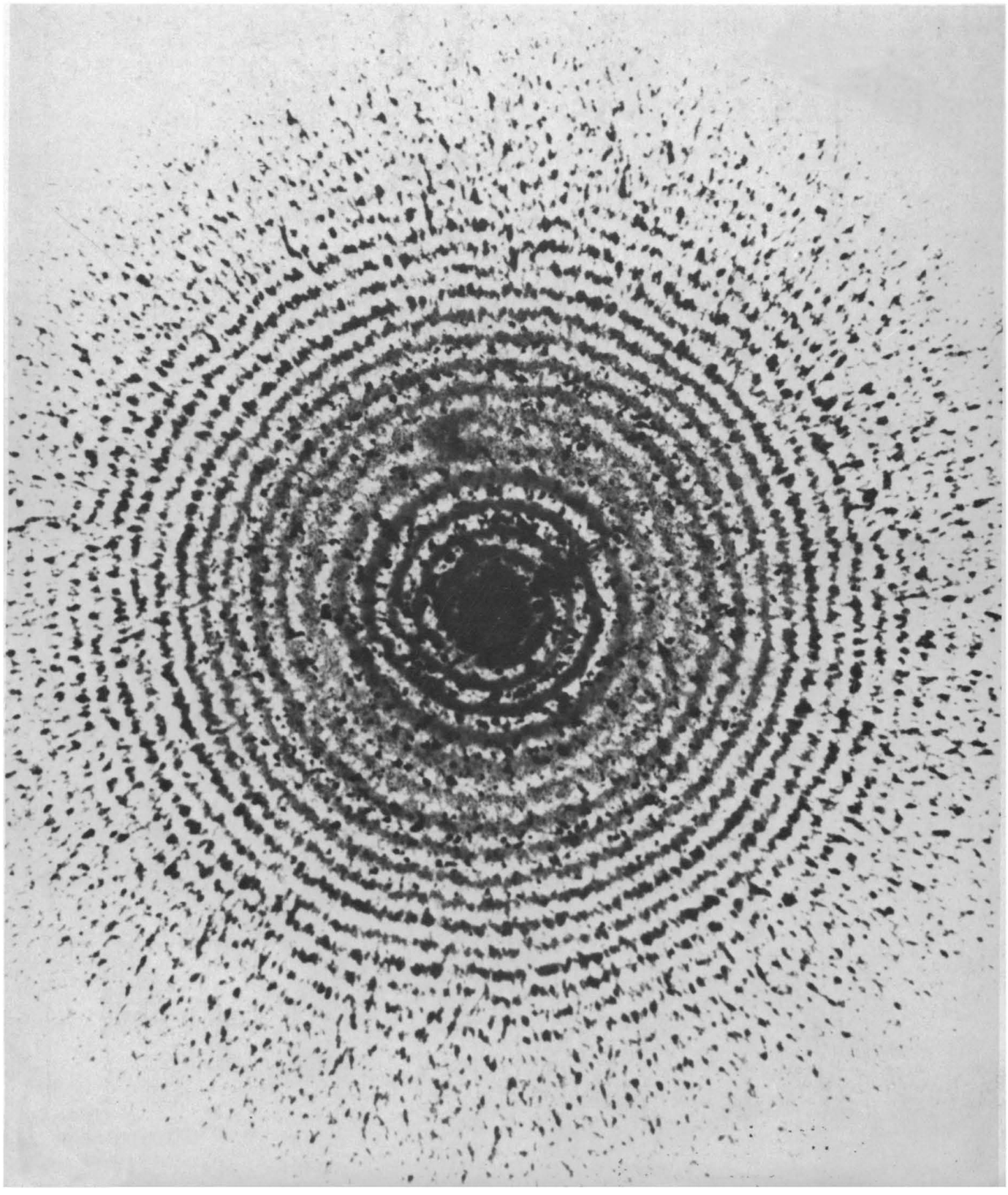
SCIENCE 7 November 1969
Vol. 166, No. 3906
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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7 November 1969
Vol. 166, No. 3906

SCIENCE

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COVER

Culture zonation in the fungus *Nectria cinnabarina* in the form of a single Archimedean spiral (× 6). See page 763. [J. A. Bourret, California State College at Long Beach]

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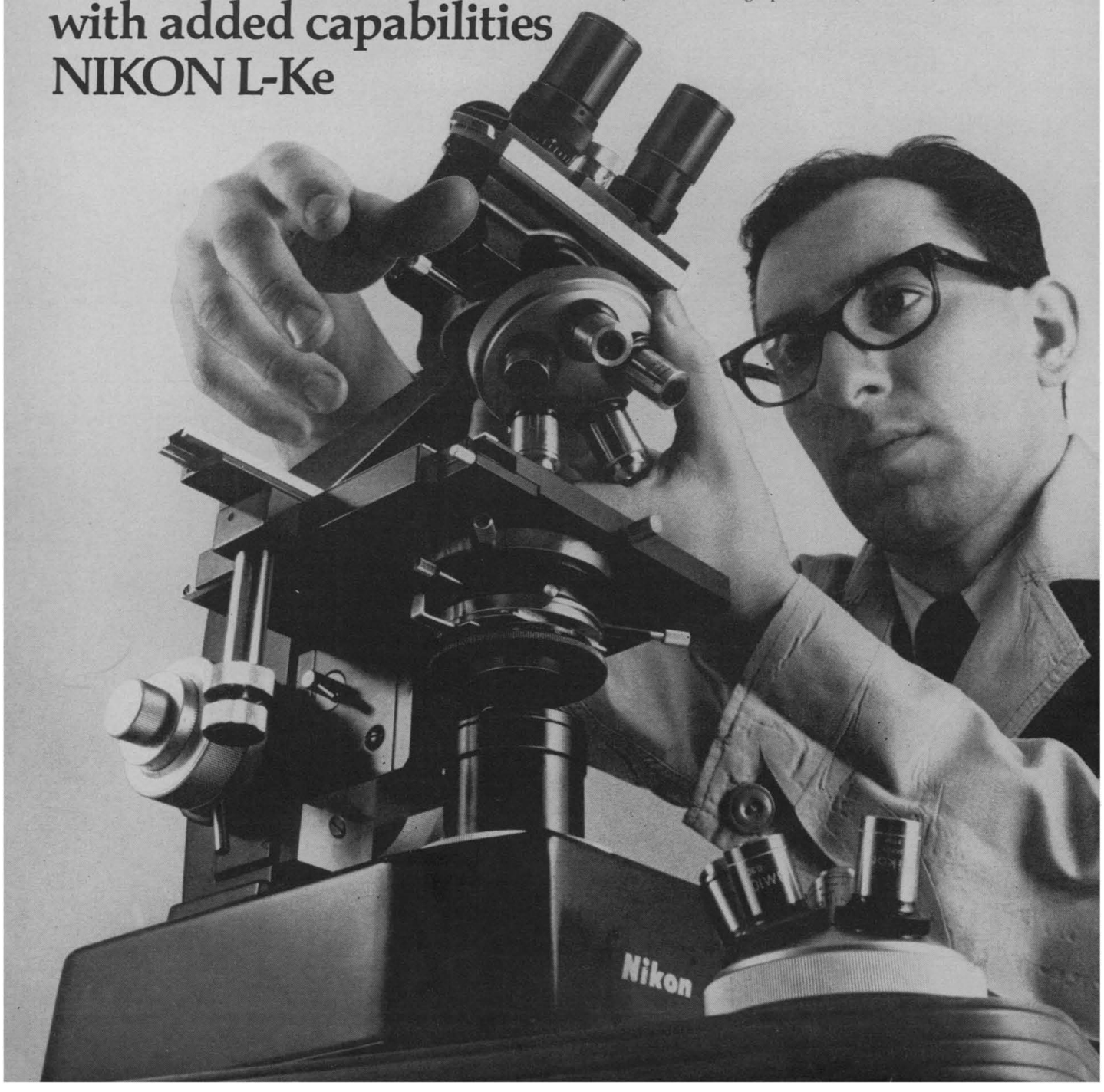

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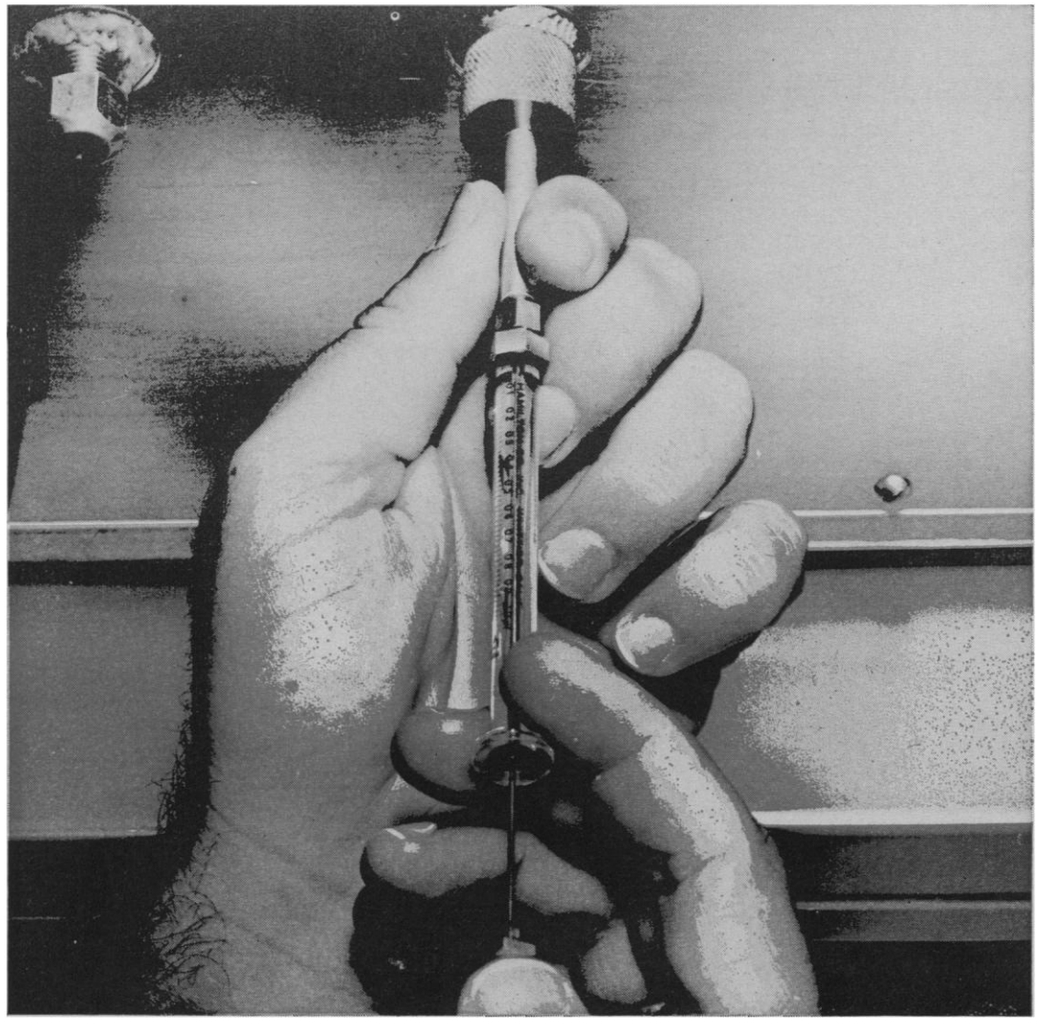

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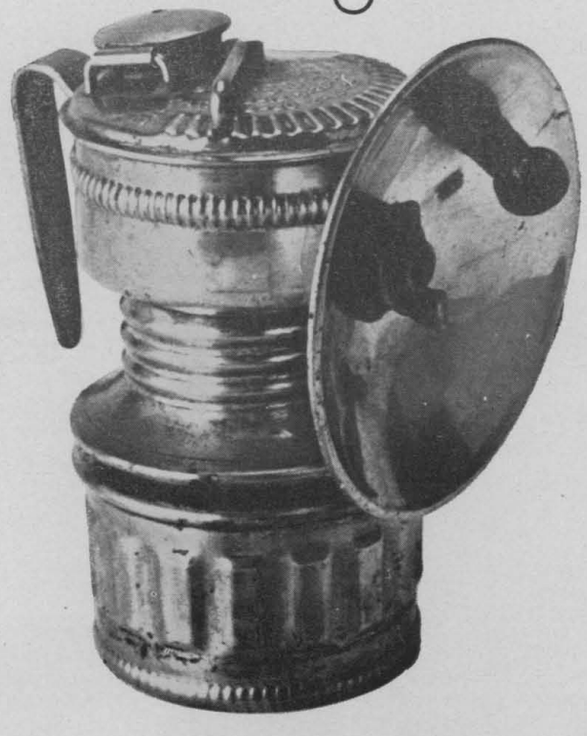

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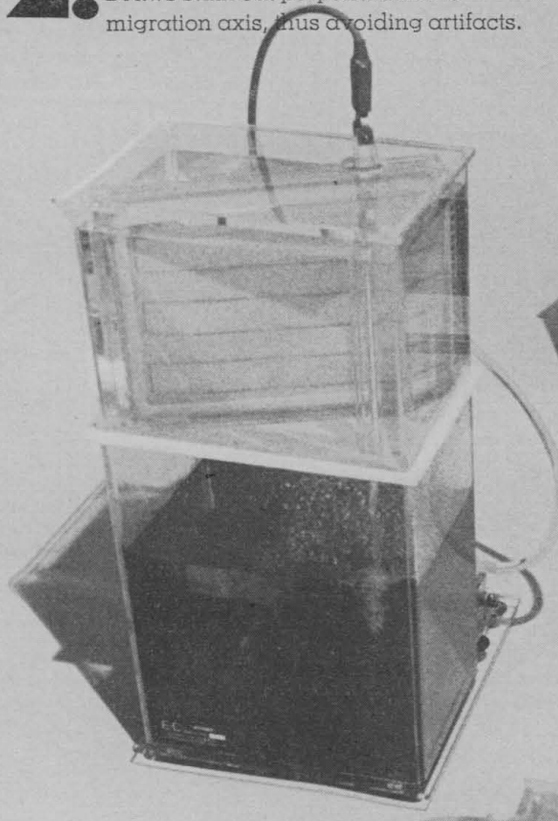

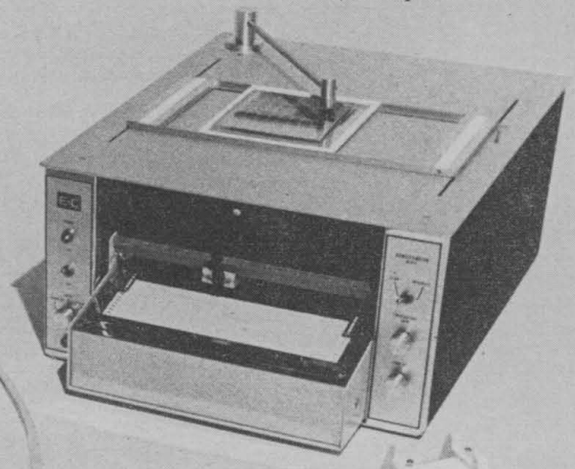

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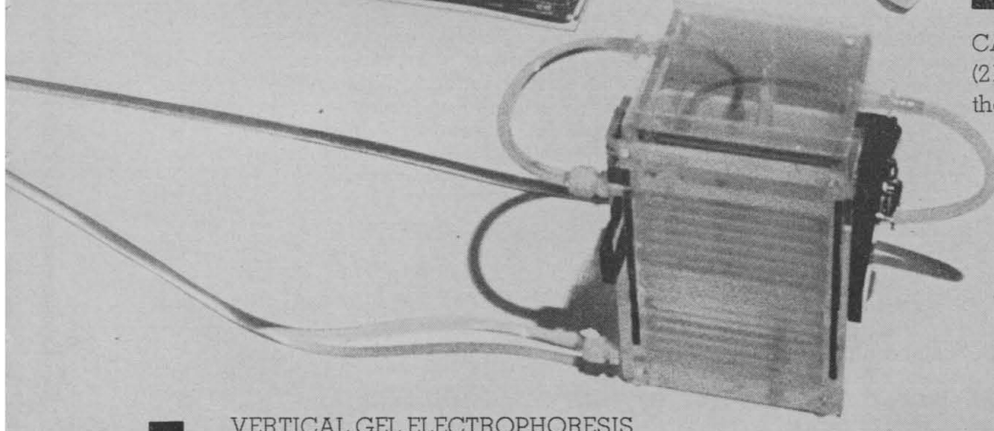

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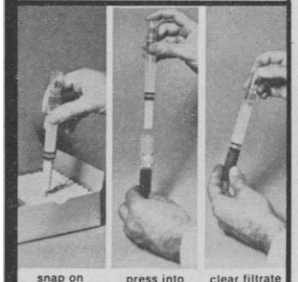

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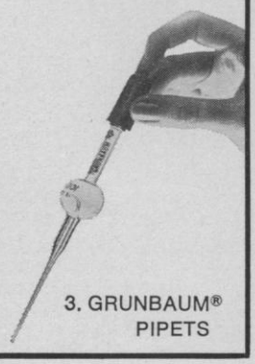

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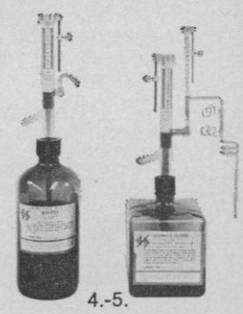

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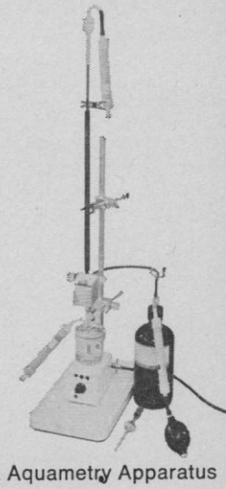

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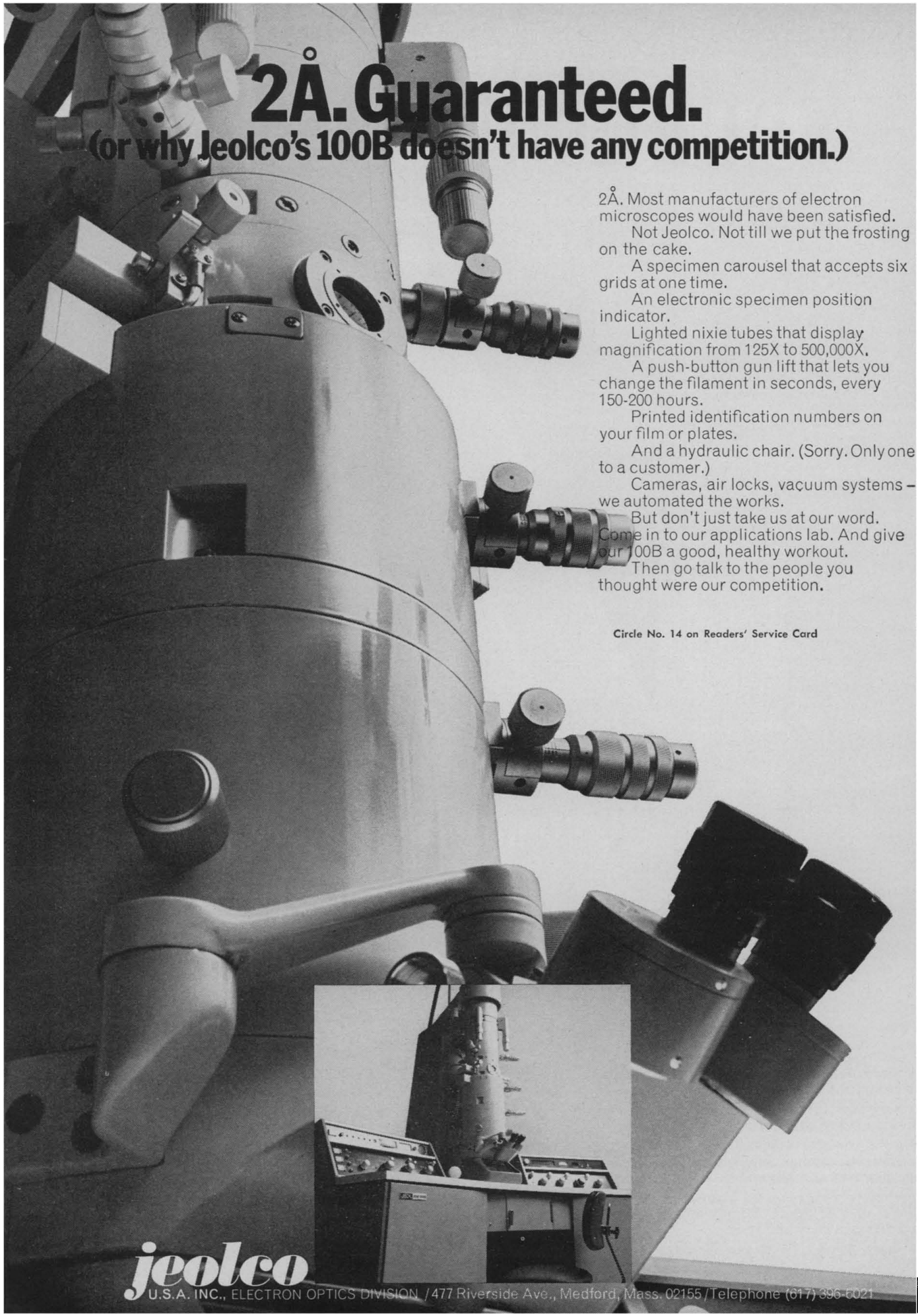

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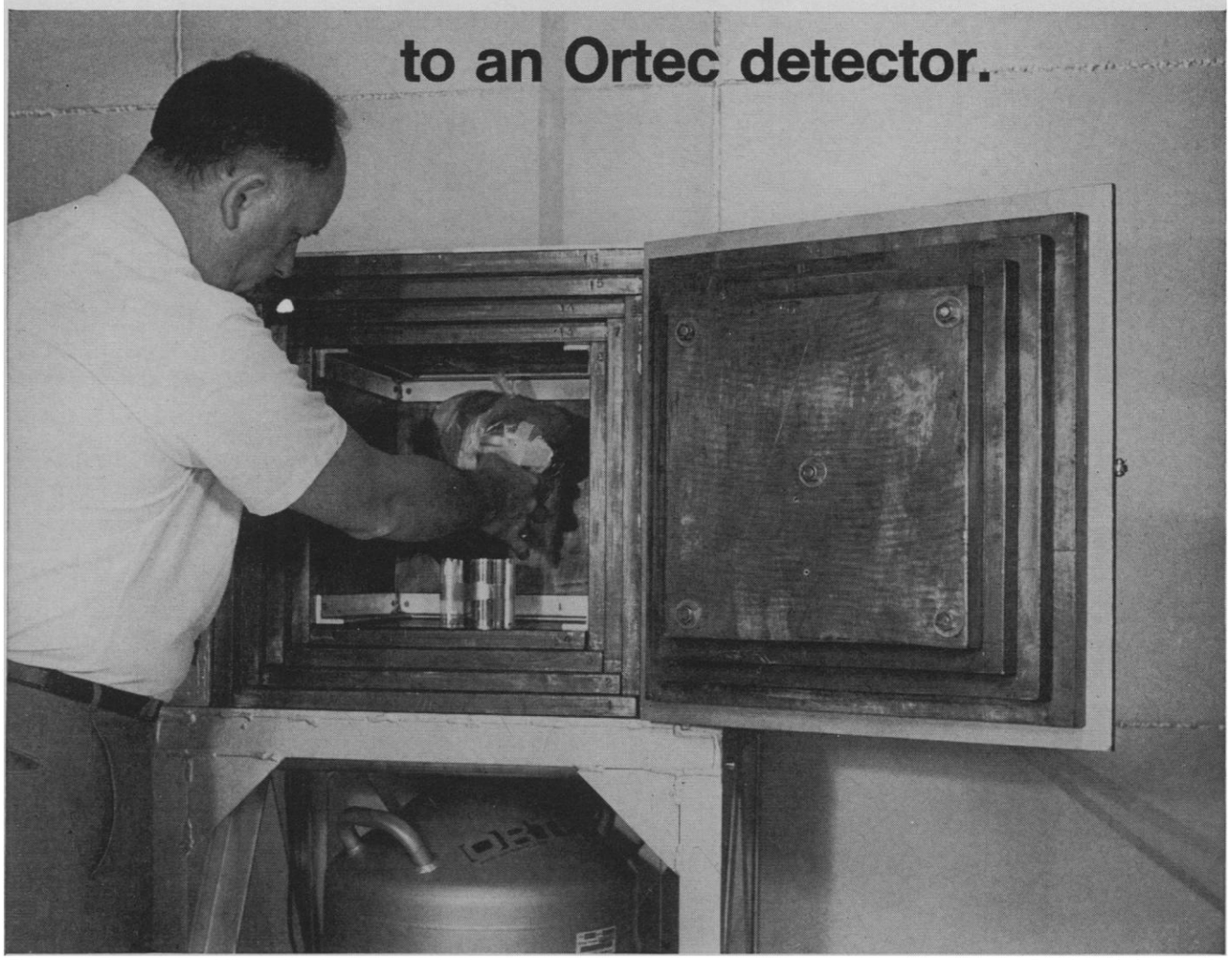

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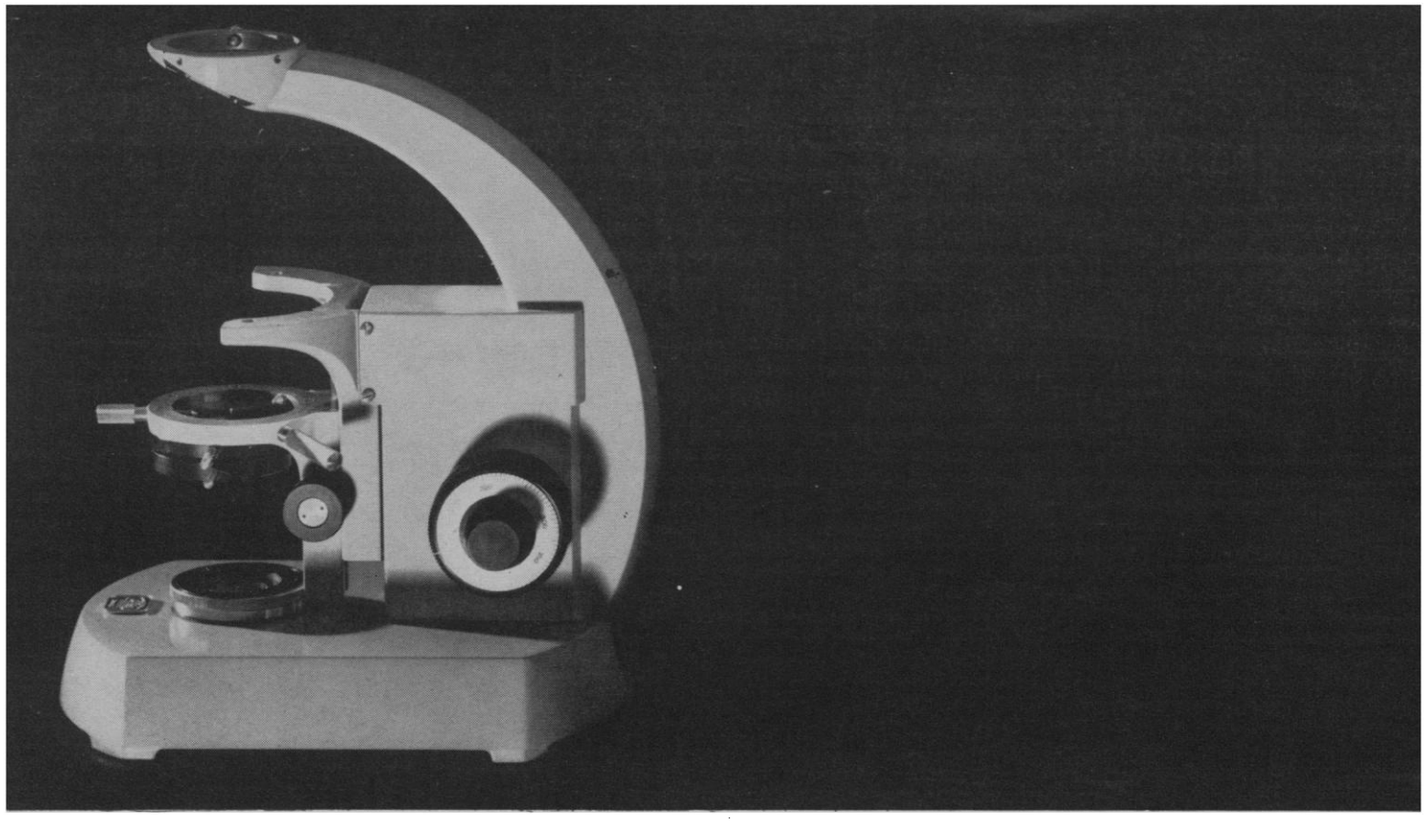

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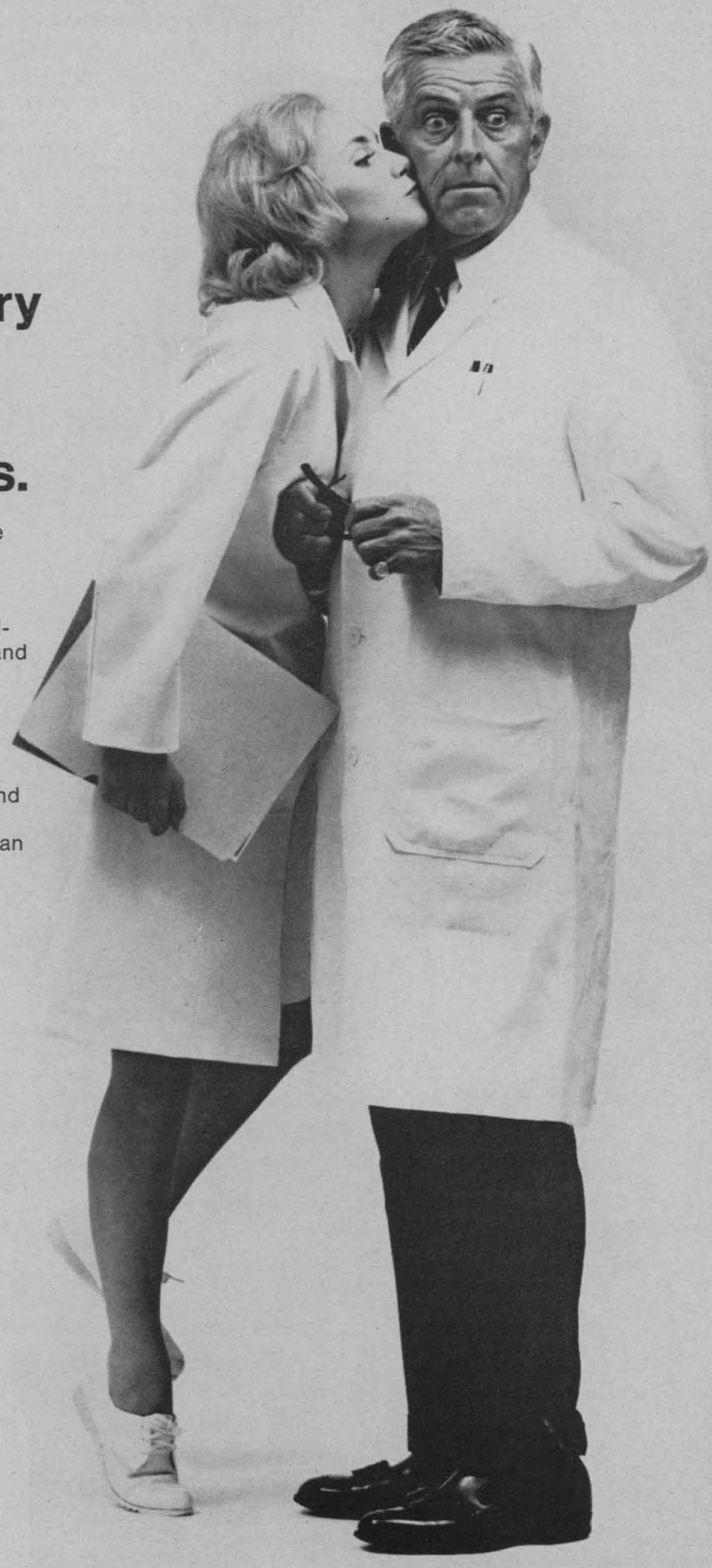

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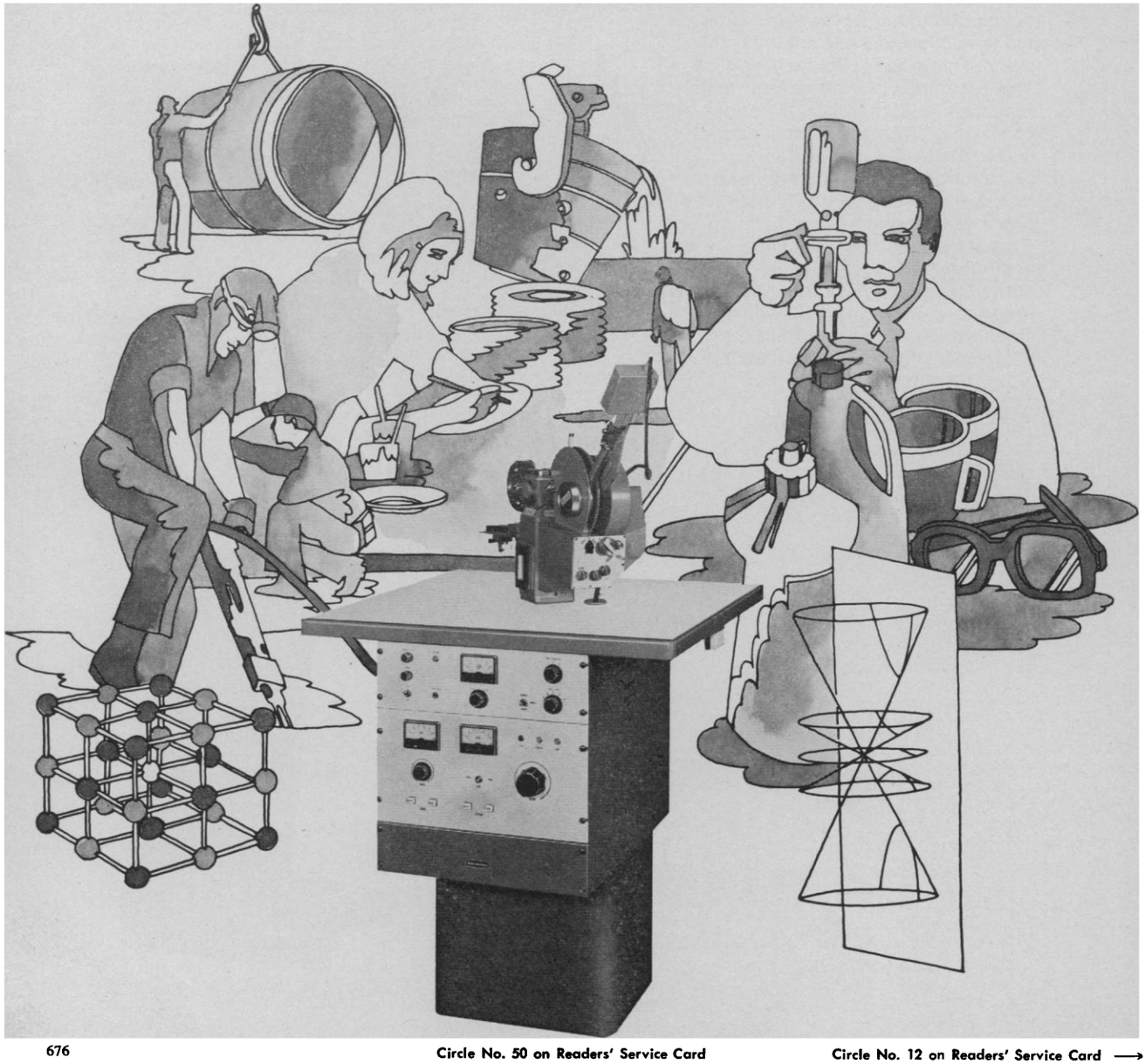

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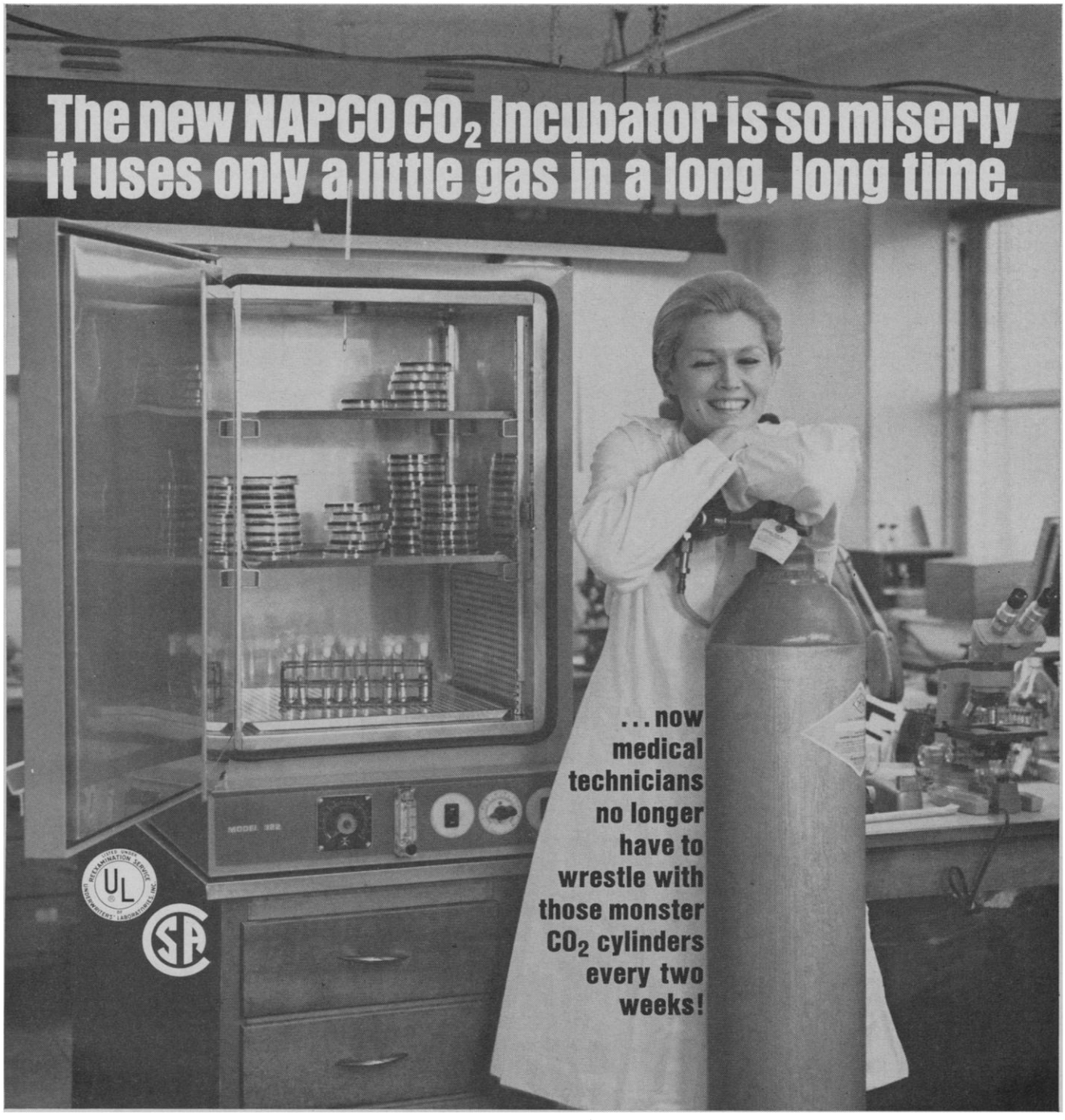

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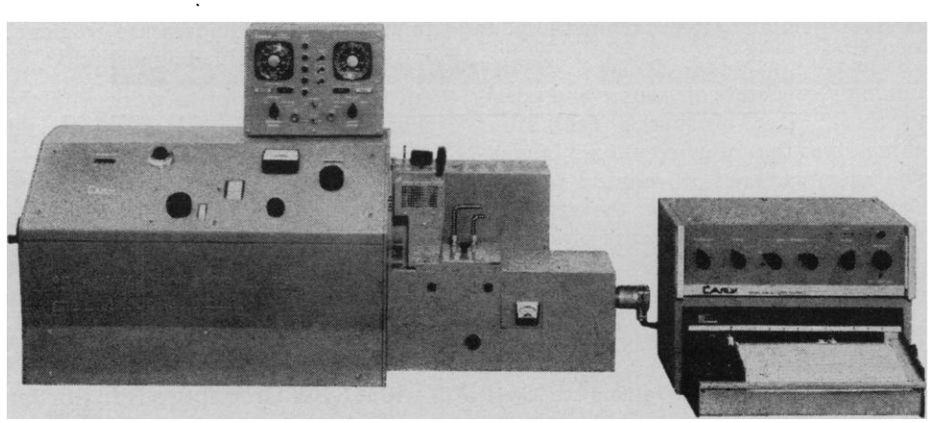

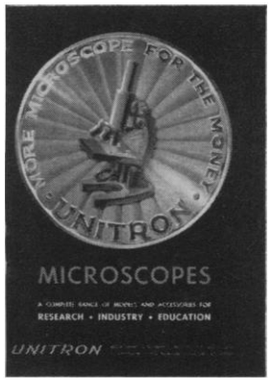

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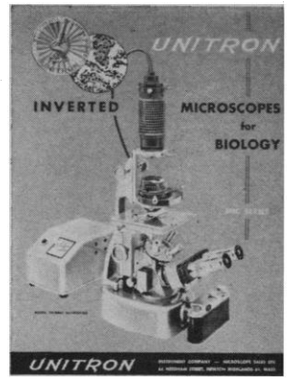

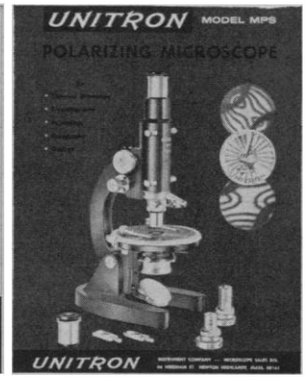

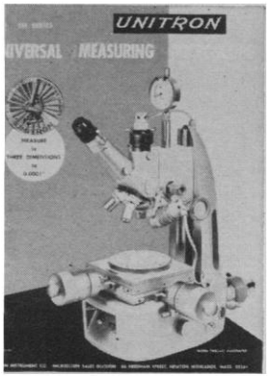

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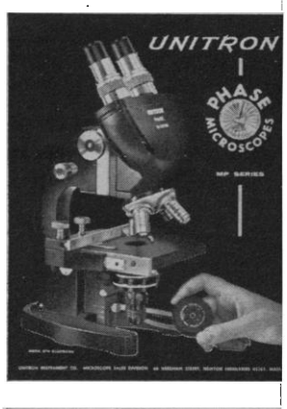

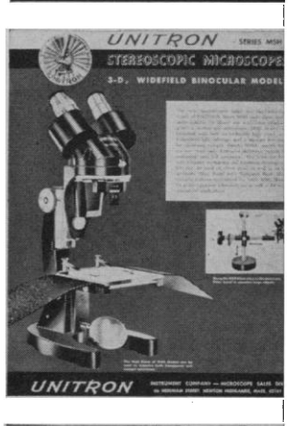

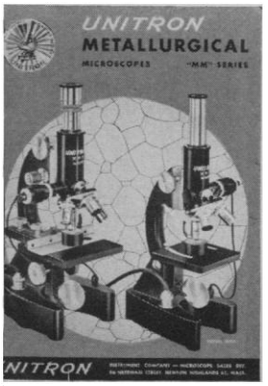

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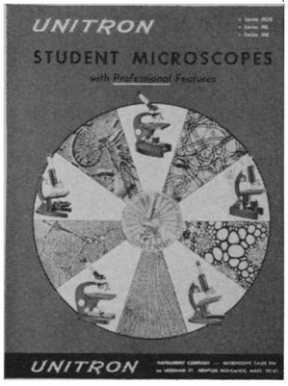

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Reactors and the Public Good

It is dismaying to find that *The Careless Atom*, by Sheldon Novick, was assigned to a book reviewer (1 Aug., p. 483) who admits to "not being an expert in these matters." I find *The Careless Atom* a thinly disguised antireactor tract which seems more intended to alarm than to inform. It contains statements taken out of context, misrepresentations and partial presentations of fact, and depictions of conjectures and events of low probability as seeming imminent disasters.

Novick uses several excerpts from hypothetical studies of reactor accidents to support his allegation that the potential consequences of a reactor malfunction are unacceptably great. . . . One finds in the book no accompanying indication of the assumed succession of human, mechanical, and structural failures on which these postulated incidents are based, and hence of their extremely small probability. He states that the dozen atomic power plants which were to be built by the utilities alone or in cooperation with the Atomic Energy Commission "ran into trouble from the outset. . . ." The Fermi and the Hallam plants, both novel types (which have presented economic problems to their backers but no radiation hazard to the public), are cited. From reading *The Careless Atom* one would not know of Yankee, Indian Point I, or Shippingport, not to mention the total of about 100 other reactors in the United States, that operate routinely and dependably.

Besides offering a one-sided picture of the safety and reliability of nuclear reactors, Novick has made a sensational rather than a factual presentation to suggest that the current radiation protection standards for the routine discharge of low-level radioactivity from nuclear facilities are inadequate to protect man and the environment from present serious risk and future calamity. He describes radiation effects quite graphically, but without relating them to dose or dose-rate. Thus he gives his lay readers no quantitative basis for assessing the degree of the risk involved. Although the releases of radioactivity during past years to White Oak Lake and to the Columbia River, which Novick uses as examples, were considerably in excess of the amounts from modern reactor power and fuel reprocessing facilities, neither has constituted a demonstrated radiation safety hazard to even the immediate populations. With regard to current releases Novick asserts that "reactors will continue to function just within AEC limits." This is contradicted by Bloemke and Harrington (AEC Report ORNL-4070), from which I conclude that most reactors function at less than 1 percent of these release limits.

Novick attacks the basis of public radiation protection standards which are set in comparison to background and at which no measurable damage is anticipated. He says, "It is past time that we realized that in radiation 'no measurable damage' eventually means 'not quite fatal' for everyone." This is a large assertion which indicates either Novick's bias or his ignorance of the painstaking search of the considerable available data on radiation effects made by such bodies as the International Commission on Radiation Protection, of the careful interpretation made by them in recommending radiation protection standards, and of the conservative practices of health physicists in their application.

In my view, to live in the health and well-being made generally possible by a technologically developed society is also to live at risk from a host of potentially deleterious agents. Before getting upset about the possible risk from the operation of nuclear reactors and associated activities, a reasonable person, it seems to me, would want to arrive at the best possible quantitative judgment of how this compares with other accepted risks. I believe that anyone who does not have an a priori conviction otherwise will find it small.

This is not to suggest that there are no disagreements about safety within

the nuclear industry and among health physicists and others responsible for radiation protection. But it is to suggest that those looking for a balanced presentation of the benefits and risks of nuclear energy should look elsewhere than *The Careless Atom* and other more recent publications.

ANDREW P. HULL
Health Physics Division, Brookhaven National Laboratory, Upton, New York

. . . Novick's probing is trivial compared to the grilling the electric utility and nuclear manufacturers get from the AEC and the Advisory Committee on Reactor Safety. If Novick wants to be a Nader, he ought to take on some real opposition. The nuclear industry is having a rough time trying to displace the stacks of the coal-burners that spew smoke, sulfur dioxide, radon, and about one-fourth of a plant's waste heat into our air. Novick should try fighting the coal lobby or even the bureaucracy of the AEC itself, which is bending over backward to assure nuclear safety for the public, and has reduced the pace of long-term development of nuclear power to a crawl.

The needs of the world for energy are real. The finiteness of our fossil fuel reserve is real. The desire to harness the atom to provide safe, clean, and plentiful power is real, and so are the efforts of dedicated men to achieve these goals. The public good is not well served by scare journalism.

A. DAVID ROSSIN
Adlai Stevenson Institute of International Affairs, 5757 South Woodlawn Avenue, Chicago, Illinois

Moon, Mars, and Money

Carter's rundown on NASA plans (5 Sept., p. 987) prompts me to recall Geographer George Sauer's comment as chairman of the international symposium in the 1950's on Man's Role in Changing the Face of the Earth. "We are now come," he said, at the end of that week, "to a revised version of Aldous Huxley's 'brave new world' of the '20's—to a faceless, mindless, countless multitude managed from the cradle to the grave by a brilliant elite of madmen intent on technological progress."

Paine knows full well that there is a great deal more to be done, of vital urgency, than "to fill 200 million alimentary canals every day." For one thing, there is the problem of emptying those canals! What an assault could be made on our environmental problems —physical, cultural, and economic—if the same quantities of money and brainpower and industrial facilities that go into the space program were to be applied in those fields.

"By the end of the century," says Paine, "if you haven't been to the moon, you're not going to be with it." Give NASA until 1975 (?) to create a vehicle capable of hauling 100 persons and necessary equipment to the moon. Then, a trip a day until the turn of the century would carry only 900,000 of us to the moon—only .045 of 1 percent of our present 200 million could be "with it"—about as many, perhaps, as would make use of the controversial supersonic jets with their prodigious and intolerable sound problems.

RUSSELL G. LYNCH
8121 Stickney Avenue, Wauwatosa, Wisconsin 53213

Amchitka: Waves of Opinion

Carter's technique in his article on large-yield explosions on Amchitka (22 Aug., p. 773) is to quote the opinions of "authorities." Though factual in the sense of offering valid quotes, this approach does not truly provide the reader with a basis for drawing his own conclusions. Carter further fails the scientific community by (i) quoting only seismologists who feel some degree of alarm (he could have quoted others of equal scientific renown who would have said there was no danger from large tests on Amchitka), and (ii) quoting the opinions of other scientists who have no basis for forming definitive opinions on the subject, or who are allowing their scientific opinions to be dictated by their political beliefs.

Much scientific information is available on the matter and could have been presented by Carter if he had attended the meetings of the American Geophysical Union or if he had sought the data. The possibility of venting is to be argued only by inspection of the venting history at the Nevada Test Site and Amchitka, that history being available. The possibility that large shots on Amchitka would cause tsunamis should be evaluated in terms of the relation between large shots, observed patterns of seismic radiation from such explosions, observed aftershock activ-

ity, and the regional strain pattern in Nevada, and locations and modes of genesis of tsunamis, location of Amchitka relative to earthquake foci and observed seismic radiation patterns from Longshot. . . .

GENE DAVIDSON
17269 Tennyson Place,
Granada Hills, California 91344

Davidson misrepresents my article by seeming to suggest that I arbitrarily chose to quote only those scientists who feel some concern about the Amchitka test series. To the contrary, several of the scientists' whose views I mentioned were members of the President's Science Advisory Committee's ad hoc panel on the safety of underground testing. Two others whom I mentioned, and who also are concerned about the Amchitka tests, are members of the AEC's own ad hoc panel on seismology. If I have chosen my authorities from among scientists whose judgment is colored by political beliefs, it would seem that the PSAC and the AEC have committed a similar error.

LUTHER J. CARTER
Science

Dyons Versus Quarks

Two quite different references to particles of fractional electric charge have appeared recently in the pages of *Science*. The term "quark" was introduced in 1964 to designate hypothetical entities carrying electric charges of one-third or two-thirds the normal unit. In a "Research Topics" article (26 Sept., p. 1340), Robert W. Holcomb has reported on Australian cosmic ray observations of a few events with less than normal ionization, which were detected in very high energy showers. This has been advanced as evidence for the quark, although a more conventional explanation is also mentioned in this article.

The other reference occurs in my article "A magnetic model of matter" (22 Aug., p. 757). It is pointed out that the speculation of magnetic charge can account for the observed integral nature of electric charge in ordinary, magnetically neutral, matter, while also implying that particles carrying both electric and magnetic charges can exhibit fractional electric charges in just the way suggested by high energy particle empirics. To emphasize the fundamental dyad of

charges, electric and magnetic, I called such particles "dyons." On this view, fractional electric charge cannot exist without an accompanying large value of magnetic charge. Energetic particles of this type will ionize very strongly, until they have been slowed to a small fraction of the speed of light.

I wish to draw attention to this theoretically sound possibility, and to suggest on these grounds, rather than merely general skepticism, that occasional lightly ionizing tracks must have a prosaic explanation.

JULIAN SCHWINGER
Department of Physics, Harvard University, Cambridge, Massachusetts

Electrodes

Ryan's letter "Unreliable results" (29 Aug.) does not tell the whole story. An accurate *p*H measurement of tris buffer can be made with Beckman electrodes. Excellent results have been obtained utilizing our No. 39511 combination electrode with ceramic junction. Measurements have been made in tris buffers adjusted to *p*H 7, *p*H 8, and *p*H 9. An equilibration time of at least 2 minutes is required. Rinsing the electrode between measurements with 0.1*M* NH_4NO_3 speeds equilibration. A full report on measuring the *p*H of tris buffers will soon be published by our applications research department.

Tris buffer, a primary aliphatic amine of considerable reactivity, is a difficult sample. It has a temperature coefficient 10 times as large as *p*H 7 phosphate buffer and abnormally high junction potentials have been reported in the literature. Some Beckman combination electrodes containing linen fiber junctions (39012, 39013, 39142, 39182, and 39183) should not be used in tris buffer. Large liquid junction potential, drift, and long equilibration times in tris buffer have been observed with these electrodes. We are now aware of this situation and have taken positive steps to alert users.

Beckman manufactures a variety of *p*H meters and electrodes so that our customers can obtain optimum results with all types of samples. We also provide technical information and assistance to help the user make the proper choice.

C. RONALD DAYTON
Beckman Instruments, Inc., 2500 Harbor Boulevard, Fullerton, California 92634

7 November 1969, Volume 166, Number 3906 **SCIENCE**

Chemicals and Cancer

By accident or by design, humans are being exposed to an increasing number of chemicals. Each year thousands of new compounds are synthesized, and people subsequently are subjected to them in many ways, through agents that include air, water, food, drugs, and cosmetics. Acute toxicity of pure substances can be determined quite readily; synergistic effects are more difficult to evaluate. However, the major causes for concern are delayed effects such as cancer or genetic mutations. Because of the long times necessary for manifestation of damage, the hazards attending long-term exposure to most chemicals are not known.

The primitive level of our knowledge was demonstrated recently in events attending the banning of the use of cyclamate. This artificial sweetening agent has been in use for about two decades. Short-term and long-term toxicity of the chemical had been tested repeatedly, but only now have studies of 18-month exposures at high dosages been conducted; such exposure resulted in cancers of the bladder in rats. There is no evidence that cyclamates have caused cancer in man, but the full effects of the mass exposure cannot be known for 20 years or more.

Cyclamate is only one of hundreds of chemicals—some synthetic, others natural products—that have been ingested by man. Often, for what seem rather trivial benefits, risks of undetermined magnitude have been incurred by substantial fractions of the total population. Thus far we have escaped disaster. Indeed, insofar as they can be interpreted, the long-term trends in the incidence of cancer are to some extent reassuring. Although there has been an overall increase, the major factor in the increase has been lung cancer associated with smoking. On the other hand, incidence of cancer in the stomach and liver has decreased sharply.

The public rightly expects the government to take measures necessary to insure its safety from environmental hazards, and legal authority exists for doing part of the job. No new food additive can be introduced in interstate commerce unless the manufacturer produces evidence that it is safe. The applicable phraseology includes the following statement from the so-called Delaney Amendment: "no [food] additive shall be deemed to be safe if it is found to induce cancer when ingested by man or animal. . . ."

The effect of the law has been to subject new additives to close scrutiny while permitting continued use of substances that were being used prior to 1958, even if they had never been thoroughly tested. Moreover, many foods are known to contain natural components which, when given in massive doses, have been found to produce cancer. In addition, smoked foods usually contain highly carcinogenic compounds.

The government utilizes unevenly its power to protect the public. If the nation were truly concerned with cutting the incidence of cancer, it would mount a massive campaign against cigarette smoking and it would closely examine all substances that are ingested, including even those that have long been used.

Knowledge concerning the factors leading to cancer is fragmentary and hard to acquire. However, we have not been as vigorous as we might be in obtaining it. Long-term animal research has not enjoyed sufficient support. Epidemiological studies in man should be expanded. Around the world, widely differing incidences of cancer are noted. Careful analysis of this phenomenon should be made. In addition, more comprehensive studies should be initiated in the United States, including a follow-up on individuals exposed to large doses of cyclamate.

—PHILIP H. ABELSON

Since the introduction of double-beam spectrophotometers capable of generating either a linear (% transmittance) or a logarithmic (absorbance) output, an interesting and useful new way of recording that output has evolved.

It is now possible to record the *logarithm* of absorbance as a function of wavelength. With the proper external recorder, of course.

But before we detail for you some of the advantages of log-absorbance recording, a few fundamentals.

We discuss here some of the advantages of recording the logarithm of absorbance...

To begin, the term absorbance (A) is defined thus:

$$A = ecl$$

where c is the concentration of sample in the absorption cell,

l is the *light-path* (the inside distance between front and back windows of the cell), and

e is a numerical coefficient.

The fact is that e is a characteristic of each compound or substance. It is dependent on temperature and wavelength, but independent of either the concentration, c, or the light-path length, l.

If we plot A versus wavelength for three samples of the same substance in concentrations in the ratio 1:2:5, we get the curves shown in figure 1. There is, unhappily, no basic correspondence among them.

But watch what happens with our original equation,

$$A = ecl$$

when we take the logarithm of both sides,

$$\log A = \log ecl$$

Since the logarithm of a product is the sum of the logarithms of its factors,

$$\log A = \log e + \log cl$$

such as for "fingerprinting" a compound...

Now when we plot $\log A$ versus wavelength (figure 2), we immediately see our three 1:2:5 samples are represented by curves that have identical shapes. Each curve is that of $\log e$ displaced along the $\log A$ axis by the amount $\log cl$. And each curve is separated by intervals that correspond to the 1:2:5 ratio of cl.

Here's where the "fingerprinting" of compounds comes in. Reference files of $\log A$ recordings facilitate the identification of unknown compounds by making it easy to compare their $\log A$ curves to those already on file. Large files of this sort are used in organic synthesis.

Now, a new topic: $\log A$ recording is also a valuable technique in studies of the kinetics of first-order reactions.

For proof of this statement, we resort once again to a basic equation:

$$-\frac{dc}{dt} = kc$$

where $-\frac{dc}{dt}$ is the rate at which the concentration is decreasing with time.

k is the velocity or rate constant, and

c is the concentration

A few manipulations of this basic equation yield:

$$t = \left[\frac{2.303}{k} \log c\right] - \left[\frac{2.303}{k} \log (c\text{-}x)\right]$$

Wherein we note that the first term in brackets is a constant and, therefore, the reaction time, t, is directly proportional to the second bracketed term, $\log (c\text{-}x)/k$.

Since $(c\text{-}x)$ is the concentration at time t, it will be proportional to the absorbance, A. And $\log (c\text{-}x)$ will likewise be proportional to $\log A$.

and for quickly determining reaction rates...

As long as the reaction is first-order, both $\log (c\text{-}x)$ and $\log A$ will be linear with time. So when we plot $\log A$ versus time at a fixed wavelength for a first-order reaction of a dye fading, we get the curve shown in figure 3.

The linearity of the curve in figure 3, in itself, tells us that this is a first-order equation. And where the linear section of the curve terminates (at the right of the curve) indicates a departure from strict first-order reaction. Finally, the rate constant, k, can be determined from the slope of the linear section.

These applications—for fingerprinting a compound and for studying the kinetics of first-order reactions—are but two to which $\log A$ recording is eminently suited. Other applications include the precise specification of color and the measurements of small differences in color.

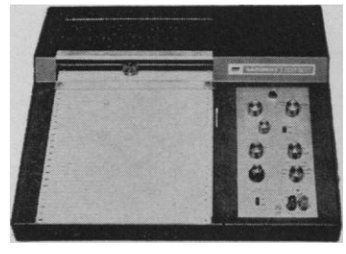
In all cases, this type of log recording requires an advanced, accurate, versatile recorder. The Sargent SRLG Recorder is just that. It uses precision, non-linear *gears* for accuracy and fidelity; these gears are much superior to electrical circuit approximations. Amplifier gain is adjusted *automatically* at all points in the log scale. There's also a switch for inactivating the zero adjustment and automatically setting the voltage-divider zero-point. Conformance of the logarithmic scale to the theoretical function is ±0.003 at any point.

But the SRLG is a *linear-log* recorder. (You change the mode of operation by simply changing the gears.)

Its accuracy on the linear scale is ±0.25% of full span and its reproducibility is ±0.1% of full span.

and we, of course, also recommend the ideal recorder for the task: our own SRLG.

The SRLG Linear-Log Recorder, like all Sargent recorders, is true potentiometric in its basic (millivolt) ranges, with no voltage dividers to load the circuit. Its full-scale pen response is less than 1 second. There are seven switch-selected, calibrated spans and three switch-selected chart speeds. Plus improved input filtering and circuit guarding to eliminate A.C. components of the input signal. All circuitry is solid-state. And batteries have been replaced by zener-diode regulation of all critical voltages.



For additional information, including complete specifications and prices, please call or write us. S-224

FIGURE 1

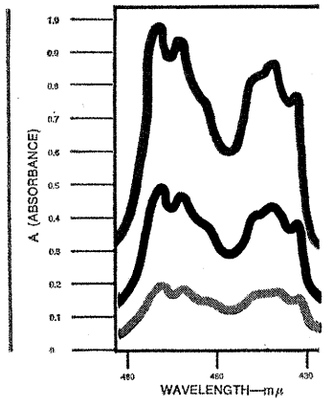


FIGURE 2

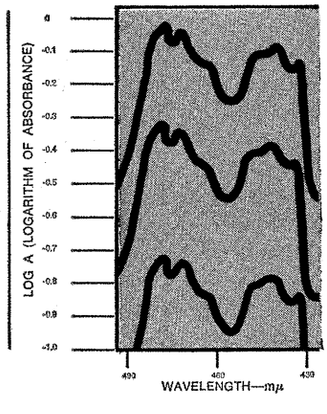
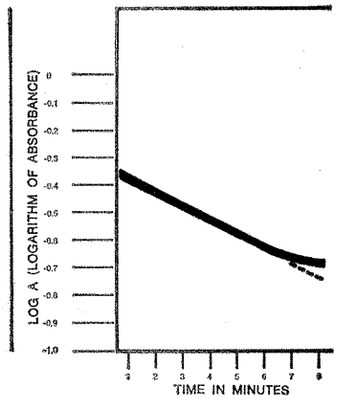


FIGURE 3



Rustum Roy (Pennsylvania State University) referred to the static nature of the mechanisms of interaction between universities, industry, and government, showing that so far only new ideas were the ARPA-stimulated and paid-for "coupling contracts" between university and industry, and a few university experiments of intensive coupling of a laboratory or unit with a selected small group of industries. He pointed to the essential role of interdisciplinary research units (as distinct from degree-granting units) to be set up by universities if they are in fact to be able to respond to society's needs and problems since the former do not come in "discipline-shaped blocks."

As a part of his talk, W. O. Baker (Bell Telephone Laboratories) pointed up the urgent need for new educational programs in the field of crystal growth. Although virtually no pedagogy is going on in the field—he graciously identified the host institution as a "striking exception"—he noted that a recent survey disclosed the need for at least 230 more doctor of philosophy degrees, 150 at the master's level, 190 bachelors, and about 400 technicians in this area so critical to materials progress.

It is perhaps fitting that Baker should have provided both a proper summary and a call to arms for the meeting because of his role in PSAC, in 1958–59, that loomed so large in developing a coherent policy leading to the ARPA grants and the present state of materials science.

"Through materials research and engineering," he said, "we must implement a large part of the revolution of expectations in our nation. This field, in cooperation with the organizing and information-handling capabilities of communications and digital computers, seems to be a principal way to civilize the future. Just as the organic world, in food production and control of disease, may sustain human life, so the material world can enrich it. And there is no spiritual loss if people have more wheels to ease the burdens of their backs, more clothes to sooth the searing of the winds, more houses to seek shelter from the storms. These ends are worthy of our wisest means which lie in materials technology; but we have rewards beyond them too. For we are part of matter and can hardly understand ourselves or our world without a deep comprehension of what surrounds us."

DIXON JOHNSON
Pennsylvania State University, University Park

Forthcoming Events

November

17–21. World **Mental Health** Assembly, Washington, D.C. (P. V. Lemkau, Assembly Chairman, 615 N. Wolfe St., Baltimore, Md. 21205)

18–19. International Federation of **Surgical Colleges**, Buenos Aires, Argentina. (R. S. Johnson-Gilbert, Secretary, c/o Royal College of Surgeons of England, Lincolns Inn Fields, London, W.C.2, England)

18–21. **Magnetism and Magnetic Materials**, 15th conf., Philadelphia, Pa. (J. Blades, Franklin Inst., Research Labs., Philadelphia 19103)

19–21. Eastern **Analytical** Symp., New York, N.Y. (R. J. Knauer, Advanced Materials Div., Armco Steel Corp., P.O. Box 1697, Baltimore, Md. 21203)

19–22. National Easter Seal Soc. for **Crippled Children and Adults**, Columbus, Ohio. (C. Bauer, Director of Public Relations, 2023 W. Ogden Ave., Chicago, Ill. 60612)

19–23. Academy of **Psychosomatic Medicine**, 16th annual, Scottsdale, Ariz. (E. Dunlop, Executive Secretary, APM, 150 Emory St., Attleboro, Mass. 02703)

20–21. Association for the Study of **Animal Behaviour**, London, England. (J. Cullen, Psychology Dept., The University, Stirling, England)

20–23. American **Anthropological** Assoc., New Orleans, La. (C. C. Reining, Suite 112, 3700 Massachusetts Ave., NW, Washington. D.C. 20016)

20–24. **Audio Engineering** Soc., 37th conv., New York, N.Y. (J. D. Colvin, Room 428, 60 E. 42 St., New York 10017)

21–22. **Clinical** Conf., 13th annual, Houston, Tex. (J. Brandenberger, M. D. Anderson Hospital and Tumor Inst., Univ. of Texas, Houston 77025)

21–22. Southwestern Conf. in **Comparative Endocrinology**, American Soc. of Zoologists, Norman, Okla. (W. Chavin, Wayne State Univ., Detroit, Mich.)

30–3. American Acad. for **Cerebral Palsy**, Las Vegas, Nev. (G. Solomons, University Hospitals, Iowa City, Iowa 52240)

30–4. American **Nuclear** Soc., San Francisco, Calif. (O. J. Du Temple, ANS, 244 E. Ogden Ave., Hinsdale, Ill.)

December

1–4. **Entomological** Soc. of America, Chicago, Ill. (W. P. Murdoch, Executive Secretary, 4603 Calvert Rd., College Park, Md. 20740)

1–5. Exposition of **Chemical Industries**, 32nd, New York, N.Y. (E. K. Stevens, International Exposition Co., 200 Park Ave., New York, N.Y.)

1–5. **Offshore Exploration** Conf., 2nd intern., Monte Carlo, Monaco. (Offshore Exploration Conf., c/o Bank of California, Main Branch, P.O. Box 110, Long Beach, Calif. 90801)

2–5. **Reticuloendothelial** Soc., 6th natl., San Francisco, Calif. (E. Dobson, Donner Lab., Univ. of California, Berkeley 94720)

3–5. International **Wire and Cable**

Symp., Atlantic City, N.J. (J. Spergel, U.S. Army Electronics Command, Amsel-K1-EE, Fort Monmouth, N.J. 07703)

3–6. American Assoc. of **Physicists in Medicine**, Chicago, Ill. (J. G. Kereiakes, Radioisotope Lab., Cincinnati General Hospital, Cincinnati, Ohio 45229)

5–6. **Oklahoma Acad. of Science**, Edmond. (J. T. Self, 730 South Oval, Univ. of Oklahoma, Norman 73069)

5–6. **Interferon** Symp., New York, N.Y. (I. Saulpaugh, New York Heart Assoc., 2 E. 64 St., New York 10021)

5–6. American **Rheumatism** Assoc., Tucson, Ariz. (M. M. Walsh, ARA, 1212 Avenue of the Americas, New York 10036)

5–7. American Acad. of **Oral Medicine**, New York, N.Y. (B. Tuchman, 200 Central Park South, New York 10019)

5–7. American Acad. of **Psychoanalysis**, New York, N.Y. (M. Carroll, AAP, 125 E. 65 St., New York 10021)

6–11. Galaxy Conf. on **Adult Education**, Washington, D.C. (E. Sydnor, 900 Silver Spring Ave., Silver Spring, Md. 20910)

7–9. American Soc. of **Hematology**, Cleveland, Ohio. (F. H. Gardner, Presbyterian–Univ. of Pennsylvania Medical Center, Philadelphia 19104)

7–12. American Soc. for **Testing and Materials**, Cincinnati, Ohio. (T. A. Marshall, Jr., ASTM, 1916 Race St., Philadelphia, Pa. 19103)

8–10. **Applications of Simulation**, 3rd conf., Los Angeles, Calif. (P. J. Kiviat, Simulation Associates, Inc., 1263 Westwood Blvd., Los Angeles 90024)

8–10. **Circuit Theory**, intern. symp., San Francisco, Calif. (B. J. Leon, School of Electrical Engineering, Cornell Univ., Ithaca, N.Y. 14850)

8–10. National **Electronics** Conf. and Exhibition, 25th, Chicago, Ill. (R. J. Napolitan, NEC, Oakbrook Executive Plaza #2, 1211 W. 22 St., Oak Brook, Ill. 60521)

8–10. Southern **Surgical** Assoc., Hot Springs, Va. (D. C. Sabiston, Jr., Duke Univ. Medical Center, Durham, N.C. 27706)

8–11. Oak Ridge Associated Universities Symp. in **Medicine**, 12th, Oak Ridge, Tenn. (R. M. Kniseley, Medical Div., Oak Ridge Associated Universities, Oak Ridge 37830)

11–12. Conference on **Holography and the Computer**, Houston, Tex. (J. A. Jordan, Jr., IBM, Houston Scientific Center, 6900 Fannin St., Houston 77025)

12–14. American **Psychoanalytic** Assoc., New York, N.Y. (H. Fischer, 1 E. 57 St., New York 10022)

14–18. American Assoc. of **Hospital Pharmacists**, Washington, D.C. (J. A. Oddis, AAHP, 4630 Montgomery Ave., Bethesda, Md. 20014)

15–17. **Phylogenesis and Morphogenesis in the Algae** Conf., New York, N.Y. (J. F. Fredrick, Director of Chemical Research, Dodge Chemical Co., 3425 Boston Post Rd., Bronx, N.Y. 10469)

15–18. American **Geophysical** Union, San Francisco, Calif. (W. E. Smith, AGU, 2100 Pennsylvania Ave., NW, Washington, D.C. 20037)

17–18. British **Biophysical** Soc., London, England. (E. M. Bradbury, Biophysics Lab., Physics Dept., College of Technology, Park Rd., Portsmouth, England)

17–19. Symposium on **Infections and Immunosuppression in Sub-Human Primates**, Rijswijk, Netherlands. (H. Balner, Radiobiological Institute TNO, Lange Kleiweg 151, Rijswijk Z.H.)

18–20. International Symp. on **Computer and Information Science** (COINS-69), Miami Beach, Fla. (J. T. Lou, Univ. of Florida, Gainesville 32601)

26–30. **Sigma Delta Epsilon**, Boston, Mass. (M. Myers, 6234 Mary Lane Dr., San Diego, Calif. 92115)

26–31. American Assoc. for the **Advancement of Science**, 136th mtg., Boston, Mass. (Meetings Manager, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

26–31. **Ecological Soc.** of America, Boston, Mass. (W. A. Niering, Dept. of Botany, Connecticut College, New London 06320)

26–31. American Soc. of **Naturalists**, Boston, Mass. (B. H. Judd, Dept. of Zoology, Univ. of Texas, Austin 78712)

26–31. Society of **Protozoologists**, Boston, Mass. (M. Hammond, Dept. of Zoology, Utah State Univ., Logan 84321)

26–31. **Scientific Research** Soc. of America, Boston, Mass. (C. A. Walker, SRSA, 155 Whitney Ave., New Haven, Conn. 06510)

26–31. **Sigma Pi Sigma**, Boston, Mass. (C. G. Shugart, Society of Physics Students, State Univ. of New York, Stony Brook 11790)

26–31. Society for the **Study of Evolution**, Boston, Mass. (D. L. Jameson, Dept. of Biology, Univ. of Houston, Houston, Tex. 77004)

26–31. American Soc. of **Zoologists**, Boston, Mass. (J. R. Shaver, Dept. of Zoology, Michigan State Univ., East Lansing 48823)

27–29. American Philosophical Assoc., New York, N.Y. (A. Pasch, 117 Lehigh Rd., Univ. of Maryland, College Park 20742)

27–30. **Archaeological** Inst. of America, San Francisco, Calif. (J. S. Ord, AIA, 260 West Broadway, New York 10013)

27–30. Western Soc. of **Naturalists**, Los Angeles, Calif. (D. H. Montgomery, Dept. of Biological Sciences, California State College, San Luis Obispo 94301)

28–30. American **Historical** Assoc., Washington, D.C. (W. D. Harris, AHA, 400 A Street, SE, Washington, D.C. 20003)

29–31. American **Physical** Soc., Los Angeles, Calif. (W. W. Havens, Jr., APS, 335 E. 45 St., New York 10017)

January

6–8. **Solid State Physics** Conf., 7th annual, Manchester, England. (Meetings Officer, Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1)

6–10. National Soc. of **Professional Engineers**, Atlanta, Ga. (P. H. Robbins, NSPE, 2029 K St., NW, Washington, D.C.)

7–9. **Polymer Chain Flexibility** Conf., Colchester, Essex, England. (M. Gordon, British Polymer Physics Group, University of Essex, Wivenhoe Park, England)

8–10. Society for **Historical Archaeology**, 3rd annual, Bethlehem, Pa. (B. Salwen, Dept. of Anthropology, New York Univ., 25 Waverly Pl., New York 10003)

8–13. **Taxonomy and Biology of Blue-Green Algae**, Madras, India. (T. S. Sadasivan, University Botany Lab., Madras 5)

11–13. Association of **American Colleges,** Houston, Tex. (R. H. Sullivan, 1818 R St., NW, Washington, D.C. 20009)

12–14. **Biological Effects of Carbon Monoxide**, New York, N.Y. (A. Selwyn, 2 E. 63 St., New York 10021)

12–15. National Assoc. of **Private Hospitals,** 37th annual, Nassau, Bahamas. (M. Herman, Executive Secretary, NAPH, 353 Broad Ave., Leonia, N.J. 07605)

12–16. **Automotive Engineering** Congr. and Exposition, Detroit, Mich. (W. I. Marble, Soc. of Automotive Engineers, 2 Pennsylvania Plaza, New York 10001)

12–16. **Highway Research** Board, 49th annual, Washington, D.C. (J. C. Allen, Assistant Director for Administration, 2101 Constitution Ave., NW, Washington, D.C. 20418)

14–16. **Engineering with Nuclear Explosives,** Las Vegas, Nev. (P. Kruger, Stanford Univ. School of Engineering, Stanford, Calif. 94305)

18–20. **Drug Information for the Medical Profession**, Washington, D.C. (R. L. Marlin, Sandoz Pharmaceuticals, Hanover, N.J. 07054)

19–20. **Biochemistry**—Papanicolaou Cancer Research Inst., winter symp., Miami, Fla. (W. J. Whelan, P.O. Box 847, Biscayne Annex, Miami 33152)

19–21. American Soc. of **Heating, Refrigerating**, and **Air-Conditioning Engineers**, San Francisco, Calif. (A. T. Boggs III, American Soc. of Heating, 345 E. 47 St., New York 10017)

21–23. Instrumentation for the **Process Industries** Symp., College Station, Tex. (R. G. Anthony, Dept. of Chemical Engineering, Texas A & M Univ., College Station)

21–24. American **Group Psychotherapy** Assoc., New Orleans, La. (M. Schiff, Administrative Secretary, AGPA, Room 702, 1790 Broadway, New York 10019)

22–26. American **Mathematical** Soc., Miami, Fla. (G. L. Walker, AMS, P.O. Box 6248, Providence, R.I. 02904)

24–26. **Mathematical** Assoc. of America, Miami, Fla. (A. B. Willcox, MAA., 1275 Connecticut Ave., NW, Washington, D.C. 20036)

26–29. American Assoc. of **Physics Teachers**, Chicago, Ill. (M. W. Zemansky, American Inst. of Physics, 335 E. 45 St., New York 10017)

26–30. Federacion **Odontologica** de Centro America, Panama City, Panama. (R. Eisemann, Secretario del Exterior, FOCAP, P.O. Box 6406, Panama City 5)

27–29. **Automatic Lab. Techniques** Exhibition, London. England (M. Duck, Pressaids Ltd., 5 New Bridge St., London E.C.4)

27–29. **Reliability** Symp., Los Angeles, Calif. (W. R. Abbott, D-60-01/B104, Lockheed Missiles & Space Co., P.O. Box 504, Sunnyvale, Calif. 94022)

27–30. Canadian **Pulp** and **Paper Assoc.**, 56th annual, Montreal, Canada. D. H. Paterson, CPPA, 2280 Sun Life Bldg., Montreal 2, P.Q.)

28–30. **Health Physics Soc.**, Louisville, Ky. (W. H. Parr, U.S. Army Medical Research Lab., Fort Knox, Ky. 40121)

February

1–14. **Alcholism** and **Drug Dependence**, Sydney, Australia. (P. Diehm, Foundation for Research and Treatment of Alcholism, P.O. Box 3284, Sydney)

2–6. American Soc. for **Testing and Materials**, 3rd, Cincinnati, Ohio. (T. A. Marshall, Jr., 1916 Race St., Philadelphia, Pa.)

9–12. American Soc. of **Range Management**, Denver, Colo. (F. T. Colbert, 2120 Birch St., Denver 80222)

9–13. American **Meteorological** Soc., Washington, D.C. (K. C. Spengler, AMS, 45 Beacon St., Boston, Mass.)

11–12. **Source and Control**, Urbana, Ill. (R. S. Engelbrecht, 3230 Civil Engineering Bldg., Univ. of Illinois, Urbana)

15–18. American Inst. of **Chemical Engineers**, Atlanta, Ga. (H. A. McGee Jr., Dept. of Chemical Engineering, Georgia Inst. of Technology, Atlanta)

15–19. Society of **Economic Geologists**, Denver, Colo. (R. A. Laurence, Secretary, SEG, P.O. Box 1549, Knoxville, Tenn.)

15–19. American Inst. of **Mining, Metallurgical and Petroleum Engineers**, Denver, Colo. (G. T. Moffatt, Activities Manager, 345 E. 47 St., New York 10017)

16–20. **Handling of Nuclear Information**, Vienna, Austria. (J. H. Kane, Div. of Technical Information, Atomic Energy Commission, Washington, D.C. 20545)

18–20. International **Solid-State Circuits** Conf., Philadelphia, Pa. (L. Winner, 152 W. 42 St., New York 10036)

22–1. **Animal and Plant Toxins**, 2nd intern. symp., Tel Aviv, Israel. (A. De Vries, P.O. Box 85, Petah Tikva, Israel)

23–24. **Chemical Marketing Research** Assoc., Houston, Tex. (P. E. Levesque, FMC Corporation, 633 Third Ave., New York 10017)

25–27. **Biophysical** Soc., Baltimore, Md. (W. A. Brodsky, Inst. for Medical Research, 220 E. 23 St., New York 10010)

25–27. **Pesticides in the Soil**, East Lansing, Mich. (S. K. Ries, Dept. of Horticulture, Michigan State Univ., East Lansing)

25–1. American College of **Cardiology**, New Orleans, La. (W. D. Nelligan, AMCC, 9650 Rockville Pike, Bethesda, Md. 20014)

26–28. American Acad. of **Forensic Sciences**, Chicago, Ill. (A. H. Schatz, 750 Main St., Room 1000, Hartford, Conn. 06103)

28–6. American Assoc. of **Junior Colleges**, Honolulu, Hawaii. (E. J. Gleazer, 1315 16th St., NW, Washington, D.C.)

March

1–5. **Radiation** Research Soc., 18th annual, Dallas, Tex. (R. J. Burk, American Univ., Washington, D.C. 20016)

1–5. American **Radium** Soc., 52nd annual, San Diego, Calif. (F. G. Bloedorn, Univ. of Maryland, Baltimore 21201)

1–6. **Analytical Chemistry and Applied Spectroscopy**, 21st conf., Cleveland, Ohio. (R. Mainier, Koppers Co., Inc., 440 College Park Dr., Monroeville, Pa. 15146)

1–6. American Soc. of **Photogrammetry**, Washington, D.C. (L. P. Jacobs, 105 N.

Virginia Ave., Falls Church, Va. 22046)

1–6. American Congr. on **Surveying and Mapping** and the American Soc. of Photogrammetry, Washington, D.C. (R. R. Randall, Room 1104, National Press Bldg., Washington, D.C. 20004)

2–4. American **Crystallographic** Assoc., New Orleans, La. (C. J. Fritchie, Chemistry Dept., Tulane Univ., New Orleans)

2–6. **Automatic Control in Space**, 3rd symp., Toulouse, France. (H. Desmoutier, LASS, B.P. 4036, 31 Toulouse 04)

2–6. **Engineering Design** Show and Conf., Brighton, England. (Miss L. Harvey, Business Conf. and Exhibitions Ltd., Mercury House, Waterloo Rd., London S.E.1)

3–6. American **Educational Research** Assoc., Minneapolis, Minn. (R. A. Dershimer, AERA, 1126 16th St., NW, Washington, D.C. 20036)

4–6. **Fundamental Cancer Research**, 24th annual symp., Houston, Tex. (F. Goff, Special Projects, M. D. Anderson Hospital and Tumor Inst., Univ. of Texas, Houston 77025)

4–6. **Ophthalmology**, 21st intern. congr., Mexico City, Mexico. (S. A. Zertuche, Apartado Postal, 35-523, Mexico City)

8–14. American Assoc. of **Pathologists and Bacteriologists**, 67th annual, St. Louis, Mo. (K. M. Brinkhous, Univ. of North Carolina, School of Medicine, Chapel Hill)

9–13. **Fast Breeder Reactors**, Vienna, Austria. (International Atomic Energy Agency, Kaerntnerring 11, A-1010, Vienna)

9–13. **Use of Isotopes in Hydrology**, Vienna, Austria. (International Atomic Energy Agency, Kaerntnerring 11, A-1010, Vienna)

9–14. **Primary Radiation Effects in Chemistry and Biology**, intern. mtg., Mar del Plata, Argentina. (M. A. Molinari, Comision Nacional de Energia Atomica, Avenida del Libertador 8250, Buenos Aires, S29, Argentina)

9–14. **Waste Water of the Agricultural Industry**, 12th intern. symp. Budapest, Hungary. (Secretariat General Commission, International des Industries, Agricoles et Alimentaries, 18 Avenue de Villars 75, Paris, France)

10–11. **Ash Utilization**, 2nd symp., Pittsburgh, Pa. (N. H. Coats, General Chairman, U.S. Bureau of Mines, P.O. Box 880, Morgantown, W.Va. 26505)

11–13. Institute of **Electrical and Electronics Engineers**, Inc. Scintillation and Semiconductor Counter Symp., Washington, D.C. (The Institute, 345 E. 47 St., New York, N.Y.)

15–19. International **Anesthesia Research** Soc., 44th congr., Las Vegas, Nev. (Executive Secretary, IARS, 3645 Warrensville Center Rd., Cleveland, Ohio 44122)

15–19. Society of **Toxicology**, annual scientific mtg., Atlanta, Ga. (J. F. Borzelleca, Dept. of Pharmacology, Medical College of Virginia, Richmond 23219)

16–18. American Soc. of **Mechanical Engineers, Plant Engineers and Maintenance**, Fort Worth, Tex. (A. B. Conlin, 345 E. 47 St., New York 10017)

16–18. **Solar Energy** Soc., 6th annual mtg., Sydney, Australia. (F. E. Edlin, Arizona State Univ., Tempe)

16–19. International Assoc. for **Dental Research**, 48th session, New York, N.Y. (A. R. Frechette, Executive Secretary, 211 East Chicago Ave., Chicago, Ill. 60611)

16–20. Symposium on **Fourier Spectroscopy**, Aspen, Colo. (G. Vanasse, Air Force Cambridge Research Lab., L. G. Hanscom Field, Bedford, Mass. 01730)

17–25. **Horticulture**, 18th intern. congr., Tel-Aviv, Israel. (Mrs. L. Roman, Ministry of Agriculture, Ha-Qiurya, Tel-Aviv, Israel)

18–19. **Mineral Waste Utilization**, 2nd symp., Chicago, Ill. (M. A. Schwartz, IIT Research Inst., 10 W. 35 St., Chicago, Ill. 60616)

18–21. American **Fertility** Soc., annual mtg., Washington, D.C. (H. H. Thomas, 944 S. 18 St., Birmingham, Ala. 35205)

19–22. American Assoc. of **Dental Schools**, New York, N.Y. (B. F. Miller III, AADS, 211 E. Chicago Ave., Chicago, Ill.)

19–24. American **Dermatological** Assoc., Boca Raton, Fla. (B. Kennedy, Louisiana State Univ., School of Medicine, 1542 Tulane Ave., New Orleans, La.)

20–22. American **Psychosomatic** Soc., 27th annual, Washington, D.C. (J. W. Mason, 265 Nassau Rd., Roosevelt, N.Y. 11575)

20–22. National **Wildlife** Federation, Chicago, Ill. (T. L. Kimball, NWF, 1412 16th St., NW, Washington, D.C.)

22–25. **Environmental Mutagen** Soc., 1st annual, Washington, D.C. (E. Freese, Chairman, Program Committee, EMS, Building 36, Room 3D02, National Inst. of Health, Bethesda, Md. 20014)

23–26. American **Orthopsychiatric** Assoc., 4th annual, San Francisco, Calif. (M. F. Langer, 1790 Broadway, New York 10019)

23–26. American **Physical** Soc., Dallas, Tex. (W. W. Havens, 335 E. 45 St., New York 10019)

24–26. **Engineering Aspects of Magnetohydrodynamics**, 11th symp., Pasadena, Calif. (L. G. Hays, Jet Propulsion Lab., California Inst. of Technology, 4800 Oak Grove Dr., Pasadena 91103)

25–27. Fundamental and Practical Aspects of **Pest Management**, Raleigh, N.C. (F. E. Guthrie, Dept. of Entomology, North Carolina State Univ., Raleigh)

26–28. Southern Soc. for **Philosophy and Psychology**, Durham, N.C. (W. Blackstone, Dept. of Philosophy, Univ. of Georgia, Athens)

26–28. **Seismological** Soc. of America, Hayward, Calif. (D. Tocher, P.O. Box 826, Berkeley, Calif. 94705)

26–29. American **Philosophical** Assoc., Berkeley, Calif. (A. Pasch, 117 Lehigh Rd., Univ. of Maryland, College Park 20742)

27–28. Northwest **Scientific** Assoc., Corvallis, Ore. (G. H. Deitschman, Intermountain Forest and Range Experiment Sta., P.O. Box 469, Moscow, Idaho 83843)

31–2. **Microwave Research**, intern. symp., New York, N.Y. (J. Fox, Polytechnic Inst. of Brooklyn, 333 Jay St., Brooklyn, N.Y.)

31–3. American Assoc. of **Anatomists**, Chicago, Ill. (R. T. Woodburne, Dept. of Anatomy, Univ. of Michigan, East Medical Bldg., Ann Arbor 48104)

31–3. Applications of **Walsh Function in Communications**, Washington, D.C. (H. F. Harmuth, Dept. of Electrical Engineers, Univ. of Maryland, College Park 20742)

BOOKS RECEIVED

(*Continued from page 732*)

Academic Press, New York, 1969. x + 270 pp., illus. $14.50.

Advances in Oto-Rhino-Laryngology. Vol. 16. L. Ruedi, Ed. The Ventral Cochlear Nucleus: The Significance of the Crossed, Inhibitory Pathways towards the Nucleus for Directional Hearing. R. K. J. Pfalz. Restoration of Laryngeal Function after Laryngectomy Experimental Research in Animals. I. Serafini. Karger, Basel, 1969 (U.S. distributor, Phiebig, White Plains, N.Y.). vi + 122 pp., illus. $8.40. Bibliotheca Oto-Rhino-Laryngologica, No. 16.

Advances in Physical Organic Chemistry. Vol. 7. V. Gold, Ed. Academic Press, New York, 1969. x + 354 pp., illus. $13.50.

Aerial Geophysical Survey of Guyana. Final Report Prepared for the Government of Guyana by the United Nations, New York, 1968. 64 pp., illus. + maps. Paper. U.N. Development Programme.

Agricultural Sciences and the World Food Supply. An international symposium, Wageningen, Netherlands, March, 1968. Veenman and Zonen, Wageningen, 1968. 112 pp., illus. Paper. Landbouwhogeschool Miscellaneous Papers 3.

Aktiver Transport. (Kurzstreckentransport bie Pflanzen.) U. Lüttge. Springer-Verlag, New York, 1969. iv + 146 pp., illus. $16.95. Protoplasmatologia, vol. 8/7/b.

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