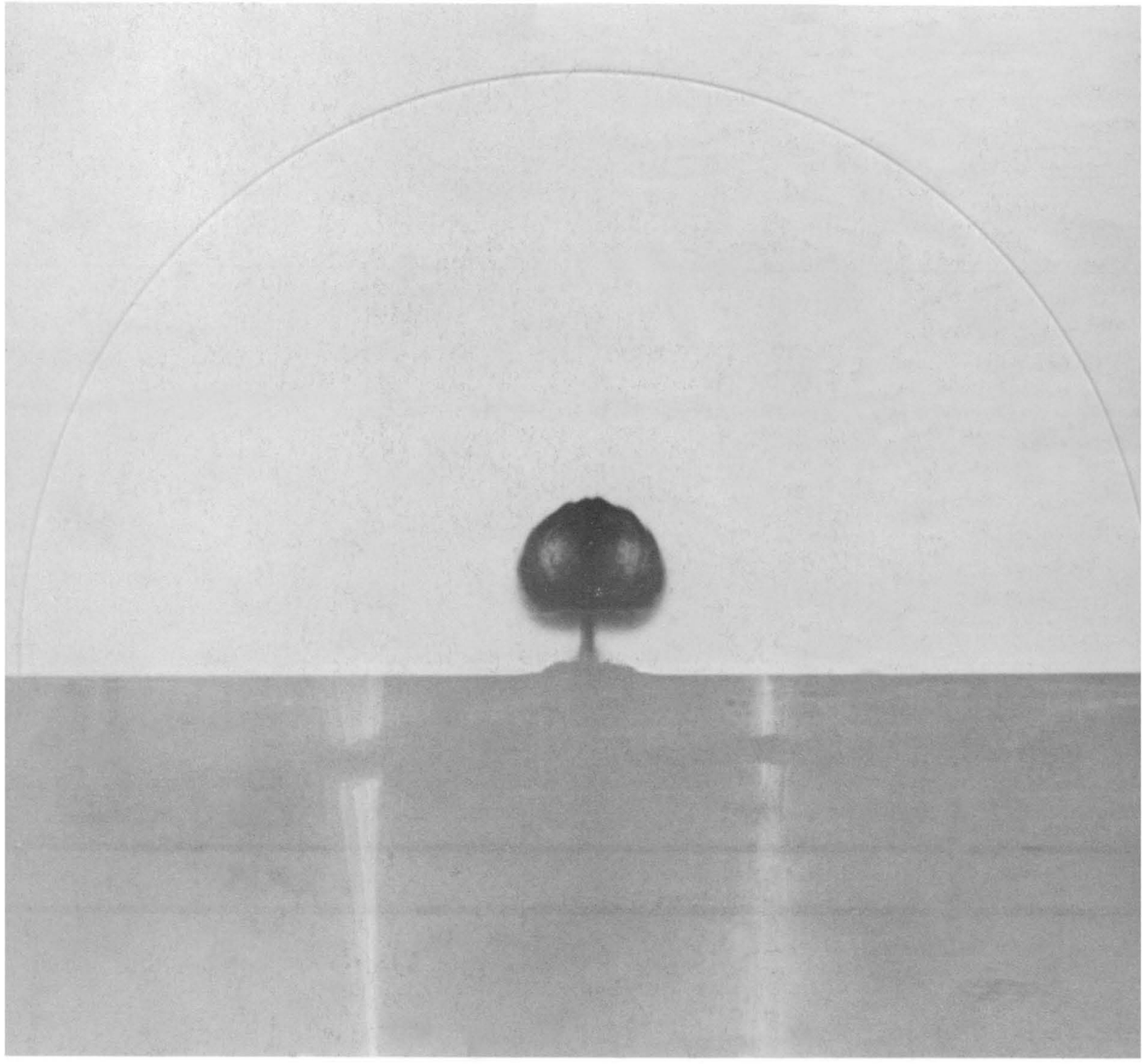
SCIENCE 15 September 1972
Vol. 177, No. 4053
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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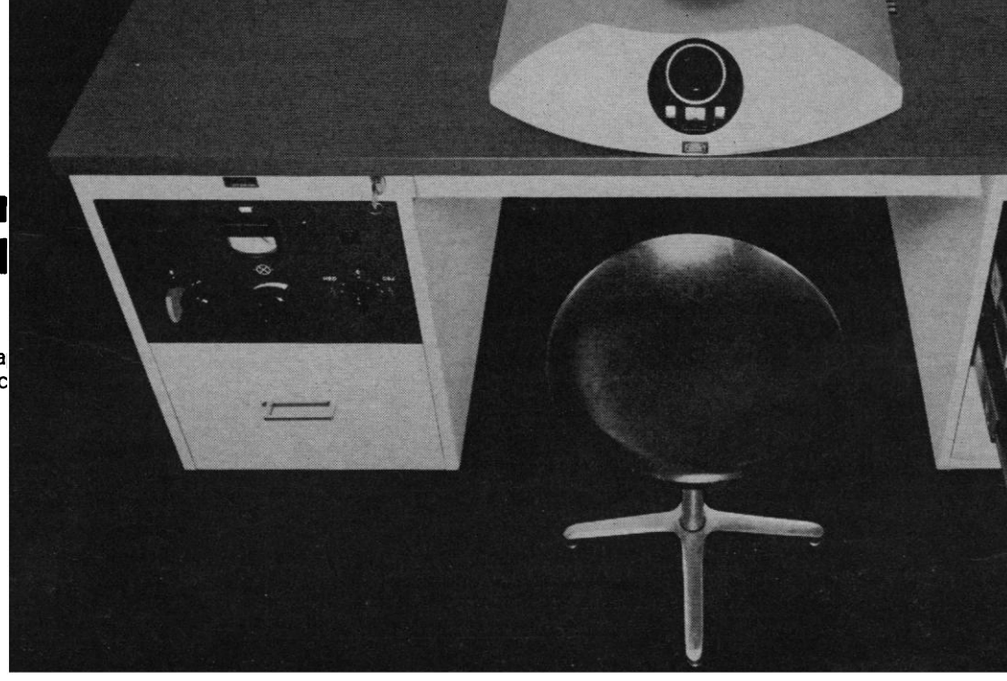

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The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion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

COVER

Shadowgraph of shock wave and vapor plume in air generated at the air-water interface by a focused high-intensity carbon dioxide, transversely excited, atmospheric laser. Research was sponsored by the Defense Advanced Research Projects Agency, Advanced Sensors Office. Picture taken 200 microseconds after start of the event; exposure time 100 nanoseconds. [Charles E. Bell *et al.*, U.S. Naval Ordnance Laboratory, White Oak, Maryland]

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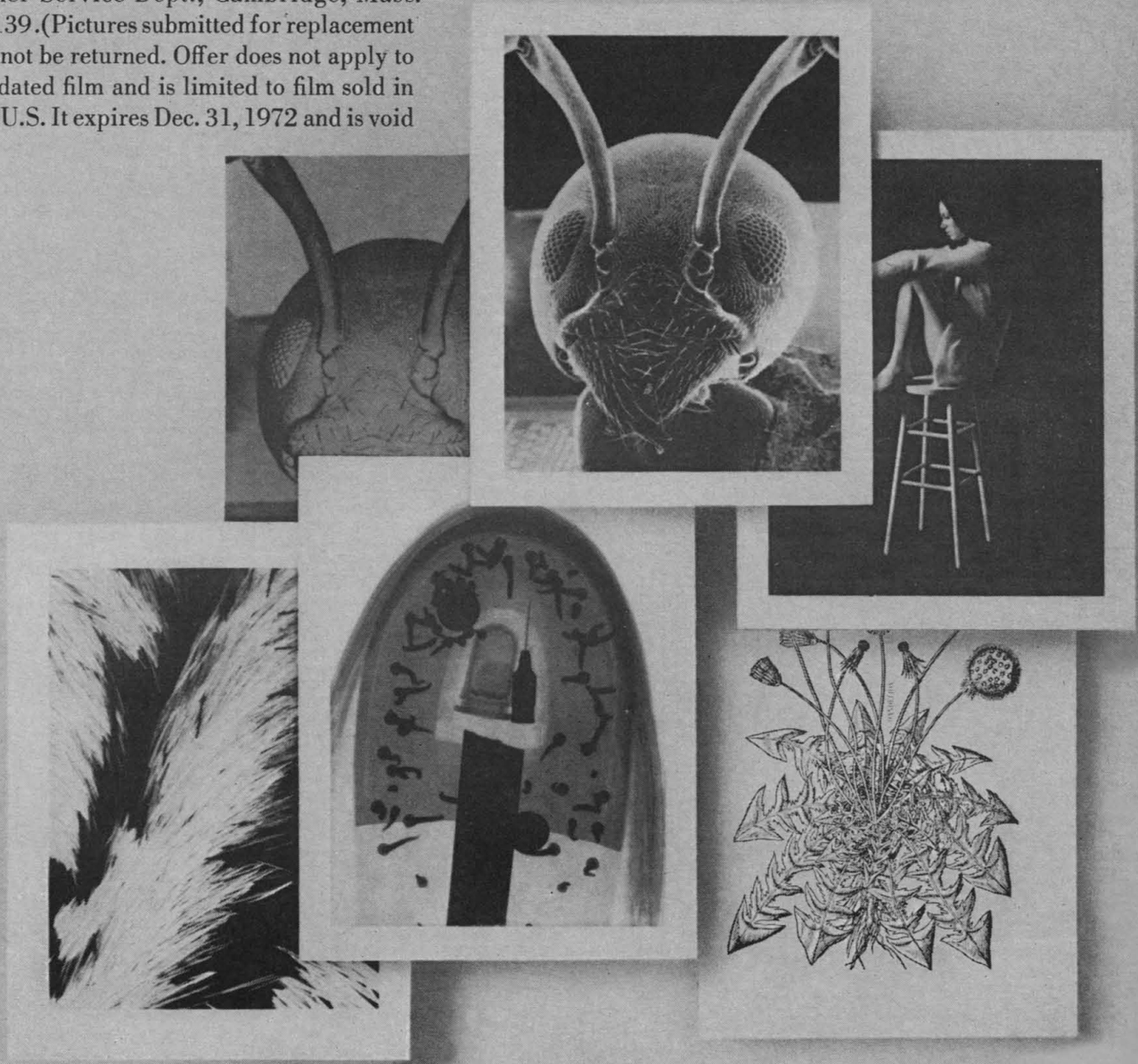
We've been working hard to perfect our films. And we want to do anything we can to help you perfect your skills.

Polaroid 4x5 Land Films



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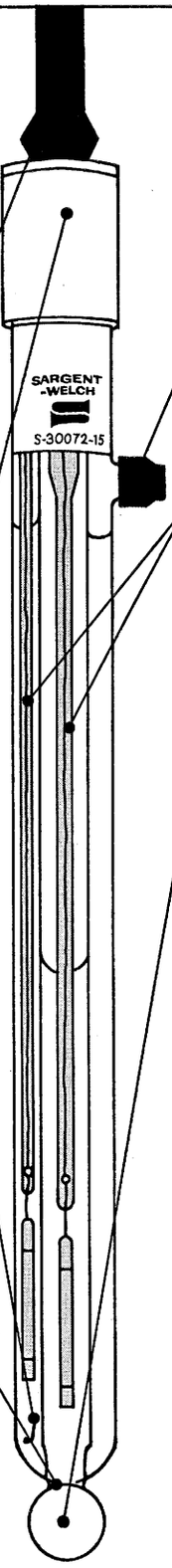

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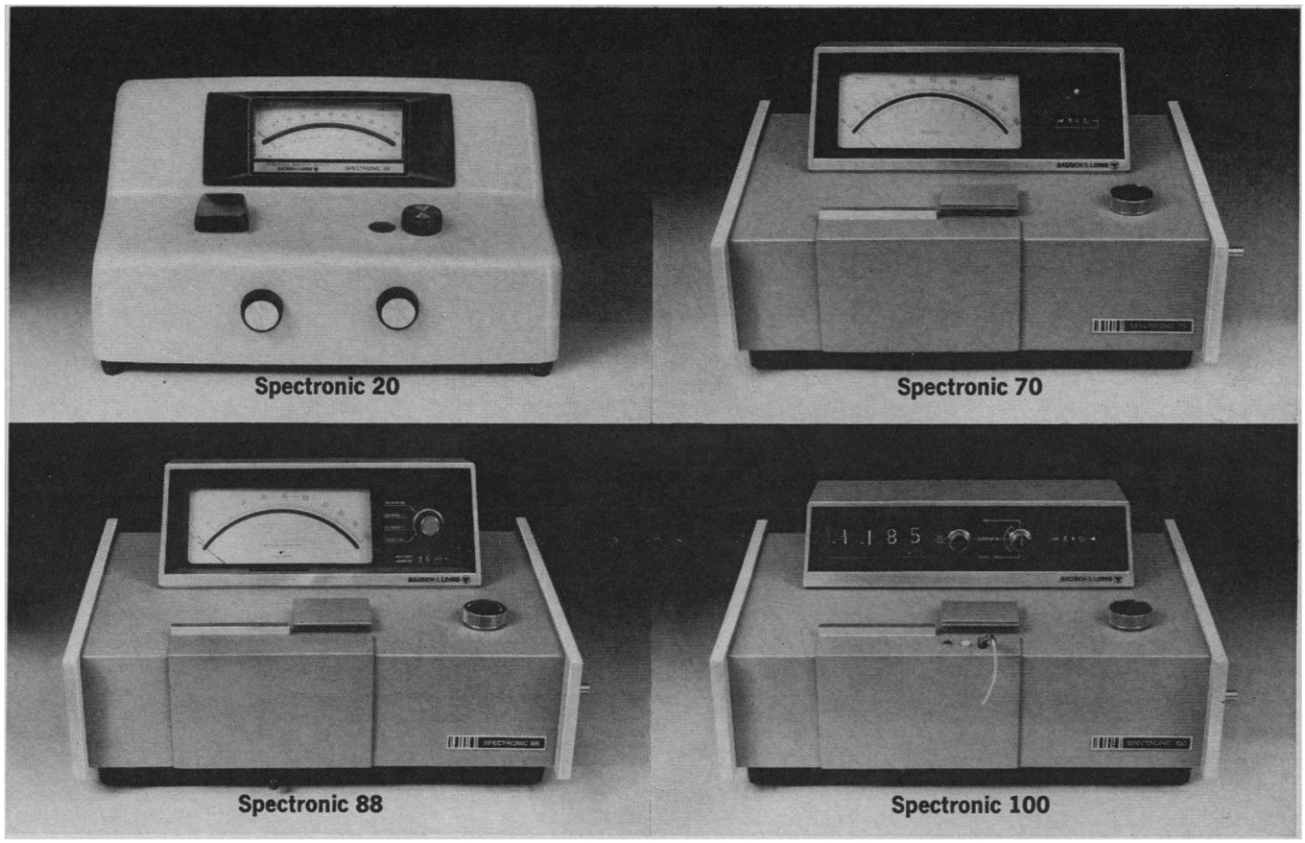

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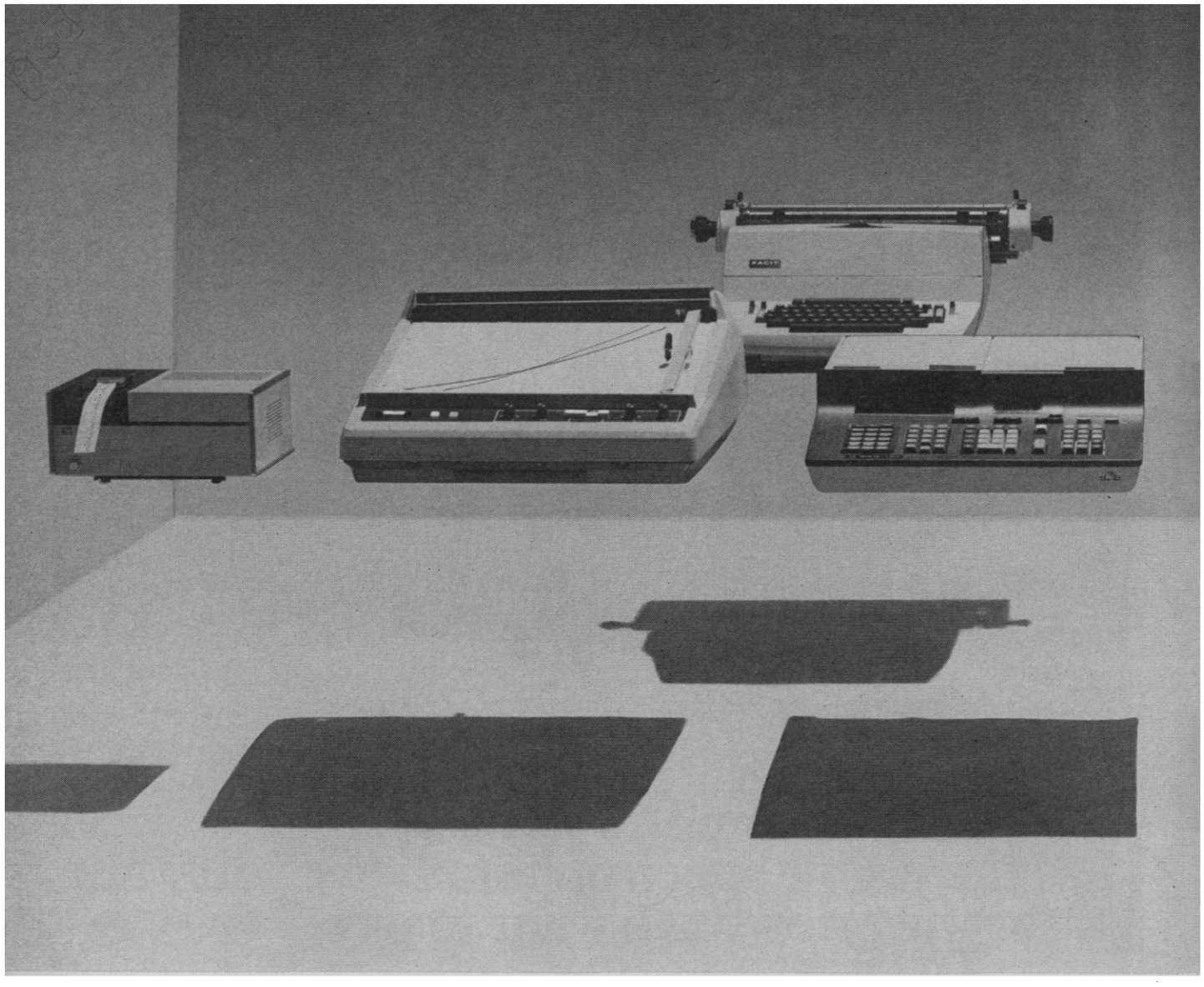

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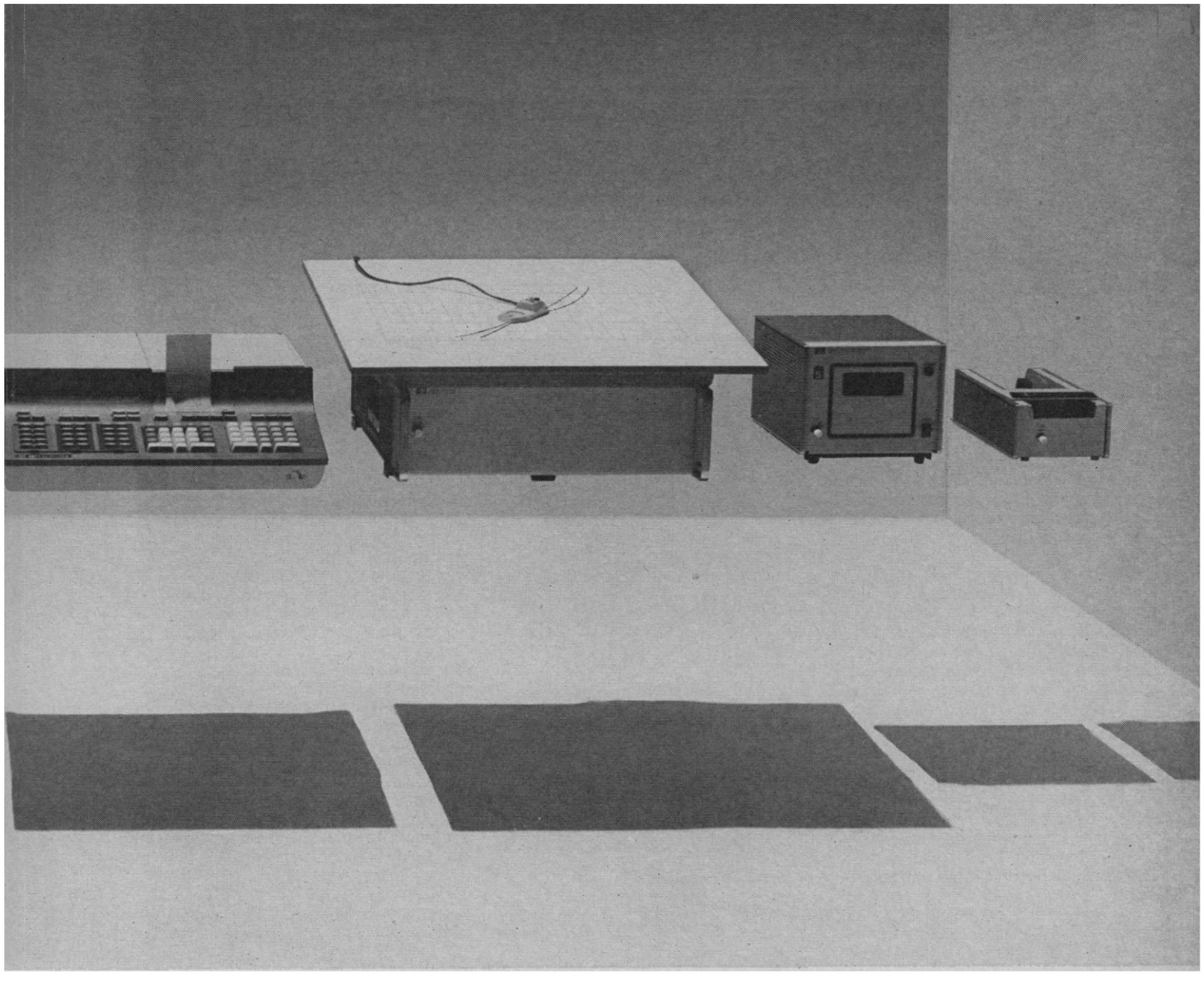

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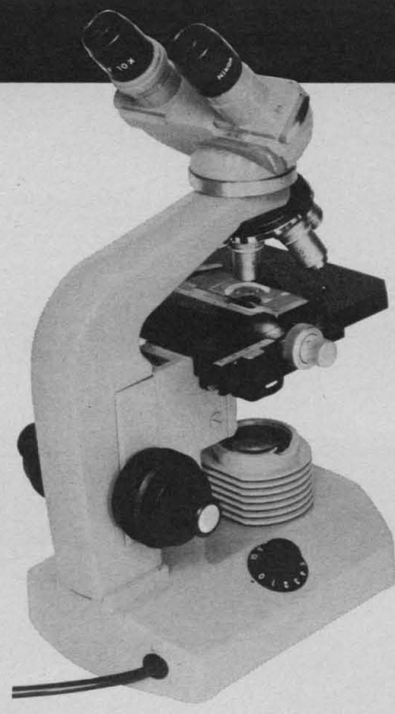

Today's classroom microscope must combine high optical quality with rugged durability. It must be realistically priced to meet tight college budgets without sacrificing quality workmanship. We are now offering such a microscope—planned, designed, and built for the student and the classroom. We offer the CL Classic.

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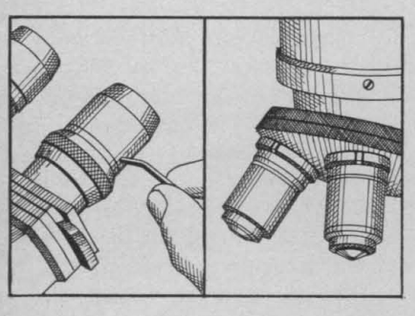
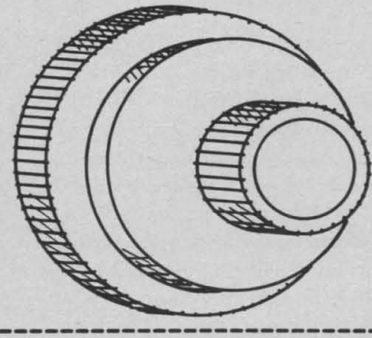
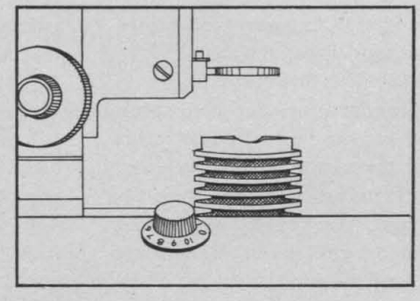
Nikon CL microscope







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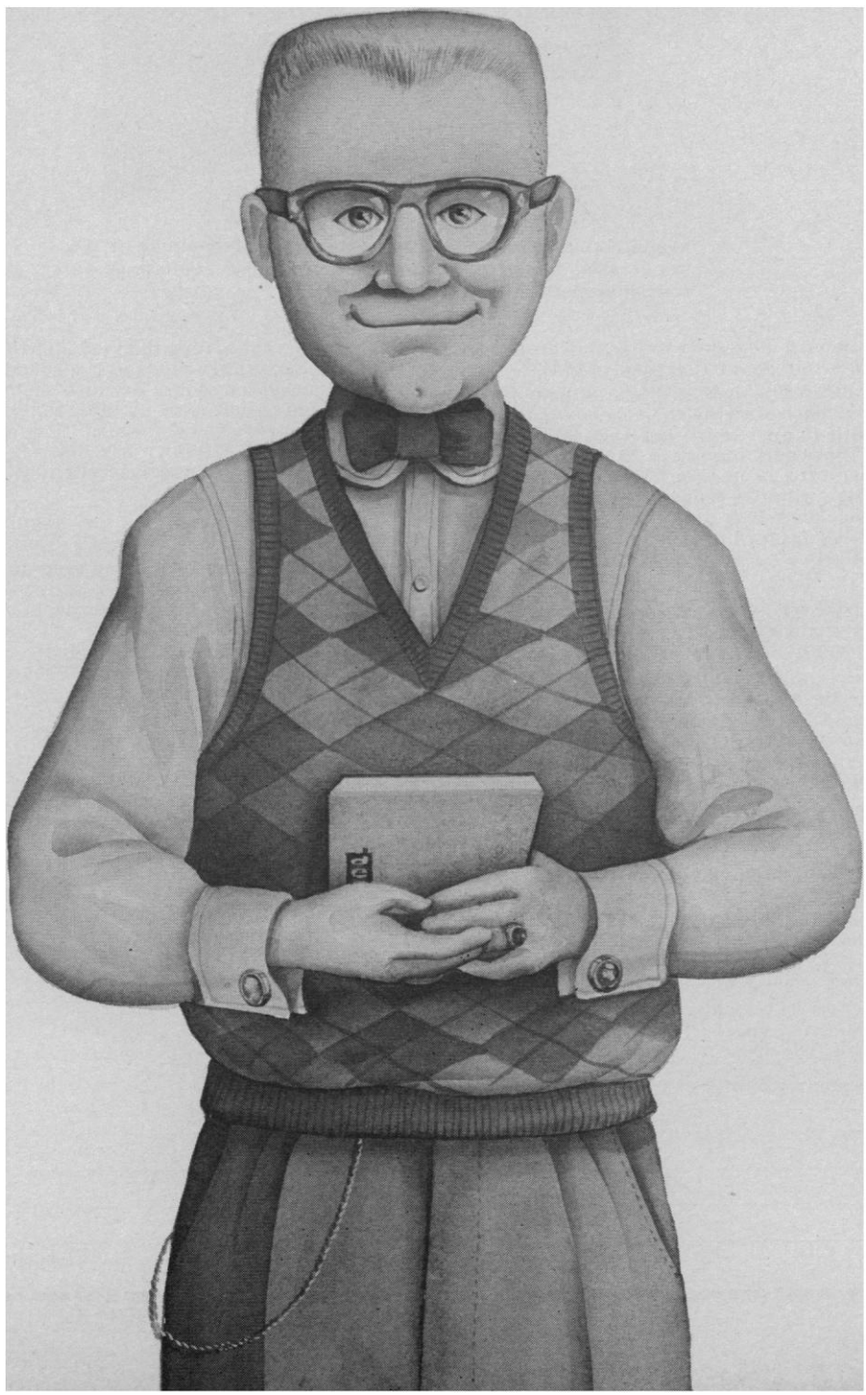

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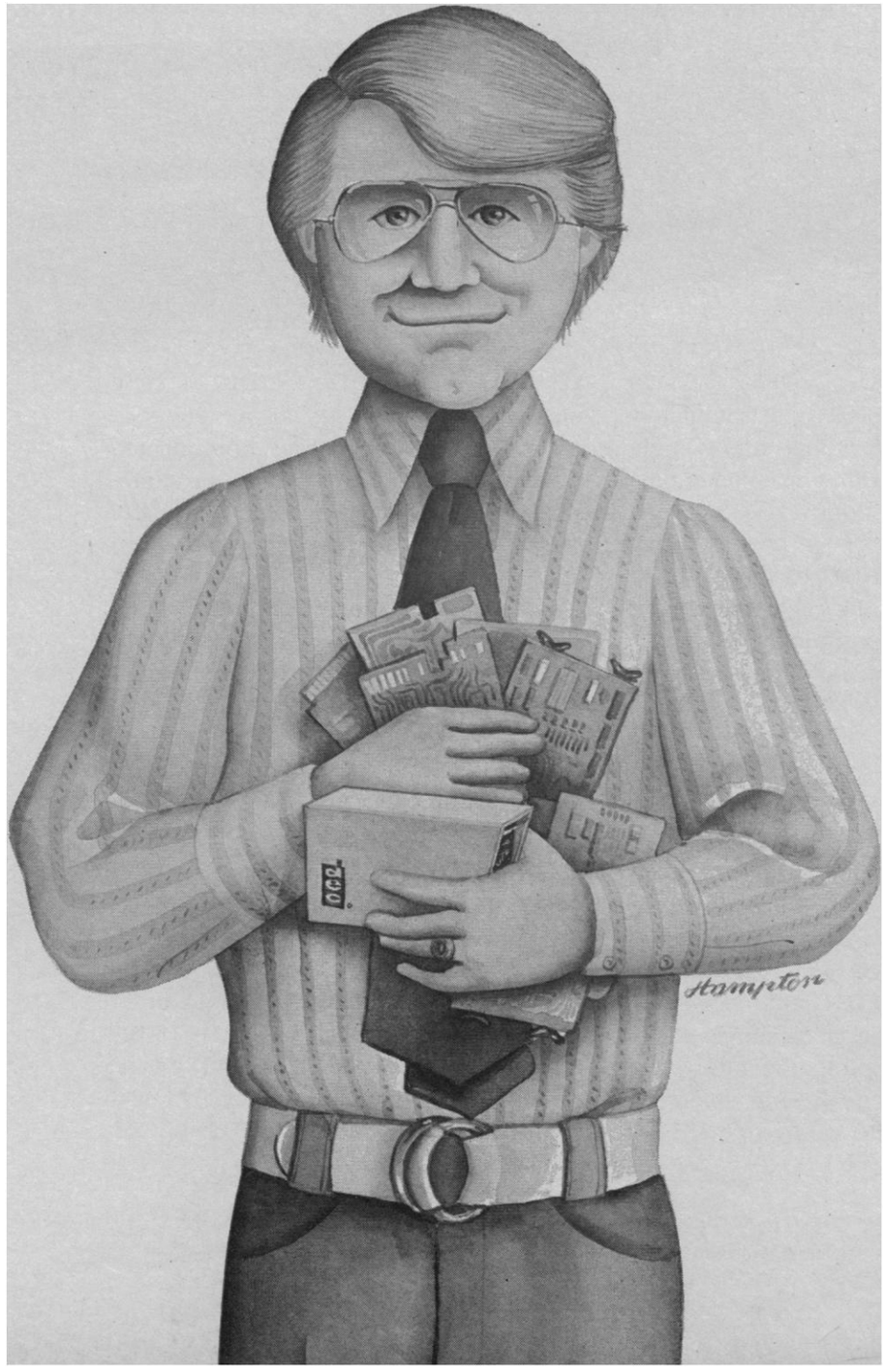

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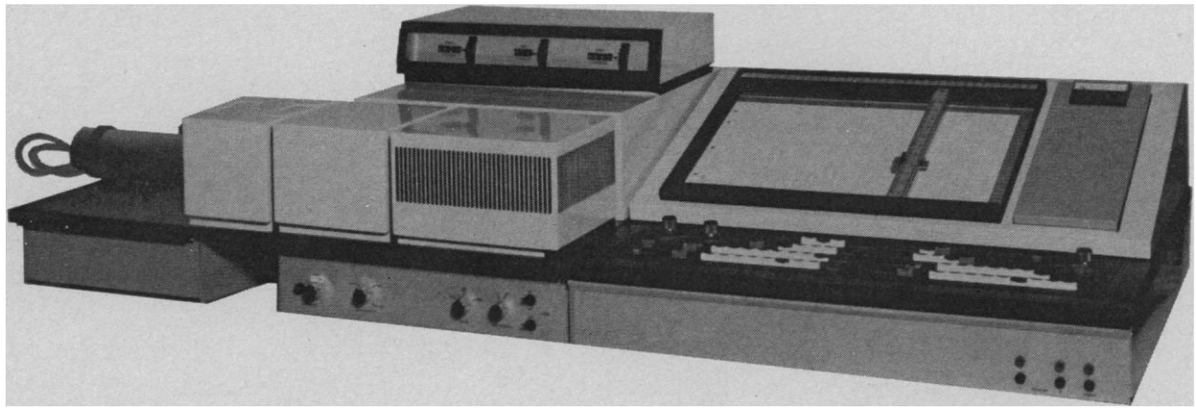

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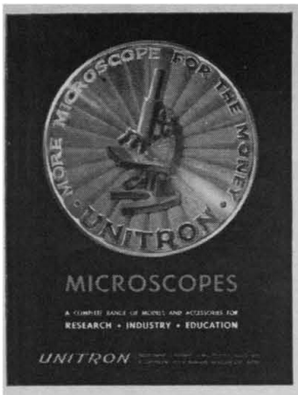

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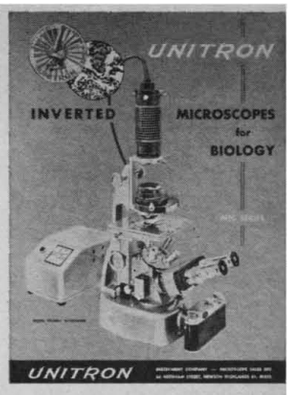

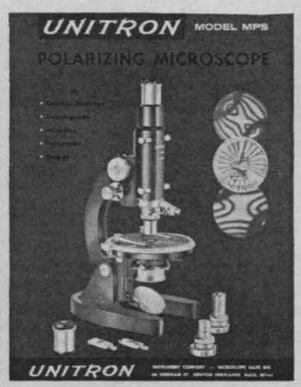

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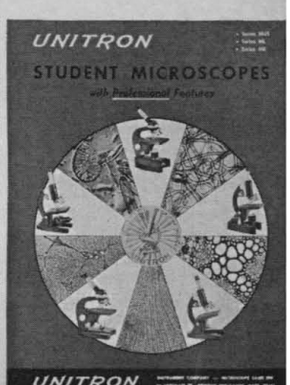

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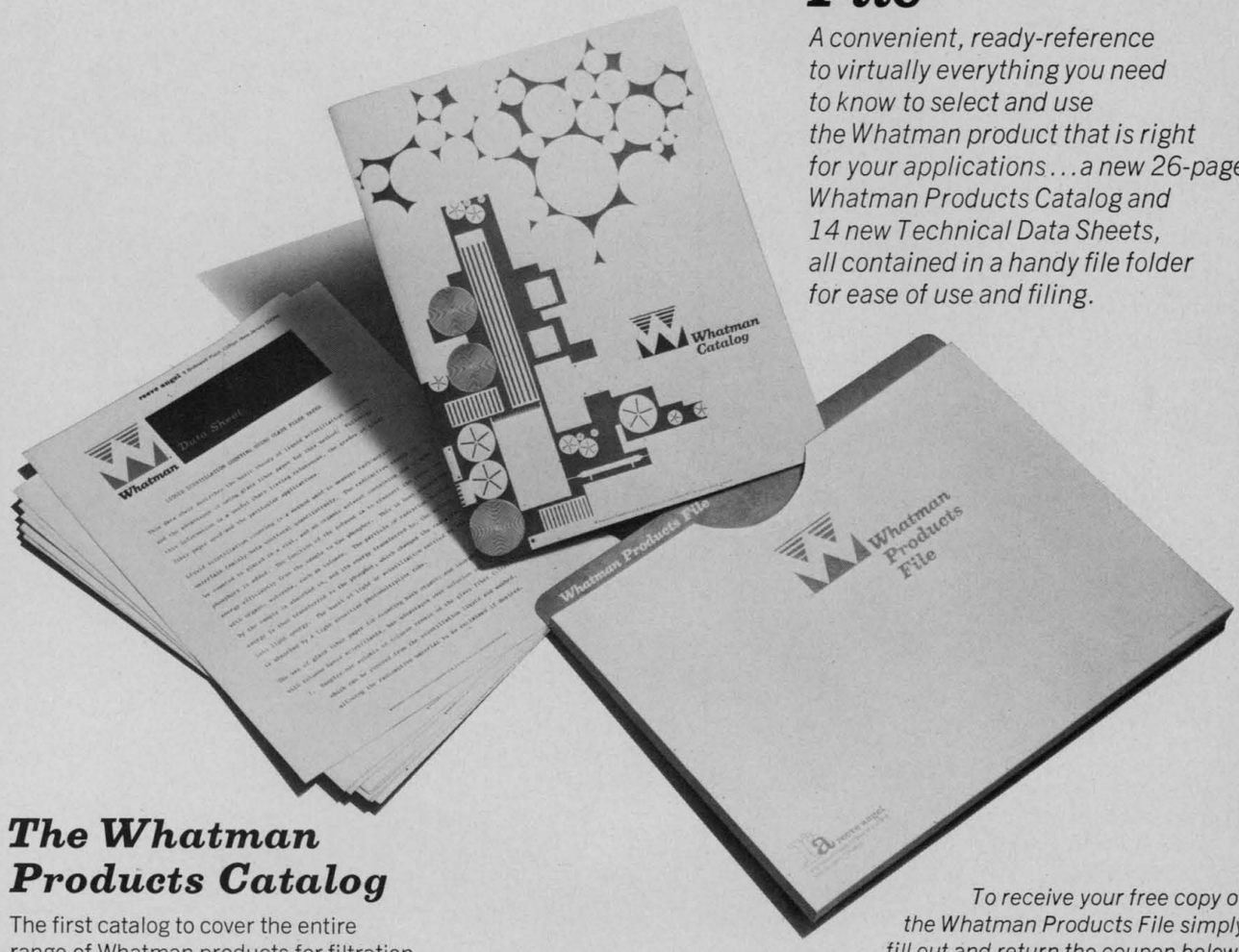

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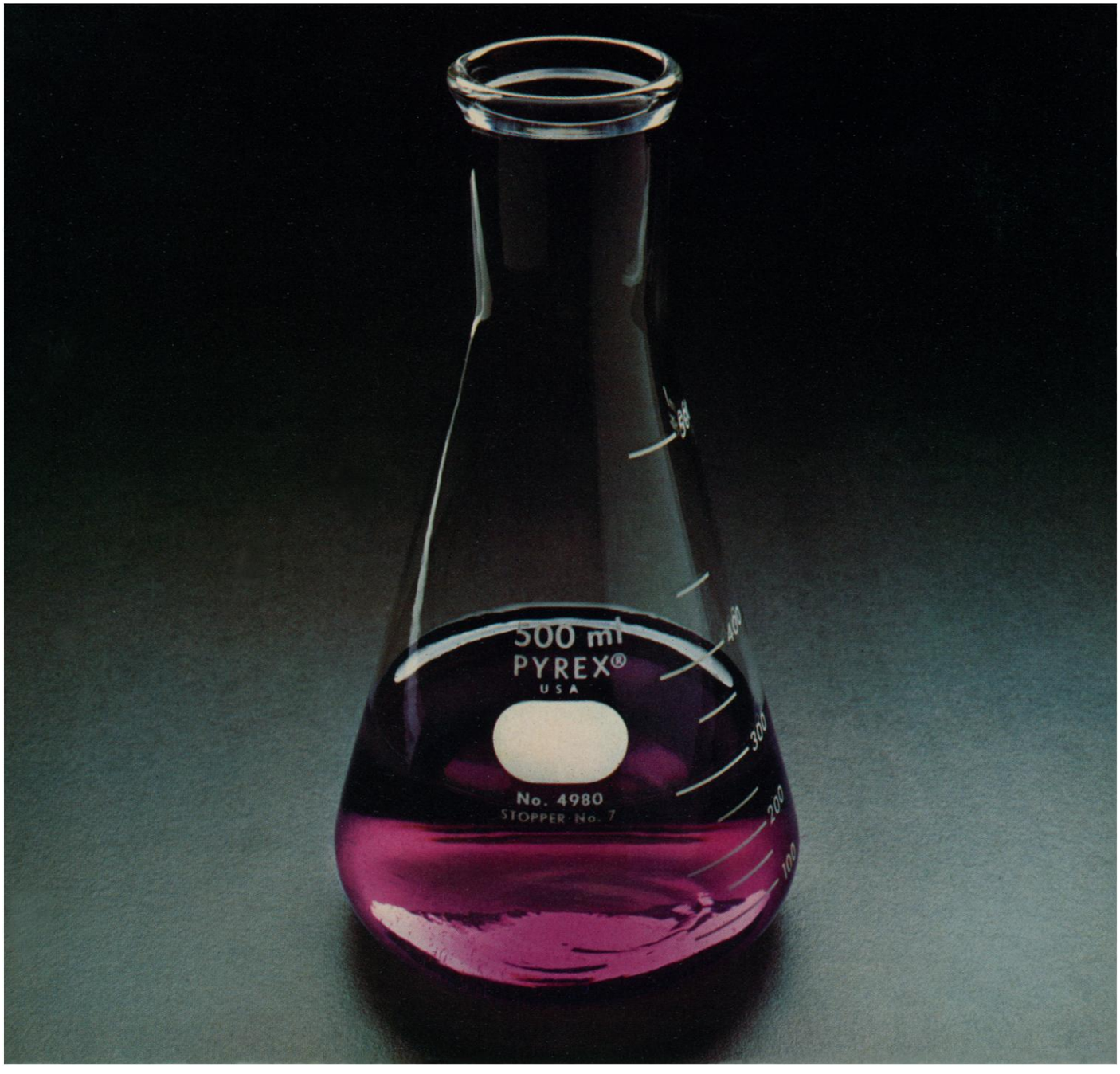

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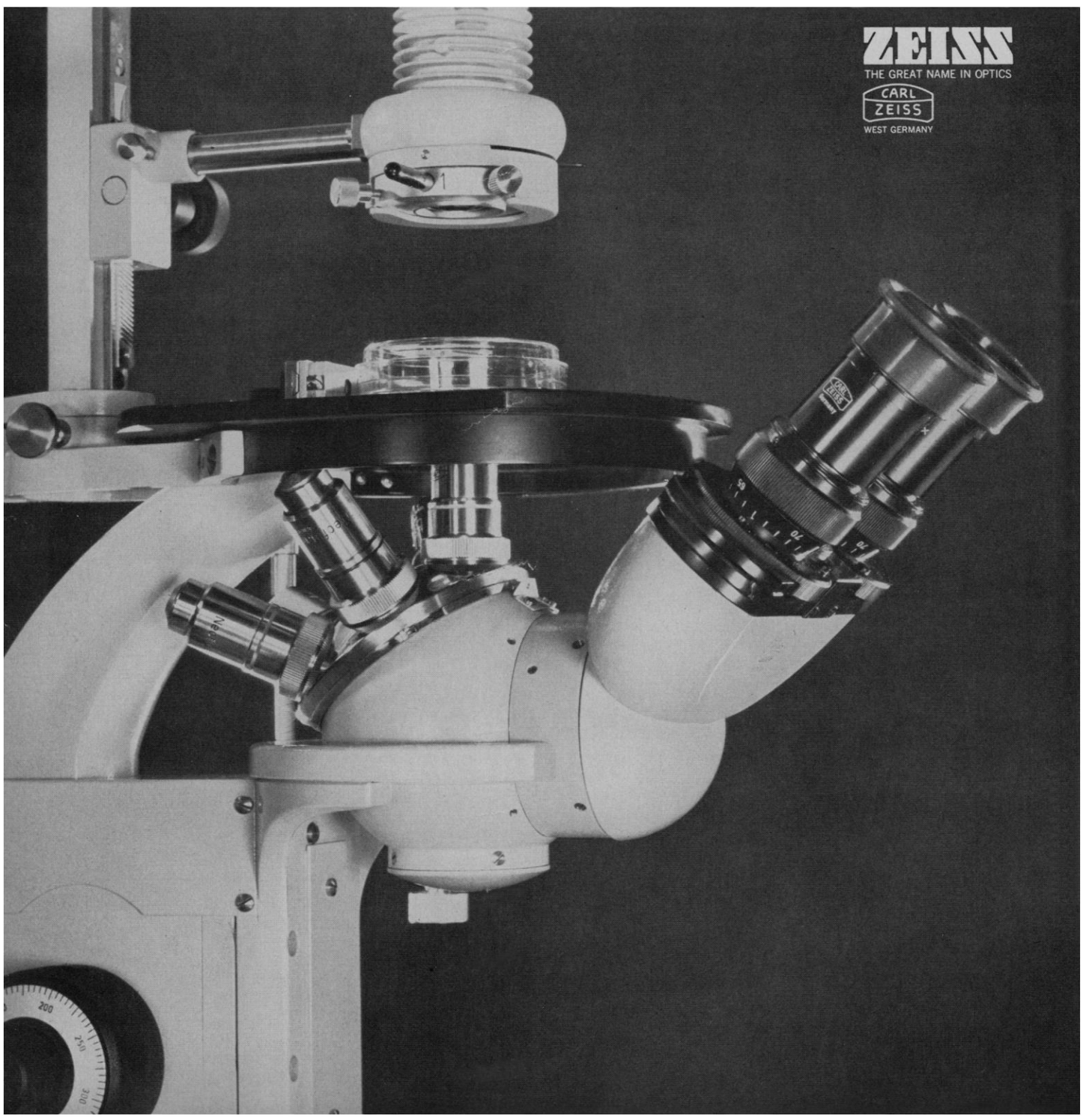

opportunity costs of such protracted agony or unnecessary babysitting seem unbearable.

Furthermore, in such a model, the number of degrees produced per student enrolled is a function not only of university size but of the student-faculty ratio as well. Thus, the effects of diseconomies of scale can be largely offset over a considerable range of size increases by optimal downward adjustments in the student-faculty ratio. In fact, from both the humanistic and the economic point of view, a strong case can be made for considering optimality in terms of student-faculty ratios rather than in terms of scale. A simulation of the 100 largest universities suggests that if the student's time is considered to be worth about $8000 per year, the cost per degree increase brought about by a reduction of the student-faculty ratio of 22 to 1 to 16 to 1 is nearly offset by the shorter time it takes to get the degree (*2*).

A fear that legislative attention to the degree measure of university output would exert pressures on universities to become diploma mills should not prevent the study of the behavior of degrees nor the search for additional reliable output measures.

Finally, consider the dysfunctions of growth as opposed to those of scale to which Gallant and Prothero have drawn our attention. Growth refers properly to rates of change over time and can be accompanied by various forms of instability. As the authors have pointed out, many institutions of higher education have experienced extraordinary rates of growth as a result of the postwar baby boom. These high rates of growth may have been accompanied by overshooting in numerous forms. The clearest example of overshooting is surely the case of Ph.D. production. Somewhat more subtle difficulties may have also arisen. For example, the rate at which faculty can be graciously and nondisruptively absorbed into existing structures may be much lower than the growth rate experienced by some institutions in recent years. There is some evidence that those institutions which have resisted growth have been least disrupted by the events of recent years. It would be a serious mistake to prematurely conclude that obesity is the problem when overindulgence is the real difficulty.

ROBBIN R. HOUGH
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References

1. R. R. Hough, in *The Outputs of Higher Education* (Western Interstate Commission on Higher Education, Boulder, Colorado, 1970).
2. ———, *What Economists Do* (Harper & Row, New York, 1972), pp. 69–99.

The rank-order test is valid within the limited domain of highly rated departments which we tabulated. That is, the number of departments in each size increment was approximately constant in the sample we used. Van Nostrand is, however, correct in suggesting that a survey of all departments in the world would be more illuminating.

As weight-watchers, we agree with Hough's distribution between obesity and overindulgence. (The scale principle in biology pertains to the former, rather than the latter.)

Meier has put a backhanded finger on a fundamental problem which underlies the questions raised in our article: the application of the scale principle to *all* social institutions. We limited ourselves to the narrow context of university growth, but universities have not been alone in the recent trend toward expansion and centralization. If the scale principle does apply to social institutions, then dysfunctions of scale should also be identifiable in Big megalopolis, Big government, and Big multinational corporation.

Meier suggests that Big university should be thought of as "relevant preparation" for these other constellations. Indeed it is, and that is what worries us. Before hastening to slot the university neatly into this big "brave new world," we think it prudent to ask, first, whether the entire trend is adaptive for society and healthy for human beings.

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Organic Gardening

Emmanuel Epstein (Editorial, 21 Apr., p. 235) refers to "an amazing recrudescence of quaint lore about 'organic' gardening and food production that reveals an almost total ignorance . . . of the most basic facts concerning the nutrient elements of plants and their absorption."

An example of such ignorance was revealed on a recent television program, when the author of a best-selling

book on nutrition advised the audience to beware of food grown with "chemical fertilizer." This reminded me of the answer given by a freshman just enrolled in a chemistry class to the question: Are the nitrogen and oxygen in air present as a physical mixture or as a chemical compound? He wrote, "Air cannot be a chemical compound, because chemistry was not invented for thousands of years after the Creation."

The boy had only begun to study chemistry and presumably soon learned that synthetic ammonia is the same stuff as ammonia from steer manure, but there are multitudes who shy away from chemistry and easily become the dupes of those who prey upon ignorance. The rise of the cult of "organically" grown food is one more example of the fact that some minds are more open to superstition than to knowledge.

JOEL H. HILDEBRAND
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Women Physicists

The Roster of Women Physicists, for which information was obtained by questionnaires circulated last fall, has just been printed by the American Physical Society (*1*). A supplement to update the present roster is in preparation, and women now listed are being sent new questionnaires. We urge women physicists who have not yet filled out a roster questionnaire to obtain one promptly by writing to E. Baranger, Committee on the Status of Women in Physics, at the address given below.

The term "women physicists" is meant to include women with the B.A., B.S., or a higher degree who are actively engaged in work related to physics and also women with advanced degrees in physics who are working in areas not related to physics or are not presently working.

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15 September 1972, Volume 177, Number 4053

SCIENCE

Earth Sciences and the Quality of Life

One of the great developments of this generation has been sharply increased realization of our mutual interdependence as citizens of this planet. The concept has been dramatized by the phrase "space-ship earth" and given worldwide political recognition in the holding of the Stockholm Conference. Two major themes emerged at the conference. One was the obvious desire of the wealthy countries to minimize global effects of environmental degradation. The second was a great wish for help in development manifested by the less-developed countries. Both these desires are likely to endure, and they will influence the worldwide evolution of science and technology.

Zest for the coming challenges was especially evident at the recent International Geological Congress in Montreal. There the first scientific plenary session of the congress was devoted to "Earth sciences and the quality of life." Included were talks by Maurice Strong of Canada on "Science and society in the environmental age," J. Goguel of France on "La geologie et les connaissances humaines," and Sir Kingsley Dunham of the United Kingdom on "The influence of crustal resources." On succeeding days additional symposium sessions were devoted to the same topic. In a broad sense, though, the entire congress and its nearly 2000 presentations dealt with this topic. There was naturally a broad spectrum in the degree to which various papers related to the human condition. Many papers were immediately relevant. Others dealt with studies aimed at enriching our understanding of the earth. For example, the concept of plate tectonics continues to be extremely stimulating of new ideas and interpretations; presentations relating to it were very well attended.

When one considers the effort and money that goes into a great international congress it at first seems questionable whether the outcome justifies the expenditures. If one approaches the matter solely from the standpoint of transfer of technical information in formal talks, the congresses are perhaps inefficient. But that is not the crucial point. The major value of such gatherings lies in the facilitation of human contact. These contacts permit quick mutual evaluation to a depth that no amount of correspondence could ever achieve. Given a meeting of minds, new friendships are formed that carry with them trust and a willingness to enter into all manner of collaborative arrangements at the meeting and subsequently. Thus the international meetings lead to purely scientific cooperation; they also lead to international collaboration in areas where science and society interact.

Quality of human contact is at least to some degree dependent on the physical circumstances. In this respect the Canadians put on an especially admirable show. Montreal now has superlative facilities and is an excellent setting for scientific meetings. The Canadian scientists who arranged the Montreal meetings had unusually great responsibilities which they discharged very well. Before and after the congress they provided about a hundred geological field trips throughout almost all of Canada. They edited and published about 5000 printed pages of scientific material. They arranged for the majority of the scientific talks and handled all the other logistics of a congress. Most important of all for the facilitating of useful human contacts, the Canadians were excellent hosts, and their guests were comfortable. The Montreal meeting ranked with the best ever and represented a new high in Canadian contributions to international science and human progress.—PHILIP H. ABELSON

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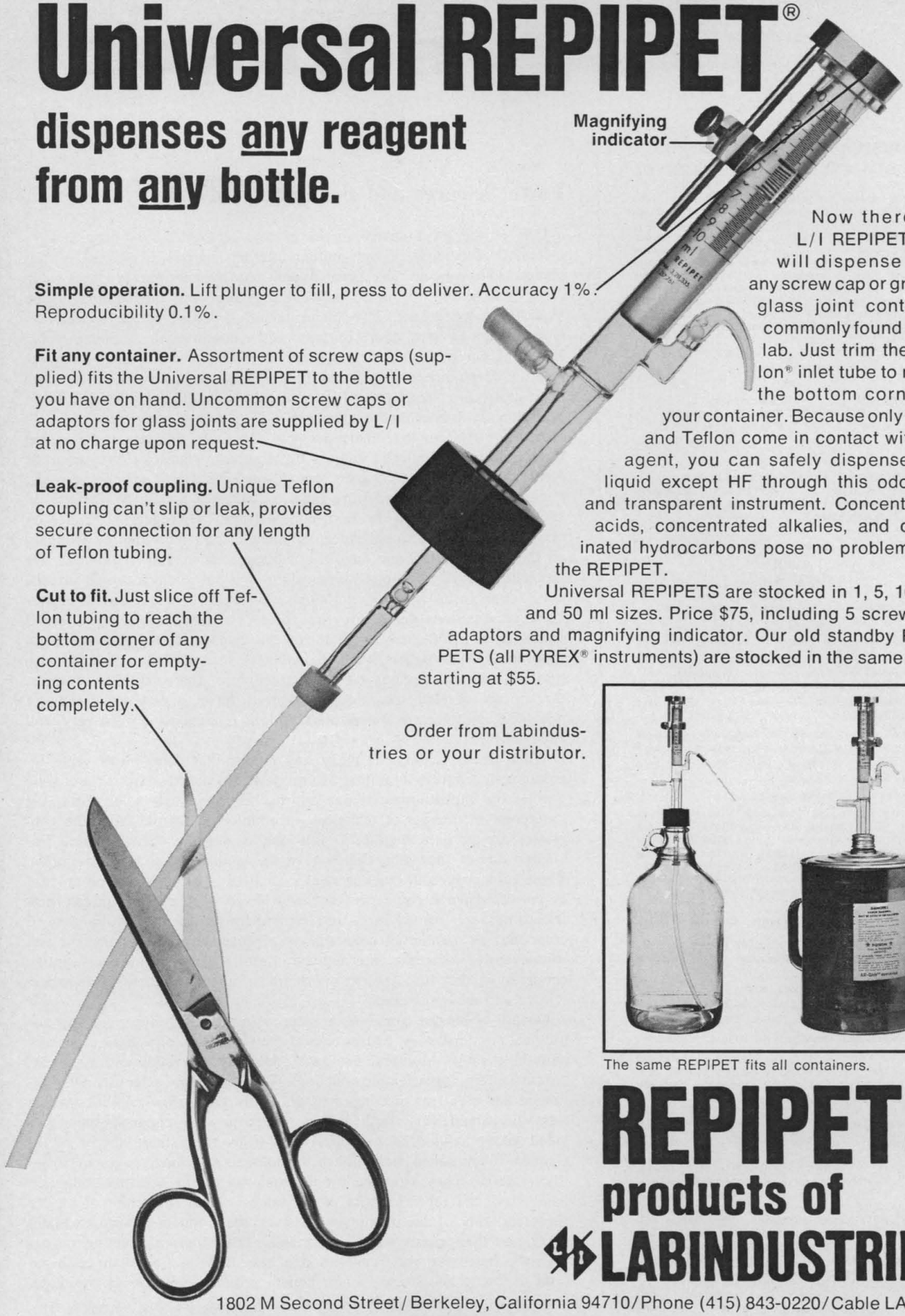

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Advances in Quantum Chemistry. Vol. 6. Per-Olov Löwdin, Ed. Academic Press, New York, 1972. xvi, 414 pp., illus. $24.50.

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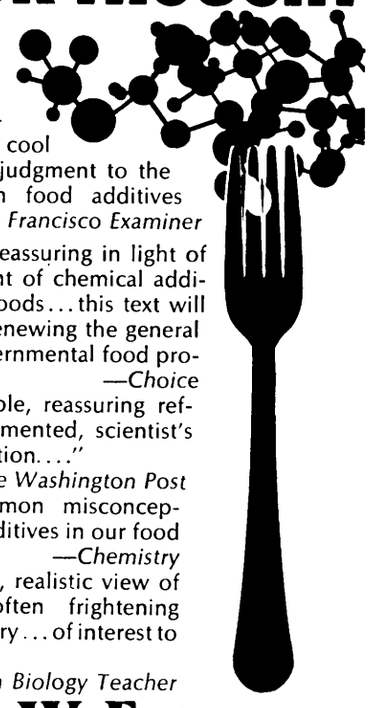

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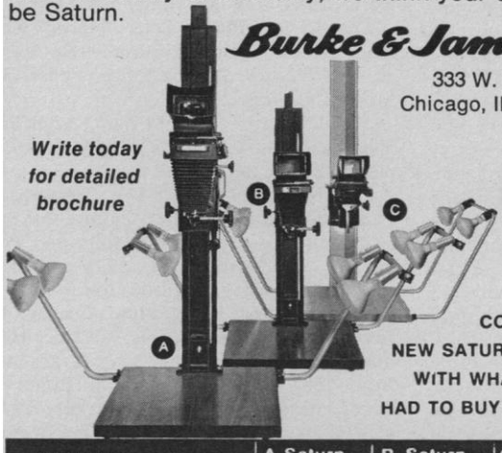

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APPOINTMENTS

George E. Gullen, Jr., acting president, Wayne State University, to president of the university. . . . **Charles W. Terrel**, district manager, Computer Sciences Corp., to president, Indiana Institute of Technology. . . . **Loring E. Hart**, vice president and dean, Norwich University, to president of the university. . . . **Ronald W. Roskens**, executive vice president, Kent State University, to chancellor, University of Nebraska, Omaha. . . . **Donald E. Walker**, vice president for academic affairs, San Diego State College, to president, Southeastern Massachusetts University. . . . **Sidney Borowitz**, provost, New York University, University Heights, to chancellor and executive vice president of the university. . . . **C. Peter Magrath**, vice chancellor for academic affairs, University of Nebraska, Lincoln, to president, State University of New York, Binghamton. . . . **Robert W. Deutsch**, chairman, nuclear science and engineering department, Catholic University, to president, General Physics Corp., Maryland. . . . **William H. Moretz**, chairman, surgery department, Medical College of Georgia, to president of the college. . . . At the University of Bridgeport: **Warren Carrier**, dean, College of Arts and Letters, San Diego State College, to vice president for academic affairs and **Albert J. Schmidt**, professor of history, to dean, College of Arts and Sciences. . . . **Noel L. Leathers**, dean, College of Arts and Sciences, University of Toledo, to vice president for academic affairs, University of Akron. . . . **Robert F. Wambach**, professor of forestry, University of Montana, to dean, Forestry School at the university. . . . **David C. Kraft**, professor of civil engineering, University of Dayton, to dean, School of Engineering at the university. . . . **Gail E. Myers**, associate dean, Trinity University, to dean, College of Arts and Sciences at the university. . . . **Harry P. Ward**, associate professor of medicine, University of Colorado, to dean, School of Medicine at the university. . . . **Julian H. Lauchner**, professor of engineering, Southern Illinois University, to dean, Fenn College of Engineering, Cleveland State University. . . . **James C. Hall, Jr.**, dean of students, New York City Community College, to dean of continuing education, York College, City University of New York.