SCIENCE

25 July 1975

Volume 189, No. 4199

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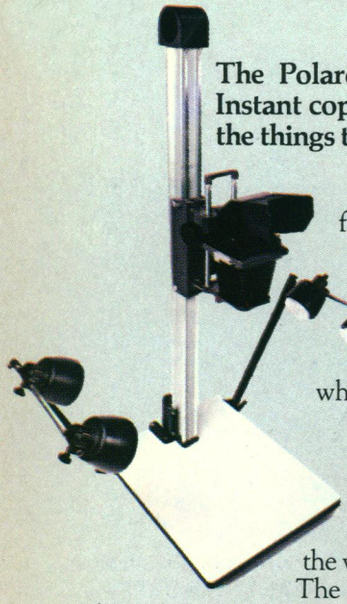

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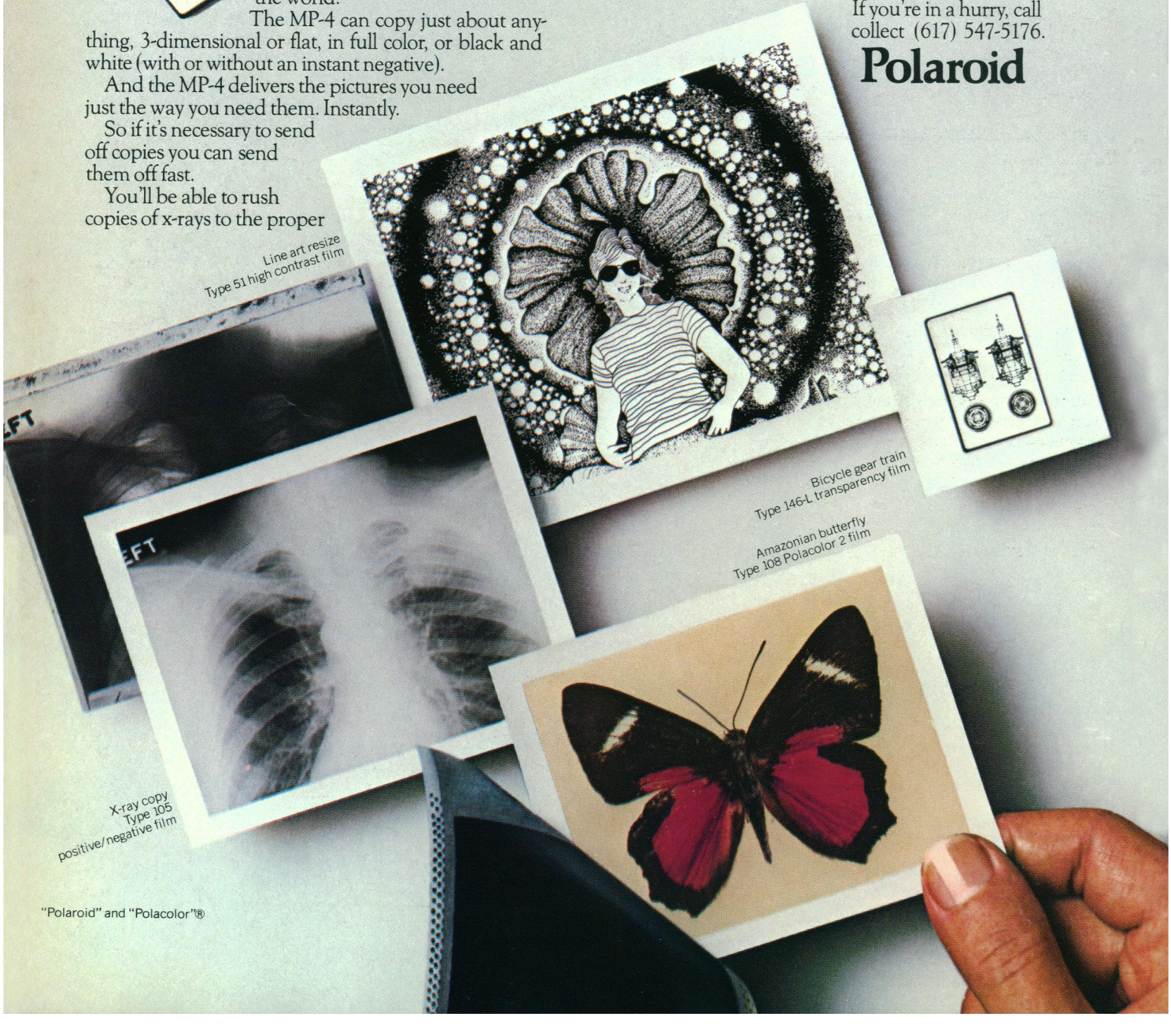

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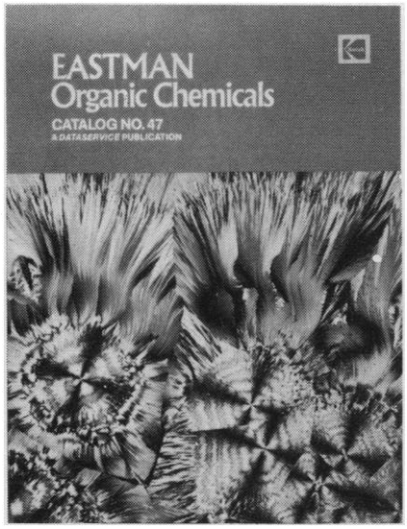

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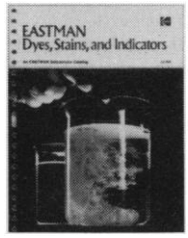

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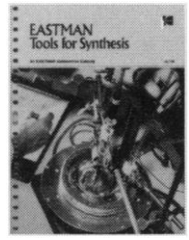

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25 July 1975

Volume 189, No. 4199

SCIENCE

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COVER

If, in the future, thousands of windmills will supply energy (for example, in Denmark), designs must be of high esthetic quality. See page 255. [Jean Fischer, F.L.S. Overseas Innovation, Hjallese, Denmark]

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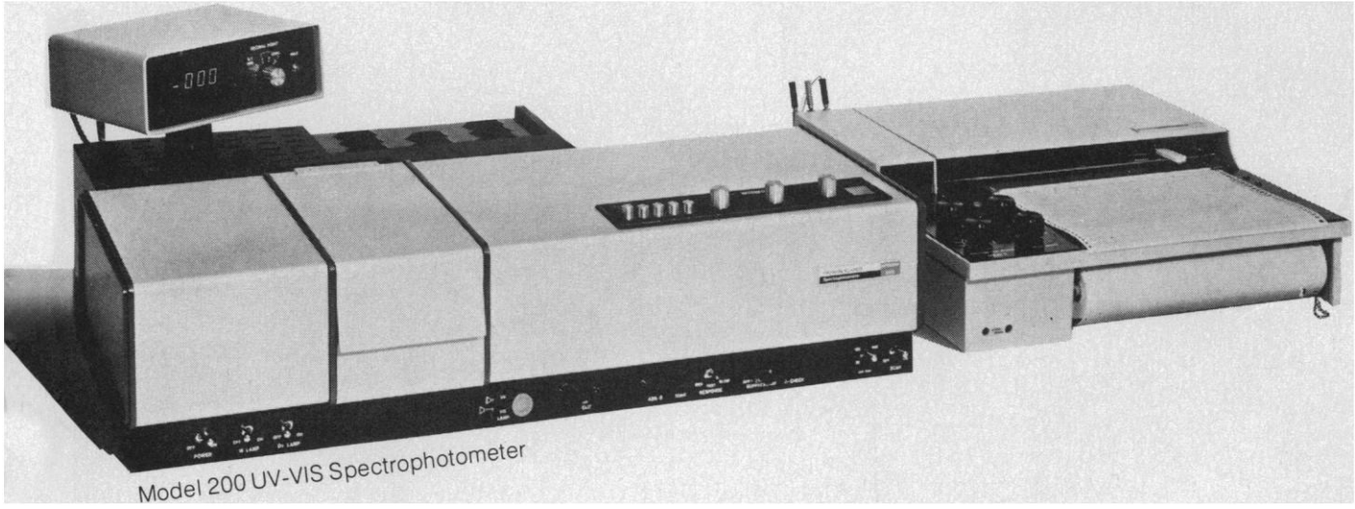

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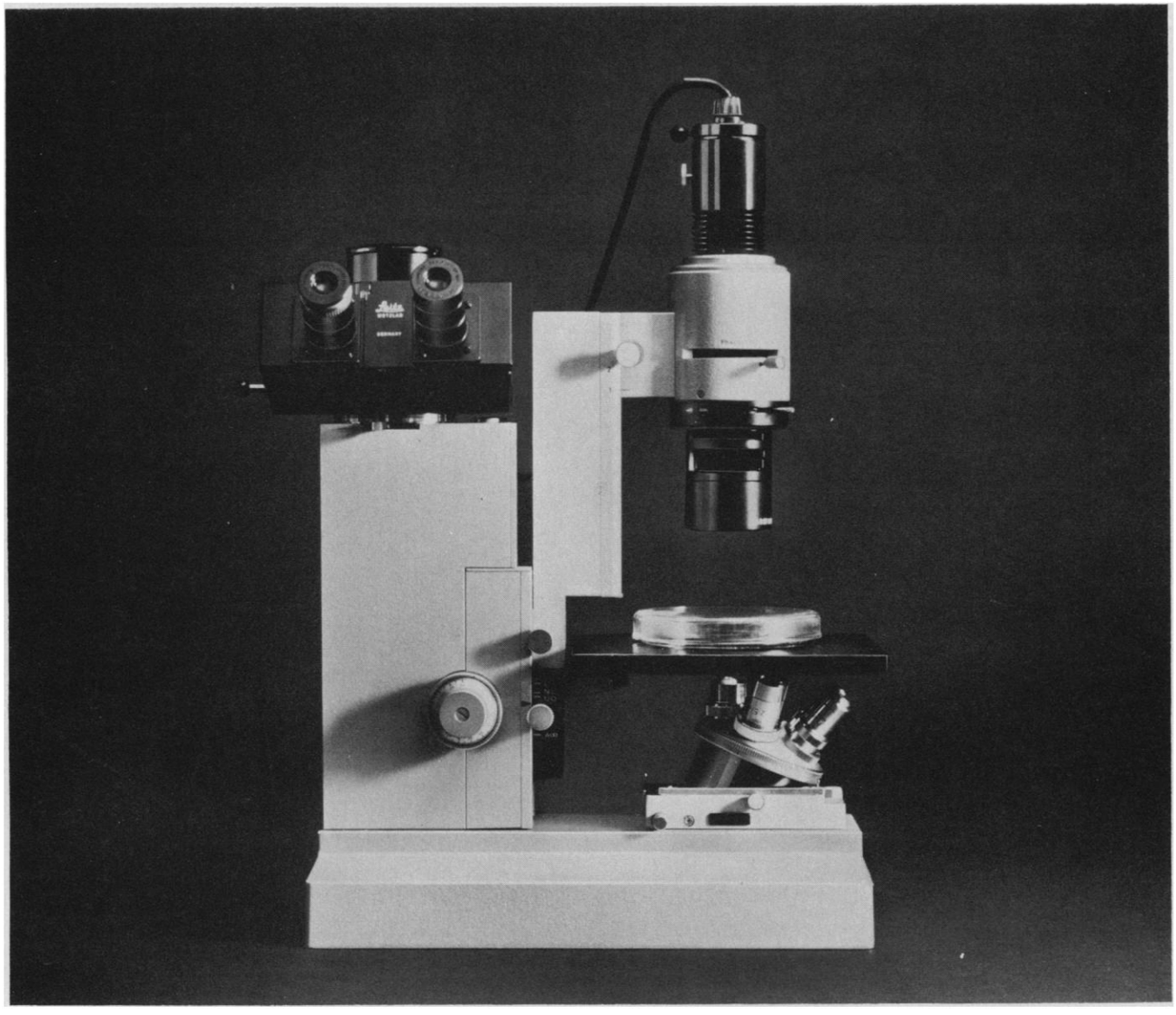

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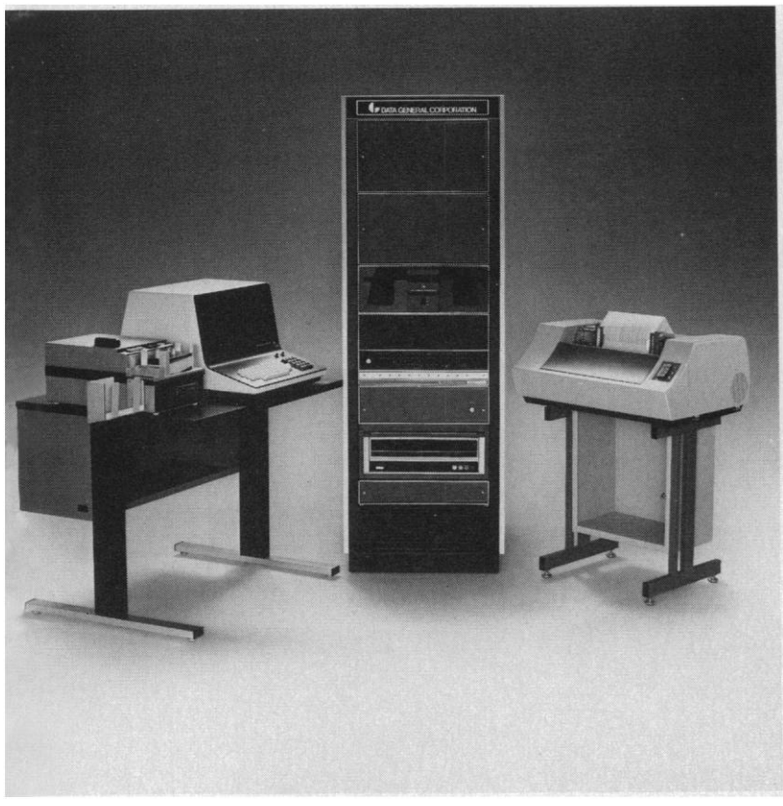

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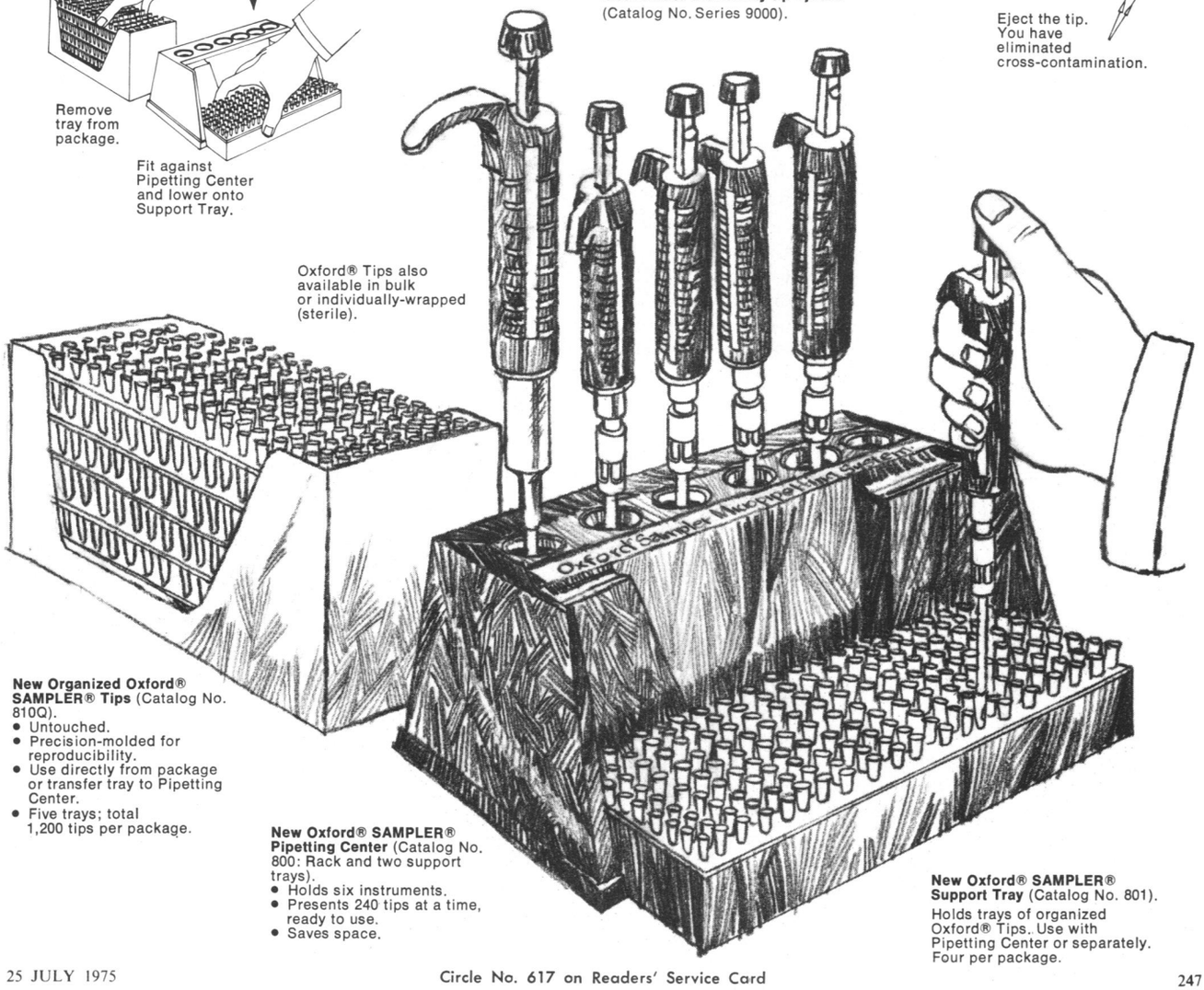

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litical purposes in our institutions of higher education, but it is these same institutions that are unable to come up with solutions to the problems of sex discrimination, inept handling of student files, and the dearth of physicians in rural areas. As Anthony Lewis pointed out in his article "Liberals now worry about federal power" (*1*), the federal government acted because no one else would. Of course it is distasteful to those who value academic freedom to feel that they are subject to "disciplinary action" by the federal government because of their views on such controversial subjects as the antiballistic missile and ROTC programs, but to date no one except the federal government has attempted to solve the problems of unfair treatment of women academics or the lack of adequate medical personnel in remote areas of the country. The government's methods of solving these problems may be open to question, but until alternative solutions are forthcoming from the academic community itself, the coercive power of the federal purse seems to be a successful way of righting the wrongs of the past. Perhaps the questions we should be asking are not Is your objective worthy? or Are the means you would use consistent with the values of the Constitution? but rather, What are the alternative solutions to these problems? and How can we remedy them without government intervention? It is the presidents of our universities who should be finding solutions to the problems of academia and not Washington. There is no doubt that the coercive power of the federal purse should be made subject to a rule of law, both in terms of limits on authority and redress against its abuse, but that too will require some action, if not by the legal profession, probably by the federal government.

ALICE J. BELLING

Department of Biology, Graduate School of Arts and Sciences, New York University, 952 Brown Building, Washington Square, New York 10003 and *Metropolitan New York Chapter, Association of Women in Science, Box 601, Madison Square Station, New York 10010*

References

1. A. Lewis, *New York Times*, 13 April 1975, sect. 4, p. 18.

Brewster states that "use of the leverage of the government dollar to accomplish objectives which have nothing to do with the purposes for which the dollar is given has become dangerously fashionable." He does not discuss the other side of the issue, namely, the use of government dollars *by the recipient* for purposes which have little or no relationship to the purposes for which the dollars were awarded. This, I suspect, is an equally important part of the problem. Congress and the President are elected by the people and they have an obligation to enact legislation to cope with problems and in general meet the needs of the populace.

An example cited by Brewster is that of the general lack of quality health care at a cost people can afford. Congress attempted to cope with this problem by legislation such as the so-called capitation grants to medical schools. However, there is still a shortage of primary care physicians, an uneven distribution of health care throughout the country, and medical costs continue to soar. Clearly, the legislation and appropriations have not achieved the goals intended by Congress. A lack of leadership from the American Medical Association and the nation's medical schools has significantly contributed to the development and continuation of these problems. The "coercive power of the federal purse" therefore appears to be (at least in part) a reaction to the failure of leadership in health education and the medical profession. The proposed health manpower legislation would provide funding only to those medical schools which increase the number of general practitioners and which place their graduates in areas of greatest need; these are, in fact, the unrealized goals of the earlier legislation.

Affirmative action is another example used by Brewster. There is a good deal of evidence that higher education has not provided leadership and has opposed changes required for affirmative action. It is very disappointing that the institutions with the greatest commitment to maximum development of the human potential should oppose affirmative action. The federal coercion in this area, including any shortcomings in the affirmative action programs, can be directly traced to the weak responses from educational institutions.

Federal legislation and funding is always directed toward some goal(s). From this point of view it is supposed to be coercive. If we don't agree with the goals, we shouldn't take the money. Because of the democratic process, I believe the goals are generally good and we can be supportive of them. The higher education community has become another pressure group seeking funding for its own interests. I suggest that we need to exercise broader and stronger leadership. Make more use of our academic freedom, so hard-won and treasured. Look to long-range national interests and the public good. Decline federal funds awarded or administered in ways which conflict with our values. Cooperate with legislators and federal administrators in the design and administration of pro-

grams to meet the needs of the people. Brewster has focused attention on an important problem. The answers, I believe, will be found in examining our values, rising above selfish interests, and bringing our actions (policies, practices) into agreement with our beliefs. It won't solve the problem to blame it on the Feds.

ROBERT H. LINNELL
Office of Institutional Studies, University of Southern California, Los Angeles 90007

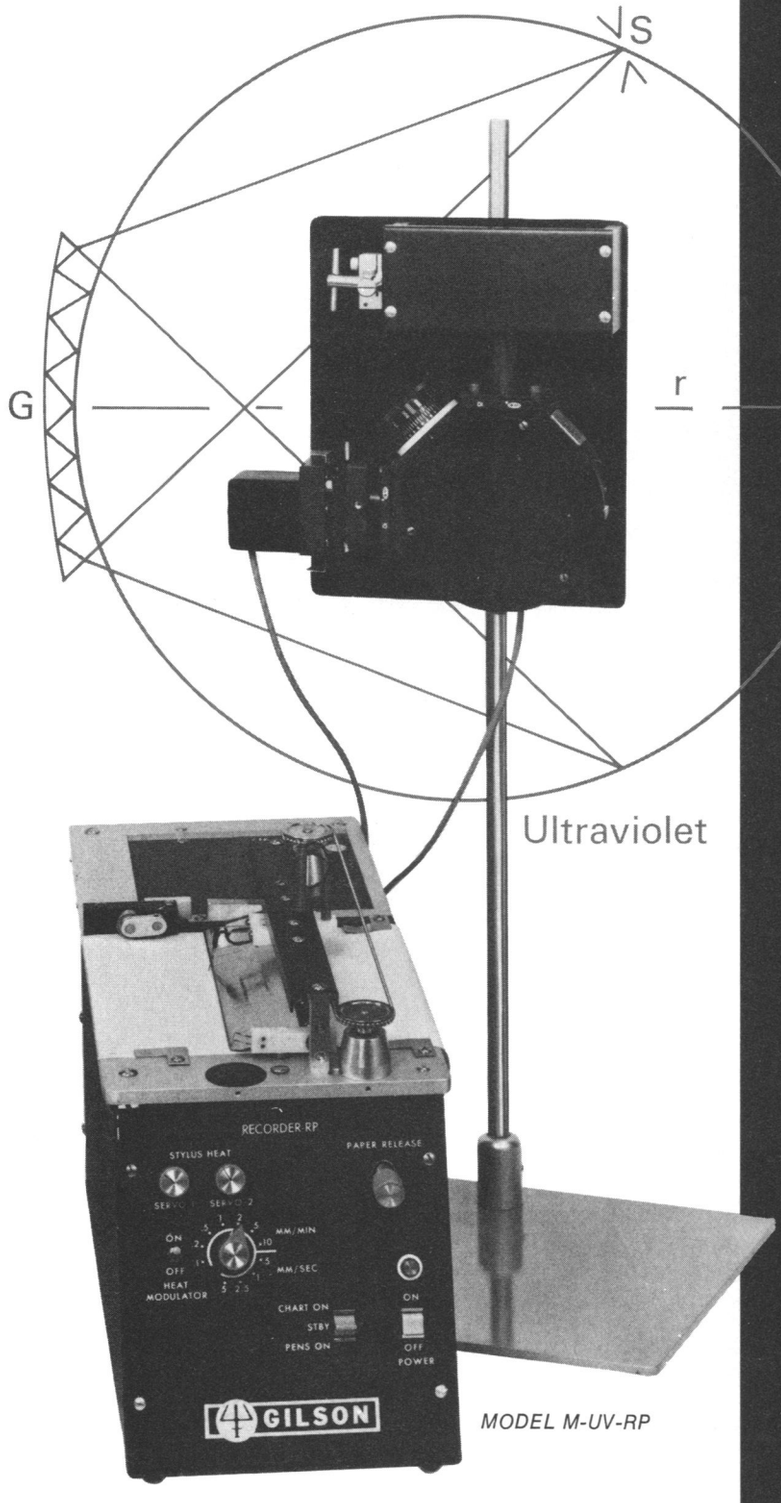
Uranium Enrichment

I read with great interest the articles by Robert Gillette on the coming of age of the German "separation nozzle" process (News and Comment, 30 May, p. 911) and the related South African "helikon" technique (News and Comment, 13 June, p. 1090) for the enrichment of uranium-235. Gillette states that the man credited with inventing the nozzle process is E.-W. Becker of the Karlsruhe Nuclear Research Center. The possibility of separating gas mixtures in high-velocity jets appears to have been suggested first by Dirac during World War II, and demonstrated experimentally by P. A. I. Tahourdin (*1*) at Oxford University. Dirac suggested that the separative action of a gas centrifuge could be reproduced without any moving parts in a high-velocity jet having curved lines of flow. The centrifugal field established across such a jet would then affect the distribution of atoms and molecules differing in mass in a manner similar to that achieved in a gas centrifuge. Tahourdin, using mixtures of carbon dioxide with either hydrogen or nitrogen, confirmed that this method was able to produce separations of considerable magnitude under certain conditions. Light and heavy fractions of these mixtures were extracted through appropriate slits. A curved-path slit system investigated by Tahourdin bears a close resemblance to that employed in a separation element in the Becker nozzle process, as depicted in one of Gillette's articles (30 May, p. 912). This does not detract in any way from the achievements of E.-W. Becker and his associates at Marburg and Karlsruhe, who have studied the nozzle technique in depth and have moved it from the laboratory to the pilot plant.

S. ALEXANDER STERN
Department of Chemical Engineering and Materials Science, Syracuse University, Syracuse, New York 13210

Reference

1. P. A. I. Tahourdin, "Final report on the jet separation method" (Oxford Report No. 36, Br. 694, Clarendon Laboratory, Oxford, England, 1946).



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Control of Sulfur Dioxide Emissions from Coal

During the next 5 years the United States must adapt to coal as its leading domestic energy source. Merely to make up for the decay in the availability of hydrocarbons, use of coal must at least double during the next decade. But prudence would dictate an even greater shift to coal while reserving hydrocarbons for more crucial purposes than for boiler or process heat. The shift to coal will not be without problems. For example, control of the emission of SO_2 accompanying the burning of coal will be difficult and costly.*

There is abundant evidence that SO_2 alone is less toxic than many pollutants. But SO_2 was present on several occasions when lethal air pollution occurred a decade or more ago. Moreover, SO_2 was present during pollution episodes in major cities where a detectable excess of morbidity occurred. Partly because SO_2 is easy to measure and other components of pollution are unknown or difficultly determined, it became the focus of attention. In the United States one of the first regions to take action with respect to pollution was the metropolitan area of New York City. In 1967 regulations were enacted which in effect banned the use of coal and led to enhanced use of natural gas and low sulfur fuel oils. The measures were effective in reducing SO_2 concentrations by 85 percent. But despite this dramatic change there has been no significant decrease in sulfate levels or demonstrable effect on morbidity attending air pollution episodes.

Most of the coal mined and burned in the United States is consumed in the area north of the Ohio and east of the Mississippi rivers. In that region, the average sulfur content of much of the coal is about 3 percent. On burning, about 5 pounds of SO_2 are released per 10^6 Btu. The Environmental Protection Agency (EPA) has adopted a national standard which limits SO_2 emissions by each new stationary source (installation commenced after August 1971) to 1.2 pounds of SO_2 per 10^6 Btu. In addition, some states have adopted even more stringent regulations (0.2 pound of SO_2 per 10^6 Btu). Coal meeting the federal regulations is in short supply and expensive. During the next several years in many cases older plants will be burning high sulfur coal, and compliance with the federal standards and state regulations will be waived on new plants, for the public will not stand for drastic curtailment of its electricity.

To attain long-term compliance with its regulations, EPA has been pushing hard for installation of flue gas desulfurization systems. Some of the installations that were promising at first have not proved reliable. The leader at present involves the use of a slurry of lime. The process gives rise to a soupy sludge containing $CaSO_3$, $CaSO_4$, soluble salts, trace elements, and fly ash. For each ton of coal burned about a third of a ton of sludge is formed. During the next 10 years, if EPA standards were to be met generally for all new stationary sources, the annual production of sludge would rise to about 300 million tons a year. In 20 years such an output would form a body of sludge 10 feet deep covering an area of about 240,000 acres. Much of the coal would be burned in urban areas where waste disposal sites are already scarce. The total cost of scrubbing, including capital costs, lime, and other operating expenses, would amount to $8 to $30 or more per ton of waste, depending on costs of disposal.

There must be and there are better solutions. First, at comparatively low cost the principal sulfur component of coal, pyrite (FeS_2), can be removed. Thus, a large-scale reduction in sulfur emissions (though probably not enough to meet EPA standards) could be achieved comparatively quickly. A good preliminary removal of pyrite would facilitate subsequent cleanup, using technology now under development. Particularly interesting are closed-cycle processes (*Science*, 11 July, page 128) that produce elemental sulfur.

It is clear that the United States will spend tens of billions of dollars fighting air pollution. Isn't it about time a serious effort was made to identify the crucial pollutants, learn how to measure them, and proceed to abate them in ways that take into account costs and benefits?—PHILIP H. ABELSON

*A useful source of information is a report prepared by the Commission on Natural Resources, National Academy of Sciences, National Academy of Engineering, and National Research Council, *Air Quality and Stationary Source Emission Control* (Government Printing Office, Washington, D.C., 1975).

PRODUCTS and MATERIALS

Digital Thermometer

This new thermometer (Fig. 1) features a digital display to within 0.1°C that is accurate to within 0.1 percent over the full range of −99.9° to +199.9°C. It is portable and self-contained. It is also self-compensated for an ambient temperature from 4° to 53°C. The 100-ohm platinum probe is joined by a 6-foot wide connection. Forma Scientific. Circle 826.

Urine Specimen Collection and Transport

A system is available that uses disposable products for convenient collection and delivery of specimens from patient to laboratory (Fig. 2). The tubes are constructed for use in a centrifuge. Tubes are flared at the top for secure fit and ease of filling and for use with micro urinometers. Tubes are calibrated and feature a pouring track. Other components of the system are collection cups, caps, patient identification labels, and a 20-tube transport rack. Lab-Tek Products Division, Miles Laboratories. Circle 819.

Liposomes

In certain solutions, lecithin and cholesterol spontaneously form tight globular masses that resemble membrane structures and are called liposomes. If charged, mutually repulsive molecules are introduced into the aqueous channels between the layers in such masses these channels may be widened. These channels trap ions present in the aqueous phase when the masses are formed. Removal of untrapped ions by dialysis or gel filtration permits the determination of the rate of leakage of sequestered ions. Kits are available with instructions for the formation of liposomes. They are designed for the production of positive or negative liposomes. Avanti Biochemicals, Incorporated. Circle 828.

Potentiometric Recorders

A line of flatbed chart recorders is available for use with a variety of analytic instruments. The line offers chart speeds from 0.5 inch per hour to 16 inches per minute and accepts input from 1 to 100 millivolts. Whether the user selects the single- or the dual-channel model, the same 1-volt potentiometric amplifier is included. In more sensitive spans a high impedance preamplifier isolates the input signal from the servo amplifier. LKB Instruments, Incorporated. Circle 817.

Fig. 1. Forma Scientific offers a portable thermometer self-compensated for ambient temperatures from 4° to 53°C.

Fig. 2. These components comprise the urine specimen collection and transport system from Lab-Tek Products.

Calcium Titrator

The Ultra-Micro Calcette automatically aspirates samples of 5, 10, or 20 microliters. Titration consists of the calcium-calcein complex with EGTA. Operation is simple and the large illuminated digital display is easy to read. A reagent kit is supplied with the instrument. Applications include studies of neonates, infants, geriatric patients, and small animals where sample size is usually limited. Precision Systems, Incorporated. Circle 825.

Medical Student Microscope

Model OE-1B-W4L (Fig. 3) features a heavy base, a rotating, 45-degree-inclined binocular head and a 30-watt, 115-volt variable intensity illuminator. Coaxial coarse focusing range is 35.5 millimeters; the fine range is 2 millimeters. Interchangeable right- or left-handed stage controls provide 2 by 3 inches of motion in the X and Y planes, respectively. There is a 1.25-numerical aperture Abbe condenser with a swing-out filter holder. Kelner-type oculars are wide-field, 10-power. Objectives are research acromats of 4-, 10-, 40- and 100-power. The 40- and 100-power objectives are retractable. Uchida of America Corporation. Circle 821.

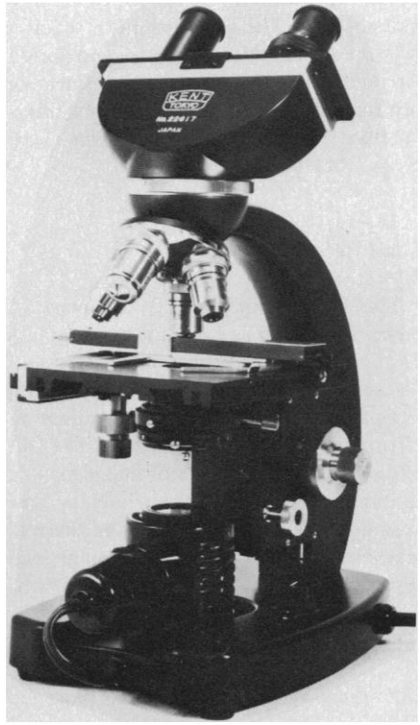

Fig. 3. Uchida's new medical student microscope features built-in illuminator and four research acromat objectives; the larger 40- and 100-power objectives are retractable. The 18-mm Kelner type eyepieces feature hard-coated air-glass surfaces.

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (on pages 254A and 302A) and placing it in the mailbox. Postage is free.—RICHARD G. SOMMER

Electrophoresis Apparatus

The M-1 is constructed of Plexiglas and features complete visibility (Fig. 4). The modular construction eliminates cross-contamination of species. The gel slab is placed horizontally and thus allows continuous elution of separated species at both the anode and the cathode. Miles Laboratories, Incorporated, Research Products Division. Circle 827.

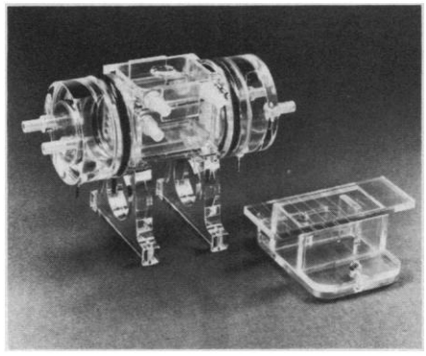

Fig. 4. The M-1 is an electrophoresis apparatus in which the gel slab is horizontal for elution at anode or cathode.

Drug Standards

Drug standards in kit form are offered for the analysis of anticonvulsants and for antianxiety-antidepressants in blood or urine. These standards are available in Drug Enforcement Administration exempt form and they consist of the types of these drugs that are most frequently encountered in blood and urine analysis. Kits consist of 20 2-milliliter serum vials with instructions for use. Theta Corporation, Chemical Division. Circle 818.

Graphic Plotter

The DP-1600 will accommodate drawings up to 22 by 34 inches at plotting speeds up to 800 increments per second. Accuracy is ±0.004 inch. A microprocessor simplifies the construction of straight lines. The slope generator requires only the specification of the two end points. An internal 55-character symbol generator further simplifies software and data transmission requirements. Glaser Data Company. Circle 824.

Chart Recorder

The Speedomax XL630 occupies 3.5 inches of vertical space but exposes 2 inches of visible chart. There is an unroll-reroll feature which allows the user to look at a trace again and reroll the paper without interrupting the recording function. The unit offers up to ten chart speeds and it may be calibrated in English or metric units. Disposable markers are standard and thermal markers may be specified on single-pen systems. Leeds & Northrup Company. Circle 822.

Ultraviolet-Visible Spectrophotometer

The HS 870 has a double-beam optical system and features push-button selection of absorbance, concentration, and transmission with a digital display. Other features include wavelength selectivity with a high-resolution grating monochromator, high sensitivity, and versatility. The device is capable of making repeatable measurements in the milli absorbance unit range. It can function as a spectrophotometer or as a variable wavelength detector in liquid chromatographic applications. It will accommodate a wide range of cell types. Schoeffel Instrument Corporation. Circle 823.

Thin-Layer Chromatography Accessory

A device called the tEMplate (Fig. 5) simplifies and combines the functions of sample application, determination of Rf values, stacking, storing, and handling thin-layer plates. Plates up to 20 by 20 centimeters may be accommodated. The acrylic plastic device consists of a calibrated frame and a slide that resembles a T-square. A plate is inserted in the frame and spotted or streaked with the slide as a guide. After development, the slide is used to measure Rf. With the slides removed, the tEMplate functions as a storage module. EM Laboratories. Circle 820.

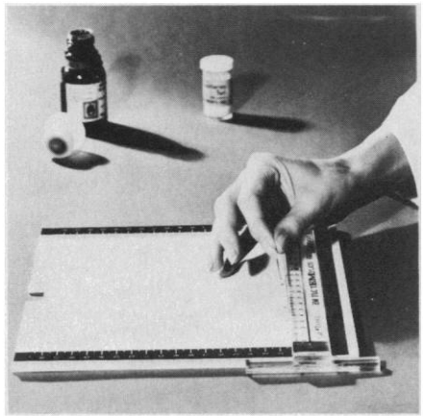

Fig. 5. The tEMplate simplifies handling and storage of thin-layer chromatographic plates.

Literature

Vacuum/Pressure Measurement Systems describes sensors, analyzers, data display, and outlines their operating principles. Datametrics, Incorporated. Circle 829.

Industrial Endoscopes/Fiber Optics specifies devices for internal inspection of cavities in mechanical structures. Expanded Optics Company. Circle 830.

Voltage Regulator Catalog Volume 2 includes circuit diagrams, principles, specifications, and applications of a variety of electronic devices. Lambda Electronics Corporation. Circle 831.

Research Incubator is described in a data sheet. The device is a dry, table-top, mechanically connected unit with 42.4 square feet of load area. Hotpack Corporation. Circle 832.

Metering Pumps are covered in a 24-page handbook. Metering processes, limits of practical applications, and design specifications are included. American Lewa, Incorporated. Circle 833.

Gas Mixtures—Facts and Fables is a study of the technique and analysis of compressed gas mixtures in cylinders. Matheson Gas Products. Circle 834.

Acta Ampholinae Reference List includes literature on electrofocusing and isotachophoresis. References, author index, and subject index are also included. LKB Instruments. Circle 835.

Biomedical Products Catalog is devoted to a complete line of glassware and analytic devices for clinical and research applications. Kontes. Circle 836.

Products for Liquid Chromatography describes gradient elution apparatus, stirrers, packaging, columns, tubing, fittings, syringes, pumps, septa, and monitors. Analabs, Incorporated. Circle 837.

Analytical Methods Guide contains procedures for water quality analyses and apparatus for sensing contaminants and other constituents. Orion Research, Incorporated. Circle 838.

Cryogenic Apparatus is the subject of a 12-page catalog of items for research, medical, and industrial use. Almac Cryogenics, Incorporated. Circle 839.

Chemist-Analyst is a bimonthly publication devoted to analytic chemistry and organic and biomedical research. J. T. Baker Chemical Company. Circle 840.

Nikon Microscopes for all optical and research interests are listed in a catalog. Ehrenreich Photo-Optical Industries, Incorporated. Circle 841.

Cookbook of Standard Audio Tests describes the use of a low-frequency spectrum analyzer and associated instruments to make response and distortion measurements. Tektronic, Incorporated. Circle 842.

BOOKS RECEIVED

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