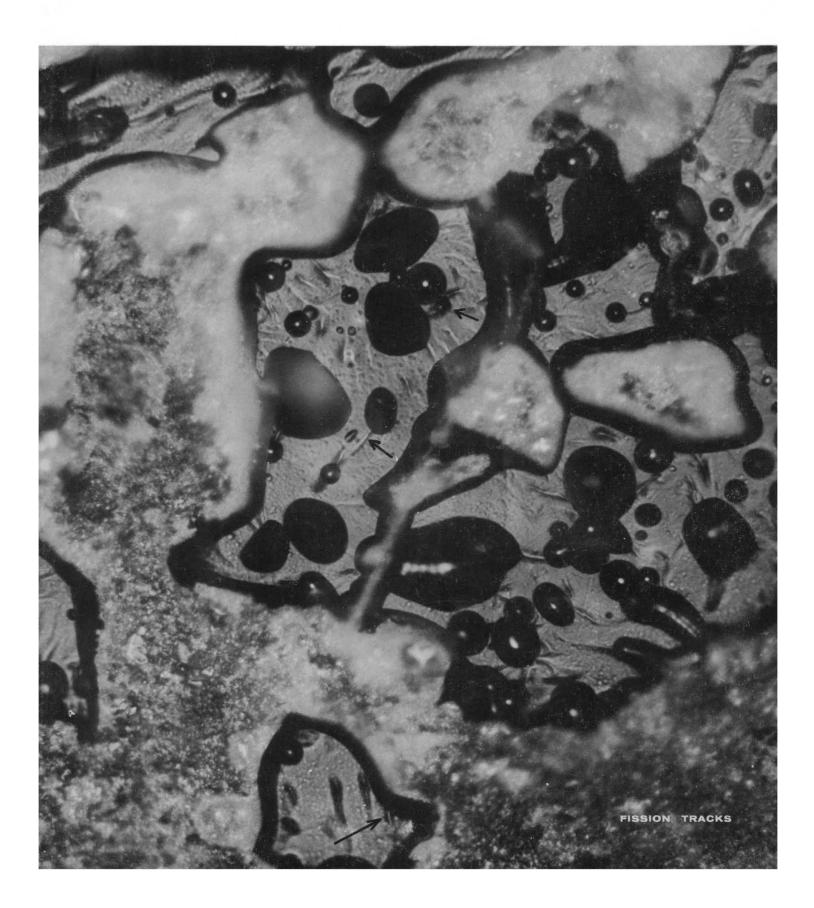
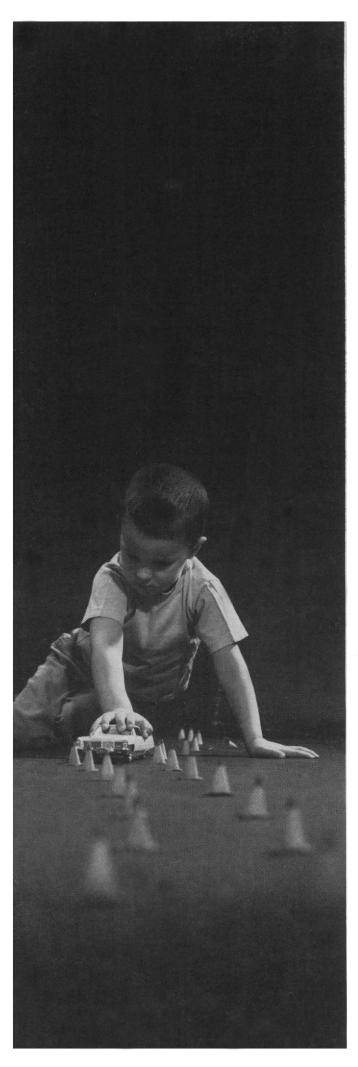
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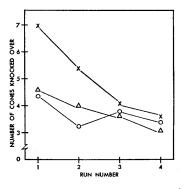
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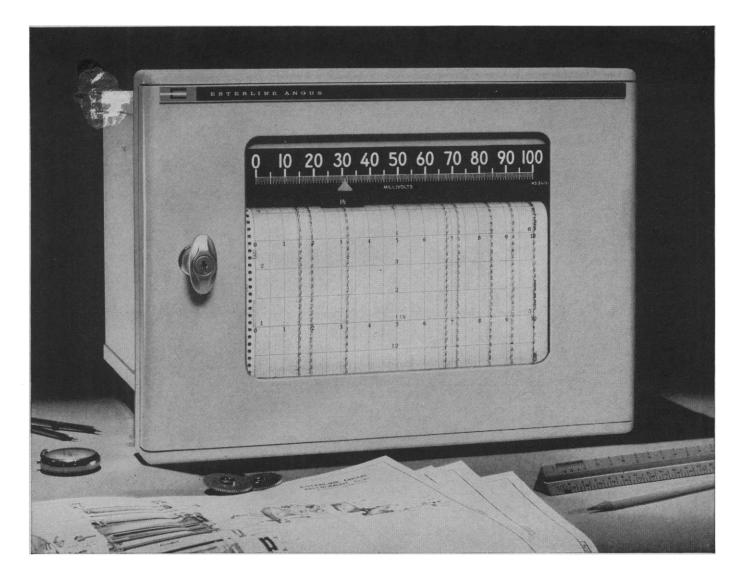
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Road data for three simulated vehicles. Averages for drivers traveling 30 mph through course marked by traffic cones.



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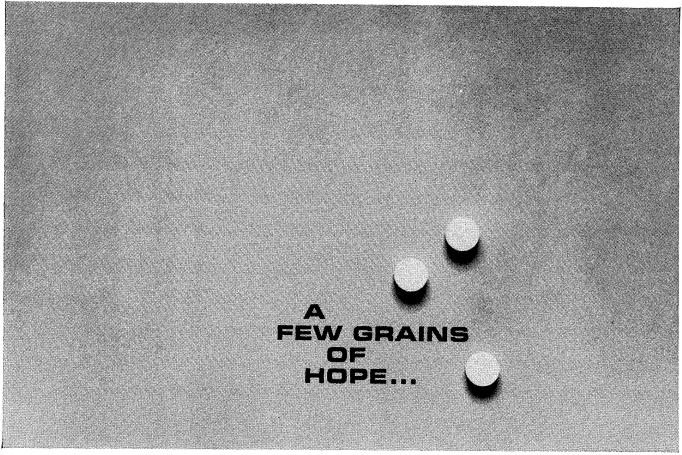
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COVER

Pumice from the volcanic tuff of Bed I, Olduvai Gorge. The specimen was mounted in plastic, polished, and etched. The three arrows indicate the location of spontaneous fission events. Each event appears as an elliptical pit. The age of the pumice, determined by counting such events, has been found to be 2 million years (about \times 700). See page 72.

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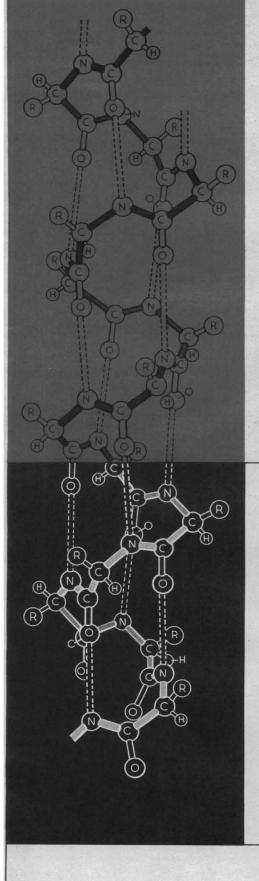
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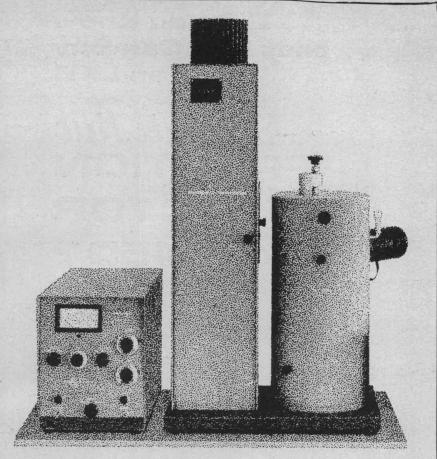
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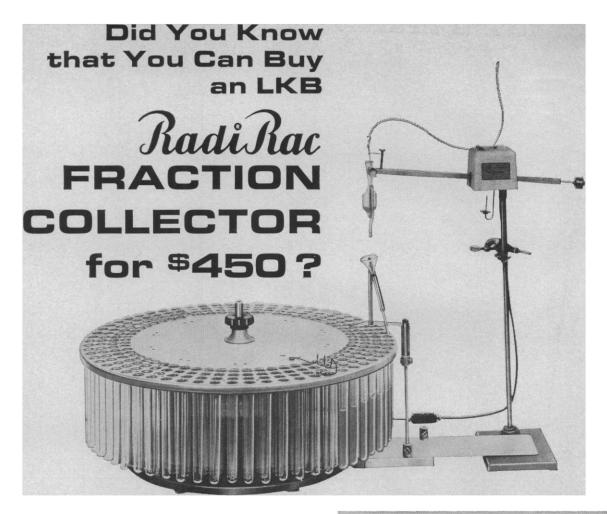
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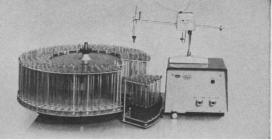
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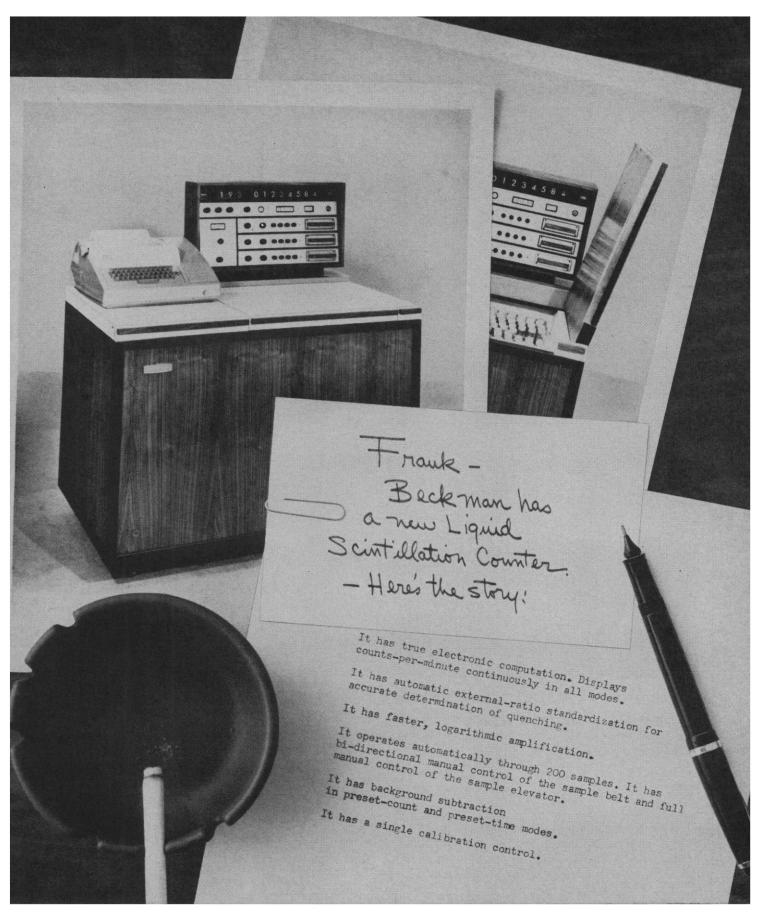


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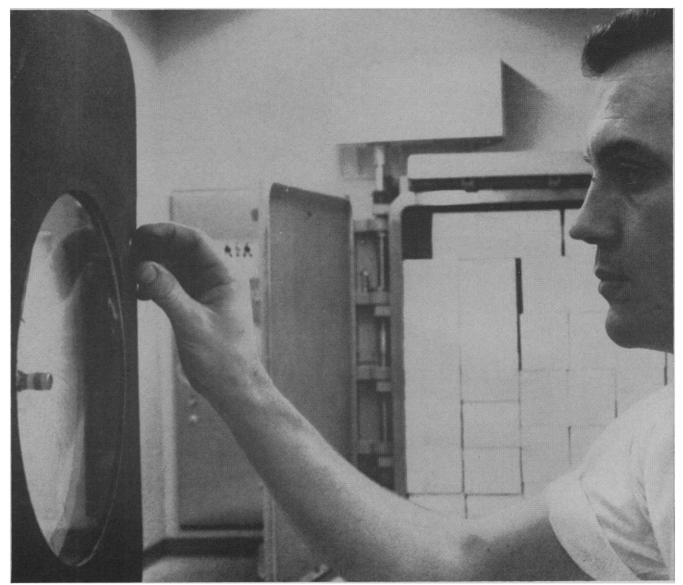


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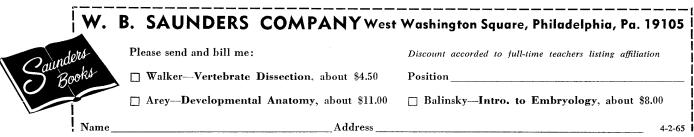
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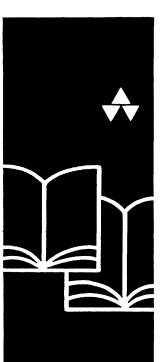
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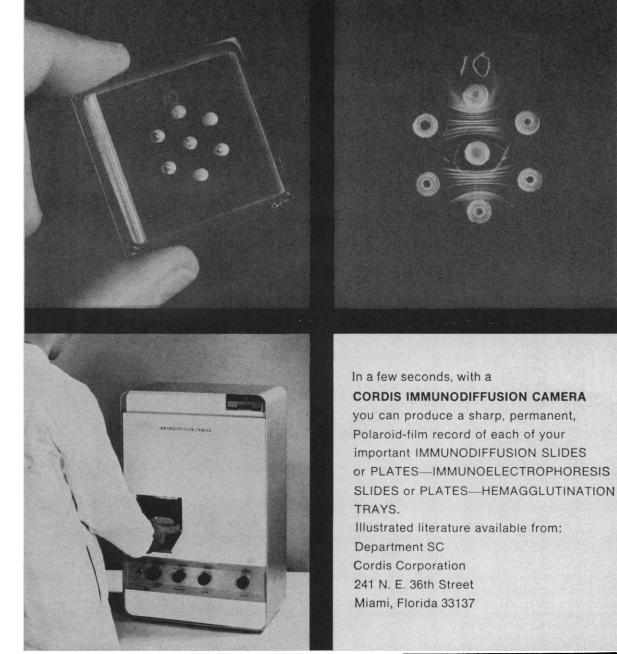
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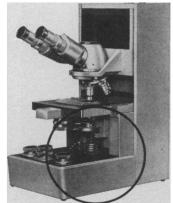




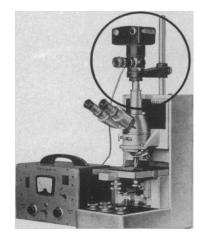
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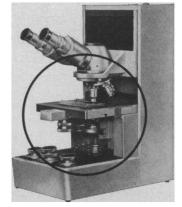
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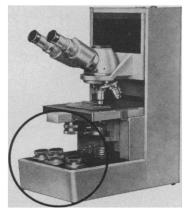
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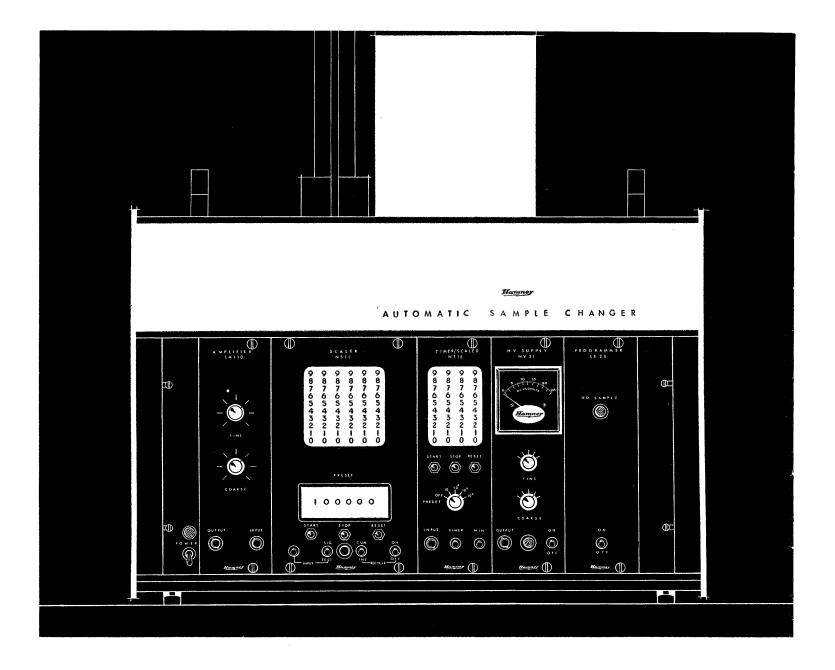


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17



Radiotracer data retrieval for the biological sciences

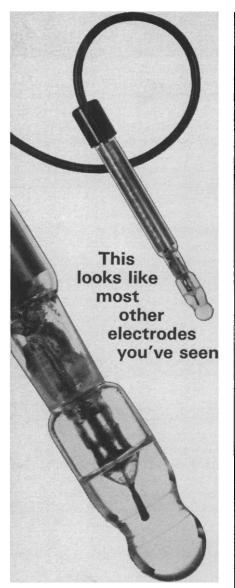
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The method originated in psychology, and it is obviously flexible. For instance, I have obtained meaningful zoning of an oil well in Alaska by applying factor analysis to palynological data that had resisted interpretation by standard techniques.

It will be of interest to some that I have adapted the Manson-Imbrie program to the system at Western Data Processing Center, where computing time is free to academic users from the 13 western states.

DONALD B. MCINTYRE Department of Geology, Pomona College, Claremont, California

Congress and Science

In the News and Comment section of 15 January, John Walsh makes the following comment:

While it should not be exaggerated, the current split on weather modification falls into the area of the problem of science advice for Congress. It represents, not a breakdown, but, rather, evidence that no adequate conduit between Congress and the community represented by the Academy and NSF has ever been soundly established.

This comment, made by an excellent reporter, concludes a discussion of the problems inherent in the government-sponsored weather modification program. In my view, however, it should not be allowed to stand unaltered. The article itself shows that the split referred to is alleged to exist in the Senate. I do not feel competent to say whether or not the statement is an accurate one with regard to the Senate. But Congress consists of two coordinate branches, and I certainly regard the statement as inaccurate so far as the House is concerned. The committee which I have the honor to chair has been working very hard for the past two years to develop a sound and useful relationship between the Academy, NSF, the Office of Science and Technology, and the scientific community generally. We believe that a good deal has been accomplished along these lines, and if the entities just mentioned were sounded out I believe that they would confirm this. Certainly much remains to be accomplished in this area, but the relationships which have now been begun rest on a solid basis and are, in our judgment, a significant step forward so far as technological advice for Congress is concerned.

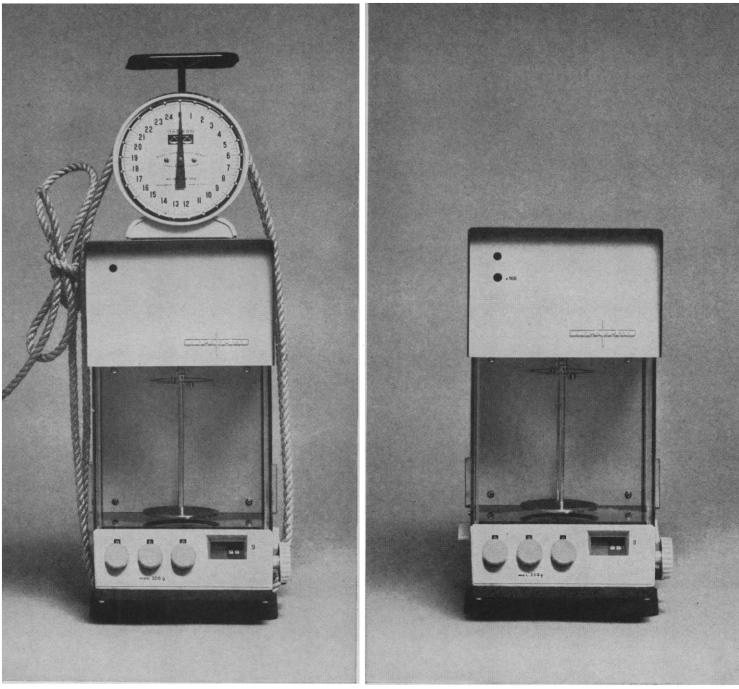
George P. MILLER Committee on Science and Astronautics, House of Representatives, Washington, D.C.

Title VI

Langer's analysis (29 Jan., p. 488) of Title VI of the 1964 Civil Rights Act, appearing shortly after the controversy precipitated by Ingle's article, raises several points of interest. One is her use of the term "tokenism" in close juxtaposition to the number of Negro students at some southern universities. What percentage of Negro students constitutes a token? Fixing a minimum fraction that must be exceeded would set up a quota system, an admission practice specifically labeled as discriminatory in the Department of Health, Education, and Welfare question-and-answer sheet. Clearly, the term token implies group-based thinking and has primarily emotional content when applied to the Civil Rights Act, where the goal is to guarantee to each individual treatment which does not discriminate "on the basis of race, color, or national origin.'

While I suscribe to the opinion that Title VI will have an immense impact on southern life, it appears that there is a third alternative to the two potential fates Langer envisions for the bill-forceful administration or governmental hypocrisy-namely, enforcement as a result of individual or group prosecution in the courts. This alternative is not only "good politics," but also avoids involving the Public Health Service, National Science Foundation, Atomic Energy Commission, National Aeronautics and Space Administration, and certain other divisions of the federal government in activities of a primarily police type. In addition, while such an approach may not result in quite so rapid a "social revolution many people expect to be witnessing," it would certainly not permit the indefinite preservation of the Southern Way of Life.

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The Continental Shelf

A new international Convention on the Continental Shelf gives to each coastal state sovereign rights over the adjoining seabed and subsoil out to wherever the sea is 200 meters deep, and, beyond that limit, for as much farther as it can exploit the natural resources of the undersea area. To a depth of 200 meters the right is exclusive; no other state can stake a claim within this limit. At greater depths, possession goes with ability to exploit. This new convention applies only to the land beneath the sea, not to the waters and not to the airspace above. It was drawn up in 1958 at the U.N. Conference on the Law of the Sea, but went into effect only recently, upon ratification by the necessary number of states.

The legal concept of the continental shelf had its first important formulation in 1945 when President Truman proclaimed U.S. ownership of the natural resources of the adjoining continental shelf. While there has been fairly general acceptance of this doctrine, the new convention constitutes an important codification that gives agreed form and certainty to the law governing rights to the seabed and subsoil, to mineral and other nonliving resources beneath the sea, and to living organisms that at the harvestable stage are either immobile or unable to move except in contact with the seabed or subsoil.

The granting of these rights is not intended to interfere with navigation or fishing rights, obligations to conserve living organisms of the sea, or the right of access for unclassified scientific research. Nor is there yet clarification of the confused problem of the extent of territorial seas. The U.S., in 1793, adopted the 3-mile limit, as have many other countries, but not all. The Scandinavian countries claim 4 miles; some of the Mediterranean countries, 6 miles; and others, 9 or 12.

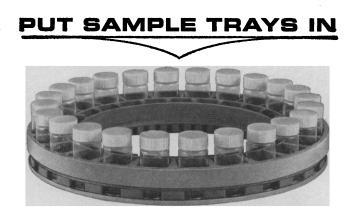
But the right to subsea resources is now clear. In 1959, the year after this convention was written, the discovery in Holland of one of the world's largest gas fields raised hopes that more riches might lie under the 220,000 square miles of the shallow (average depth = 50meters) North Sea. Under license from the six bordering countries, 50 companies in various joint ventures are prospecting for North Sea oil and gas deposits. Off the California coast, drilling for oil is already going on at a depth of almost 200 meters. The Mohole project and other crustal drillings for scientific purposes will provide experience that will help to extend present commercial limits to much greater depths. The recent National Academy of Sciences report on oceanography reports current exploitation of submarine diamond, tin, iron, and sulfur resources, as well as oil and gas, and predicts early mining of gold off the Alaska shore. Phosphates, chromite sands, and other material seem promising possibilities. The same report points out that wherever modern beaches have potentially valuable mineral content, there is good likelihood that the drowned Pleistocene beaches farther offshore have similar content.

The 3-mile limit was defined, partly at least, in terms of 18th-century technology, the estimated range of land-based artillery. But the definition was pessimistic and inflexible. The new convention also involves a technological definition, but a flexible and more optimistic one. The seabed is available for each coastal state to exploit as far as it can. The limit will move farther and deeper as technology advances.

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	12104	.130	32154	100000	5	247338	769230	38	276837	837960	76285
	12105	.131	40812	100000	. 1	311541	763358	7	344852	841846	67970
	12106	.857	100000	38	10	116686	44	11	161607	94408	73570
	12107	2.000	136012	80	38	68006	40	19	111940	92526	68941
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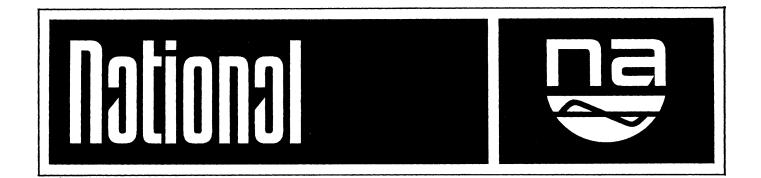
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sites studied, since the effects of local terrain cannot be ignored in describing turbulence and diffusion. In addition, Heinz Lettau presented a new hypothesis which relates eddy velocity and mean wind velocity by means of a three-dimensional vector expression. Application of proper boundary conditions to the problem leads to realistic wind profiles.

The greatest interest at the conference centered about turbulence and its relationship to the diffusion of aerosols. A theoretical approach to the problem of turbulence was offered by Hans Panofsky, who reviewed the principles of similarity theory and showed how some statistics of turbulence can be related to lapse rate, terrain, height, and mean wind speed.

F. N. Frenkiel pointed out that rigorous solutions of the complicated equations of fluid dynamics are becoming practical through the use of high-speed computing techniques. Computers are also valuable for processing the large amounts of experimental data involved in the microscale of turbulence. A large part of research on turbulence consists of statistical analysis of data obtained during field studies of wind. Several papers reported investigations of this type over various terrains. Measurements were made of vertical and horizontal wind fluctuations at several heights. Analysis included spectral energy distributions over ranges from small-scale mechanical turbulence to semidiurnal cycles. Many such studies are needed to increase our understanding of microscale processes.

Diffusion problems are currently studied directly by making measurements at grid points of tracer dosages from a known source. However, forecasting the dispersal of contaminants depends on ability to predict the fine structure of the winds. Several theoretical and empirical models are used to evaluate diffusion on the basis of turbulence statistics, which include terrain effects, source size and release time of the contaminants, and wind speed. Factors which are important in selecting the time and space scales to be used in various studies for the prediction of dosage levels and distributions were also the subject of many of the papers presented.

The conference was concluded with a panel discussion of the relation between turbulence and diffusion, chaired by Morton L. Barad. Members of the panel were S. Corrsin, H. E. Cramer, F. N. Frenkiel, F. A. Gifford, Jr., G. R. Hilst, and H. A. Panofsky. Much of the discussion revolved about the problems inherent in using Eulerian turbulence statistics to describe the basically LaGrangian process of diffusion. While data leading to Eulerian statistics are easily obtainable with current instrumentation, diffusion studies require data on moving "parcels" of turbulence which cannot be obtained with the sensing systems now available. Bubbles and balloons which simulate such parcels can be tracked but tend to influence the microscale system under study. A feasible approach in the future could include the use of lasers. Another suggestion was the greater use of high-speed electronic computers as experimental tools. Increased attention to and use of wind-tunnel modeling and testing by engineers and classical fluid dynamicists should be encouraged. In conclusion, the perennial request for increased communication among related disciplines was made during both the panel discussion and the discussion from the floor which followed.

S. BARR

Geophysics Corporation of America, Bedford, Massachusetts

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Relativistic Astrophysics

commonly sources, Quasi-stellar called "quasars," are the most distant observable objects in the universe; they are so vast and so brilliant that their very existence cannot be explained by present physical laws. Their ability to generate enormous amounts of energy is not understood. The second of a series of symposiums on the subject (sponsored by the University of Texas and the Southwest Center for Advanced Studies, Dallas, Texas) attracted about 500 participants from various disciplines and many countries to the university in Austin for 5 days in December 1964; present were physicists and astrophysicists, relativists and mathematicians, radio and optical astronomers.

At this second symposium much more information on many more quasars was presented, but no clear solutions to the questions posed by these observations emerged. The hypothesis of gravitational collapse, a process of implosion followed by explosion, that was favored at the first symposium (Dallas, December 1963) seems to be losing ground; relativity theory may provide an answer. Formal talks and discussions were largely limited to presentation of data, with a properly tentative approach to their interpretation.

But theories were inescapable. One of the more outstanding performances was the opening talk by Geoffrey Burbidge (University of California, San Diego) on "Extragalactic effects of high-energy radiation." Estimates proposed at the first symposium have been increased something like 1000 times. Burbidge listed some of the factors contributing to these larger estimates: physicists had assumed that the fast-moving particles in these sources were accelerated by a mechanism working with 100-percent efficiency. Burbidge proposed instead that an efficiency of only 0.03 percent be assumed; if the observed values for the atomic particles in these radio sources are taken in conjunction with this revised estimate of efficiency, one can easily assume that the original energy input needed to produce these gigantic events is at least 3000 times larger.

This interpretation was challenged by John Bolton (Commonwealth Scientific and Industrial Research Organisation, Sydney, Australia), who, with the advantage of the 210-foot (64-m) radio telescope at Parkes Observatory, had found that strong radio sources have the appearance of huge clouds shaped like dumbbells. These dumbbells, Bolton believes, have a shell-like structure, with high-energy particles tending to concentrate in areas of much greater brightness at the outer edges. At these bright edges, which were also described by Thomas Matthews (California Institute of Technology), it is possible that the energy builds up to the point where the gas smashes its way through the perimeter of the "dumbbell" to form a new cloud or quasar. This theory, too, had its detractors; one of the many talking points was whether a large quasar is in process of expansion leading to reproduction in an amoeba-like fashion, or whether, in losing energy, it is in fact shrinking.

Another high point in the symposium was the talk on "Models of quasi-stellars" by Maarten Schmidt (Mount Wilson and Palomar Observatories). Schmidt took the trouble to convince his audience by a process of simple logic that the quasars are in fact more than 10⁹ light years away,

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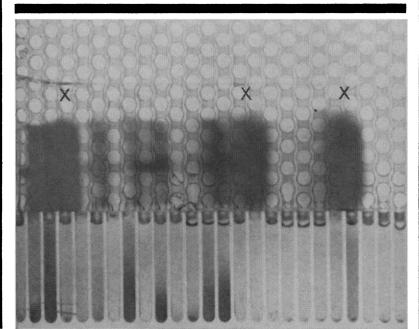
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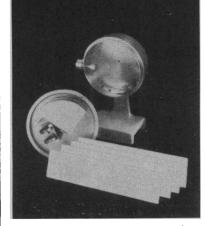
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and that they are enormous—several thousand light years across. He pictures their structure as resembling an onion, with several layers of skin. The outer skin is relatively thin, a cloud of high-energy atomic particles; the second skin is another thin shell of glowing, rarefied gas, which emits light predominantly at a few fixed frequencies. The inner core, much smaller, is thought of as a sort of hot superstar of perhaps 10^8 solar masses, with a temperature of over $10,000^{\circ}C$; its diameter may be as little as a light year.

Before the concept of a red-hot onion was served to the participants, they viewed the sky photographs presented by Allan Sandage (Mount Wilson and Palomar Observatories). The beauty and order of the pictures were reflected in the clarity and symmetry of Sandage's talk in which he gave the latest count (by now, doubtless, out of date) of 34 identified quasars. In the last few weeks before the conference, 15 new objects had been identified in a systematic search with the 48-inch (120-cm) Palomar Schmidt telescope. An enigmatic characteristic of these confusing objects is enormous variation in brightness of the quasars that Sandage had observed. The radio source known as 3C2 has varied in brightness by as much as a factor of 4 in the last 2 years-many times more than any other observed source. It is possible that 3C2 is the most distant object in the universe and is retreating from us at a speed very close to that of light.

Henry Palmer (Jodrell Bank Radio Observatory, England), who started the hunt for quasars nearly a decade ago, reported on the newly discovered sources. His observations had been made with the world's largest scientific instrument, a radio interferometer more than 100 miles (160 km) long.

H. Friedman (Naval Research Laboratory, Washington, D.C.) reported discovery of a number of new x-ray sources; one of them, Scorpio, may be only 30 light years away.

William Fowler (California Institute of Technology), in summing up the discussions of neutrinos, pointed out that our knowledge of the properties of neutrinos is minute. Attempts to increase such knowledge are being made in South Africa, near Johannesburg, where Frederick Reines (Case Institute of Technology) is installing a first crude neutrino telescope in a mine at a depth of 3450 m. The depth below Earth's surface represents an attempt to screen the instrument from cosmic radiation; one cosmic neutrino candidate has already been detected. Davis (Brookhaven) reported on a project to bury a tank filled with 400,000 liters of cleaning fluid in a deep mine; there, it is hoped, a few of the chlorine atoms in the tank will be transformed into argon atoms by neutrino radiation. If this experiment is successful, it will provide direct proof that neutrinos come from the sun, which will be established as a nuclear-fusion device; it will also have produced an instrument capable of "looking into" the sun's central region, hitherto an impossibility.

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Forthcoming Events

April

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 δ -9. Automatic Control, conv., Nottingham, England. (H. Umpleby, Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London, S.W.1, England)

7-9. American Assoc. for **Cancer Re**search, 56th annual, Philadelphia, Pa. (AACR, 7701 Burholme Ave., Fox Chase, Philadelphia 19111)

7-9. The Chemical Soc., anniversary meetings, Glasgow, Scotland. (CS, Burlington House, London, W.1, England)

7-9. Nucleation Phenomena, intern. symp., Cleveland, Ohio. (A. G. Walton, Dept. of Chemistry, Case Inst. of Technology, University Circle, Cleveland 6)

7-9. **Pesticides**, U.S.-Japan Cooperative Science program, Honolulu, Hawaii. (Office of Intern. Science Activities, Natl. Science Foundation, Washington, D.C.)

7-9. Stress Analysis, conf., Bristol, England. (Administration Asst., Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

7-16. Instrumentation for Hydraulic Research, U.S.-Japan Cooperative Science Program seminar, Tokyo, Japan. (Office of Intern. Science Activities, Natl. Science Foundation, Washington, D.C.)

8-9. Histochemical Soc., 16th annual, Philadelphia, Pa. (S. S. Spicer, National Institute of Health, Bethesda, Md. 20014)

8-9. Microbiological Deterioration in the Tropics, symp., London, England. (Secretary, Soc. of Chemical Industry, 14 Belgrave Sq., London, S.W.1, England)

8-9. British Inst. of **Radiology**, annual congr., London, England. (BIR, 32 Welbeck St., London, W.1)

8-9. X-ray Analysis, Conf., Inst. of

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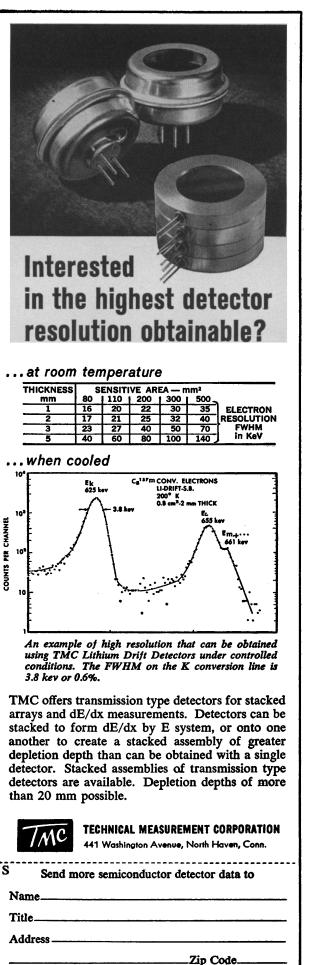
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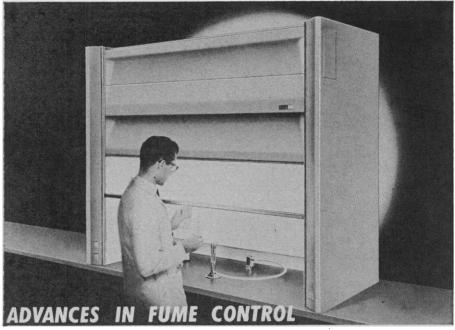
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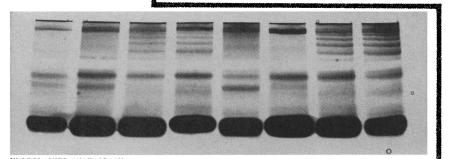
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