SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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Gas Chromatography

• Ten separate modules to provide exactly the right combination to meet your chromatography needs • The flexibility to meet your future research requirements by the simple addition of other modules • Adaptability to future developments in the field of Gas Chromatography.

The Complete System shown at right is composed of 8 modules.

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  provides power and monitors temperature throughout the system
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  uniform temperature up to 300°C.
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  proportional control over entire operating range.
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  conductivity cell with uniform temperature distribution
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  proportional control over entire operating range.
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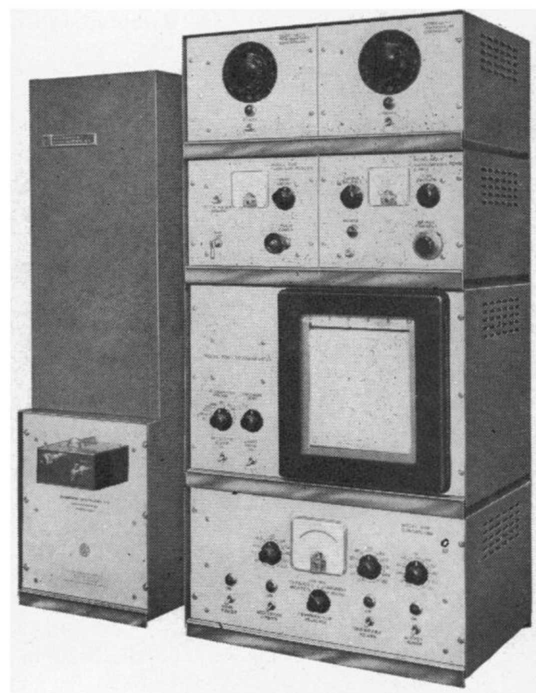

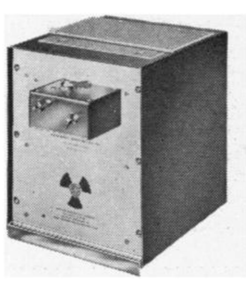

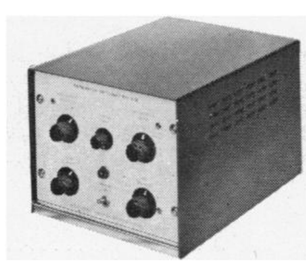

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Letters

On Supplementing Human Faculties

It was hardly to have been predicted that when a human being is completely isolated from external stimuli, as was the case in an experiment conducted by the Office of Naval Research in 1956 [discussed at the Interdisciplinary Conference on Self-Organizing Systems, Chicago, May 1959], he loses his sense of orientation and cannot change a set idea in his mind. Rather one would have assumed that he could continue to meditate on past experiences, much as if he were sitting alone in the dark of a warm, silent cave. The question occurs: Can a person be thrown into a higher level of consciousness by supplementation of his faculties? Certainly the effect of faculty supplementation can be observed in ourselves to a mild degree when we are listening to music or sitting in a Cinerama theater. What would happen if a more complete coupling were achieved between man and an artificial world, or between a person and more intense stimulation from his natural world?

This leads to another question: What faculties would have to be added to a monkey to make him react like a human being? For one thing, a monkey lacks the ability to formulate and recognize symbols. But he can learn a great deal. Conceivably, an electronic aid to symbol recognition or formulation might be provided for one of our simian friends, and he could be conditioned to use it, say, to recognize and indicate the letters of the alphabet. How much aid in grammar formulation and word categorization would we have to provide him (by means of a computer, perhaps) before he could begin to talk sensibly to us? Would this aid be less than that required by a computer operating alone?

The crux of the matter is undoubtedly in the coupling between external devices and animals. A device has to be more perfectly woven into our nervous system before we can begin to tap it as we naturally tap our other faculties. Also, some control, perhaps even a random control, must be provided, because if the extrasensing devices were not controllable they might assume the upper hand. Of course, in a movie we can shut our eyes, but more control would be necessary with extrasensing devices. If an electronic memory could be coupled into our brain we would have to have some means of scanning it in order to get at arbitrary information.

Before coupling of any higher degree of sophistication than that achieved in a stereophonic Cinerama theater can be achieved, a more thorough understanding must be had of the coding of signals in the brain. Yet, if a person (or a monkey) were conditioned to substitute senses (as, for instance, if supersonic tones in a spectrum of frequencies were transduced into pinpricks along the spine) or coupled to a more perfect form of Cinerama, would he react normally under this greater degree of stimulation?

These speculations may perhaps seem fantastic, but in the light of the results of the Office of Naval Research experiment they must be given serious consideration.

ROBERT E. MUELLER
Astro-Electronic Products Division, Radio Corporation of America, Princeton, New Jersey

Phosphorus and Phytoplankton

In the article "Bound phosphorus and growth of phytoplankton," by Whitford and Phillips [*Science* **129**, 961 (1959)], the implication that phosphorus was not limiting because total phosphorus showed no correlation with phytoplankton pulses does not appear to be valid. Not only do the authors point out that total phosphorus varied with the rainfall but they acknowledge that the phytoplankton populations were low (and presumably, therefore, would require a relatively small amount of phosphorus). Also, and more significant, total phosphorus includes a galaxy of compounds, particulate and soluble, organic and inorganic, of which the only fraction now unequivocally known to be utilizable by algae is soluble orthophosphate. This fraction generally accounts for only about 10 percent of the total phosphorus in lakes, and even in the attempt to correlate this fraction with phytoplankton, the problem is complicated by the fact that certain plankton algae are known to be able to store up phosphate under conditions of plenty and to use this reserve for growth in times of phosphate deficiency. Therefore, any correlations observed between total phosphorus and phytoplankton are likely to be fortuitous, and any lack of correlation is likely to be without significance.

JOSEPH SHAPIRO
Department of Zoology, University of Washington, Seattle

The criticism by Shapiro of our report is probably justified on the basis of data given. We believe, however, that our conclusions, which were based on data not adequately presented in the article, are valid. We are aware of the number and complexity of phosphorus compounds in natural aquatic habitats. Our analyses of total phosphorus were

(*Continued on page 347*)

Kodak reports on:

why it pays to be patient with the scientific mind . . . clear, competitive vision in the $2\text{-}8\mu$ region of the infrared . . . before and after yogurt

Color film, fast but good

Has anything big come out of the Kodak Research Laboratories lately? Sure—*Kodak High Speed Ektachrome Film*,

now on sale at thousands of film counters in 20-exposure 135 magazines,

an outcome worth all the soothing of temperaments, all the technical conferences, all the writing and reading of reports,

a film with an Exposure Index of 160 in Daylight Type and 125 in the Type B (for 3200°K),

admitting no impairment of definition in return for speed,

asking little more light than fast black-and-white film in return for full color, in slides that look right even if the photographer has not fussed much about the frigidity of his film storage cabinet or the color balance of his illumination,

and awfully near right at twice the official Exposure Index with three minutes more in the first developer.

Your dealer can arrange to have this film processed by Kodak or any other laboratory offering this service. You can also do it yourself with the Kodak Ektachrome Processing Kit, Process E-2, Improved Type.

"Irtran"—ask for it by name

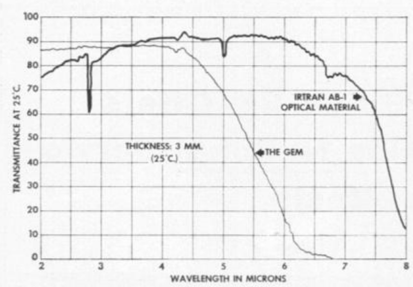
By dint of perseverance, knowledge, inspiration, judgment, experience, ambition, ingenuity, and the concentrated power of many clear heads and skillful hands, we have learned how to mold, grind, and polish a certain substance to make rugged, optically precise windows and domes that transmit efficiently the $2\text{-}8\mu$ region of the infrared.

Around this whole package of technology we put a convenient string and tag it with a new trademark, "Irtran." Immediately—so robust is the American economy—we find ourselves in competition with some excellent fellows who also possess the above-named qualities and who make a most excellent infrared-transmitting optical material—a gem, synthetic but true, with a gem's name. To spell that name out would be as unmannerly as it is unnecessary for those caught up with infrared-actuated swords and plowshares.

Rather, we want such cognoscenti to spell out *Kodak Irtran Optics, Type AB-1*.

They cost a lot less than the gem makers have a right to ask.

They see clearly through the $3\text{-}5.5\mu$ windows of the atmosphere.



They stay clear to at least 800°C instead of permitting Herr Kirchoff's law to blind them by their own emissivity.

They have a refractive index of only 1.301 at 6.7μ, paying scant tribute to M. Fresnel's celebrated equation about reflection losses.

They survive all the high temperature, thermal shock, weathering, humidity, and abrasion that the current tests for swords require.

Type AB-1 is only the beginning of the *Irtran* business, we suspect. Quartz was fine when lead sulfide was the practical detector; PbS quits at 4μ. Now the longer wavelength sensitivity of cooled lead selenide, lead telluride, and indium antimonide has outrun the transparency of good old quartz. Soon the boys will be banging on the 8 to 13μ window of the atmosphere. For lenses with optical power they'll want infrared-transmitting material of higher refractive index. *Type AB-1* may be only the beginning.

With what excitement the specifications for us to quote on will be drawn up and shot off to Eastman Kodak Company, Special Products Division, Rochester 4, N. Y.!

Acido orotico

Around the turn of the century it was brought to the world's attention that the inhabitants of certain Bulgarian villages were a) living to ripe old ages and b) consuming vast quantities of the ripe old fermentation products of the local dairying. Echoes of this coincidence have rumbled forth at intervals since.

In the twenties a certain elderly biochemist who had seen much importance in the correlation was a celebrated figure of Paris. In the thirties American milk wagons were bedizened with signs advertising a certain brand of fermented milk. In the forties the word "yogurt" entered the vocabulary of the American intelligentsia. With the dawn of the fifties, the Journal of the American Chemical Society (*72*, 2312) reported that certain strains of *Lactobacillus bulgaricus* throve when supplied with 6-carboxyuracil, a substance first synthesized in 1897 for academic exercise and later shown to be identical with orotic acid. This name was derived from ορος, whey, by two Italians who had encountered the substance while making lactose from milk whey liquors.

The flowering of biochemical sophistication in the mid-fifties has excited a deeper curiosity about orotic acid. To some it looks like a significant intermediate in the process by which living organisms fabricate nucleotides for their DNA—the stuff of genes—out of the amino acids at their disposal. This is big talk.

In Italy interest in *acido orotico* has been rekindled to a small-scale frenzy. At the University of Urbino last June a colloquium on pyrimidines (*Acta Vitaminologica*, *12*, 195-328) devoted much of its attention to the compound. One man claimed his evidence showed that a dietary deficiency of orotic acid affects pregnancy, lactation, and growth in the rat, that it is a vitamin-like factor essential for the survival of the newborn. One senses the closing of a circle.

If we had not been invited to quote on 100 kilos of Orotic Acid *recently, we might not have looked up all this lore. We didn't get the order, but in trying we made enough of it to stock as Eastman 7784 (along with* 2-Thioorotic Acid, *Eastman 7783) for the convenience of biochemical investigators. Anybody who wants to sell it from milk trucks is strictly on his own.*

We have some 3700 Eastman Organic Chemicals to worry about. Catalog on request from Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company).

This is another advertisement where Eastman Kodak Company probes at random for mutual interests and occasionally a little revenue from those whose work has something to do with science

Meetings

Contamination of the Moon

A committee to consider the implications of contamination of the moon and planets by extraterrestrial exploration (CETEX) was established by the International Council of Scientific Unions (ICSU) in March 1958 and held its first meeting two months later in The Hague. On the basis of two days of discussions, CETEX decided that there is a real possibility that exploration experiments could contaminate the moon or the planets in such a way that other experiments, particularly biological, would be made impossible. The dangers of such contaminations, and steps to avoid them, were pointed out in the report of CETEX [*Science* **128**, 887 (1958)] which was accepted by ICSU at its general meeting in Washington in October 1958. In addition, the parent organization asked CETEX to meet for a second time, with the help of appropriate technical experts, to draw up a code of conduct for space research and to suggest the correct sequence of experiments of different types.

The second meeting was held at The Hague 9–10 March 1959, the following members being present: M. Florkin, convener (Belgium); P. Alexander (Great Britain); J. Bartels (Germany); W. O. Fenn (U.S.); D. J. Hughes (U.S.); J. Roche (France); and J. Rösch (France).

It was impossible for CETEX to prepare a detailed sequence of space experiments, principally because of the short time interval between its two meetings and the complexity of the problems involved. Instead, it drew up some general principles governing space exploration that could serve as suggestions to COSPAR, the newly organized space research committee of ICSU, which presumably will include the work that CETEX has begun. These general principles are given below. Although the first report of CETEX was considered in detail at the second meeting, primarily only minor changes of a technical nature were made in it. The committee reaffirmed its position that the presence of life of any type on the moon is extremely unlikely and decided, as well, that the possibility that free radicals in explosive amounts exist on the moon is remote. A suggestion was added to the report that methods for sterilization of rockets be developed as rapidly as possible, and that sterilization be instituted as a standard procedure.

The general principles governing space research drawn up at the meeting are as follows.

"1) Space research offers a challenge and opportunities which should appeal to the most imaginative minds. The greatest encouragement must be given to novel and unconventional approaches and no proposal should be sanctioned which would hamper the experimenters' freedom of action unless there are compelling reasons. On the other hand, equally imaginative thinking is required when considering possible complications which can follow a particular type of experiment. Surprises are certain and unlikely possibilities must be borne in mind when dealing with the problem of contamination, which is better defined as the problem of reducing the risk whereby one experiment may spoil the situation for other subsequent enquiries. The question of deciding whether such a conflict is likely to arise can best be dealt with by a committee or working group engaged in planning, or advising on scientific experiments.

"2) Ideally scientists should be asked to inform COSPAR as early as possible of each space experiment which is envisaged and of the methods to be used in its execution. The broadly based committee of COSPAR containing scientists

from all disciplines may be able to see much more clearly than the space research specialists possible conflicts introduced by such experiments and may be able to suggest ways of overcoming these difficulties.

"3) There are a number of obvious and necessary experiments which are bound to be done and here the COSPAR working group dealing with experiments may be able to suggest priorities. While it may not be possible to avoid all types of contamination a proper sequence can ensure that the collection of data is not thereby hindered. For example CETEX recommends positively that no 'soft' landing, which requires the release of large quantities of gases, should be made on the moon until experiments have been successfully carried out—or at least all reasonable attempts made—to determine the nature of the moon's atmosphere.

"4) In view of the great uncertainties which face space research all operations which are not capable of conveying meaningful scientific data are to be discouraged even if they do not appear to carry with them a known source of contamination. Risks with the unexpected must be taken as otherwise no space exploration is possible but such risks must be justified by the scientific content of the experiment."

Donald J. Hughes
Brookhaven National Laboratory, Upton, Long Island, New York

Forthcoming Events

September

1–3. Association for Computing Machinery, natl., Cambridge, Mass. (J. Moshman, Council for Economic and Industry Research, Inc., 1200 Jefferson Davis Highway, Arlington 2, Va.)

1–6. College of American Pathologists, Chicago, Ill. (A. H. Dearing, Suite 2115 Prudential Plaza, Chicago 1.)

1–7. History and Philosophy of Science (General Assembly, History Div., Intern. Union of the History and Philosophy of Science), Barcelona, Spain. (R. Taton, IUHPS, 64, rue Gay-Lussac, Paris 5e.)

1–8. Acoustics, 3rd intern. cong., Stuttgart, Germany. (E. Zwicker, Breitscheidstrasse 3, Stuttgart N.)

1–7 Oct. International Civil Aviation Organization (Meteorological Div.), Montreal, Canada. (ICAO, Maison de l'Aviation Internationale, Montreal.)

2–4. Allergy, 4th European cong., London, England. (British Assoc. of Allergists, Wright-Fleming Inst., St. Mary's Hospital, London, W.2.)

2–4. Cryogenic Engineering Conf., Berkeley, Calif. (K. D. Timmerhaus, CEC, Chemical Engineering Dept., Univ. of Colorado, Boulder.)

2–4. Crystal Imperfections and the Chemical Reactivity of Solids (Faraday discussion), Kingston, Ontario, Canada. (Faraday Soc., 6 Gray's Inn Sq., London, W.C.1, England.)

2–5. American Mathematical Soc. and Mathematical Assoc. of America (joint summer), Salt Lake City, Utah. (E. Pitcher, AMS, Lehigh Univ., Bethlehem, Pa.)

2–8. Foundations of Mathematics: Infinitistic Methods, symp., Warsaw, Poland. (A. Mostowski, Dept. of Mathematics, Univ. of California, Berkeley 4.)

2–9. British Assoc. for the Advancement of Science, 121st annual, York, England. (Secretary, BAAS, 18 Adam St., Adelphi, London, W.C.2, England.)

3–4. Magnesium in Agriculture, symp., Morgantown, W. Va. (D. J. Horvath, Dept. of Animal Husbandry, West Virginia Univ., Morgantown.)

3–5. Nephrology, 1st intern. cong., Geneva, Switzerland, and Evian, France. (G. Richet, Hospital Necker, 149, rue de Sevres, Paris 7e, France.)

3–6. American Sociological Soc., natl., Chicago, Ill. (D. Young, Russell Sage Foundation, New York 22.)

3–9. American Psychological Assoc., annual conv., Cincinnati, Ohio. (R. W. Russell, APA, 1333 16 St., NW, Washington 6.)

4–7. International Federation of Surveyors, annual (by invitation), Gracow, Australia. (IFS, 4, Kanaalweg, Delft, Netherlands.)

5–12. Application of Radiation Sources in Industry, intern. conf., Warsaw, Poland. (P. Fent, IAEA, Vienna, Austria.)

6–12. Standards on a Common Language for Machine Searching and Translation, intern. conf., Cleveland, Ohio. (Secretariat, Center for Documentation and Communication Research, Western Research Univ., Cleveland 6.)

6–12. World Confederation for Physiotherapy, 3rd intern. cong., Paris, France. (A. Nicolle and J. Dupuis-Deltor, Société d'Organisation des Congrès Français et Internationaux, 1, rue Chanez, Paris 16e.)

7–9. Psychometric Soc., Cincinnati, Ohio. (P. H. DuBois, Washington Univ., St. Louis 5, Mo.)

7–9. Society of General Physiologists, Urbana, Ill. (F. G. Sherman, Dept. of Biology, Brown Univ., Providence 12.)

7–10. Institute of Management Sciences, Paris, France. (A. S. Manne, Dept. of Economics, Yale Univ., New Haven, Conn.)

7–11. American Soc. of Clinical Pathologists, Chicago, Ill. (C. E. Wells, 2052 N. Orleans, Chicago 14.)

7–11. Illuminating Engineering Soc., annual natl. conf., San Francisco, Calif. (A. D. Hinckley, IES,, 1860 Broadway, New York 36.)

7–12. European Soc. of Haematology, cong., London, England. (E. Neumark, Dept. of Pathology, St. Mary's Hospital, London, W.2.)

7–12. World Medical Assoc., 13th general assembly, Montreal, Canada. (WMA, 10 Columbus Circle, New York 19.)

8–15. Sociology, 4th world cong., Milan and Stresa, Italy. (Intern. Sociological Assoc., Skepper House, 13 Endsleigh St., London, W.C.1, England.)

9–10. Air Pollution, 2nd intern. cong., New York, N.Y. (American Soc. for Mechanical Engineers, 29 W. 39 St., New York 18.)

(*See issue of 19 June for comprehensive list*)

New Products

The information reported here is obtained from manufacturers and from other sources considered to be reliable, and it reflects the claims of the manufacturer or other source. Neither Science *nor the writer assumes responsibility for the accuracy of the information. A coupon for use in making inquiries concerning the items listed appears* *on page 350.*

■ IONIZATION GAGE achieves linearity over a wide operating range by enclosure of the ionization region with a grid-like end covering that prevents straying of ions. Range of the gage for accurate measurements is said to be 10^{-10} mm-Hg with direct readings possible down to 10^{-12} mm-Hg. Flash filament technique permits estimation of partial pressures of adsorbable gases to 10^{-12} mm-Hg. Full-scale ranges from 0-to-10^{-3} to 0-to-10^{-10} mm-Hg are selectable. (N. R. C. Equipment Corp., Dept. 954)

■ PULSE-HEIGHT ANALYZER uses a ferrite-core memory system to store information in 400 channels. Capacity per channel is 65,545 counts. Linearity is better than 0.5 percent. Average dead time is 120 μsec. Maximum input counting rate without distortion or shift of data is greater than 5×10^6 count/min. Features include automatic print-out, memory subgrouping, and external programing. (Radiation Instrument Development Laboratory, Inc., Dept. 955)

■ ELECTRIC BENCH FURNACE for continuous operation at 1900°F and intermittent duty to 2100°F is said to achieve unusual compactness and efficiency by use of fibrous potassium titanate for insulation. One model with chamber volume 222 in.^{3} has an over-all volume of 1160 in.^{3}; heat-up time 25 min from 70° to 1830°F; power consumption to hold at 1900°F, 580 w; and case temperature 260°F for inside temperature 1920°F. Weight is 17 lb. (Electric Hotpack Co., Dept. 957)

■ VISCOMETER of rotating cone type provides a constant rate of shear adjustable from 2 to 20,000/sec by a ten-turn potentiometer. Three models are available for maximum sample temperatures 30°, 100°, and 200°C. Speed is indicated directly, and full torque is available at all speeds. Gap is reproducible within ±0.0001 in. Three cone diameters and three torque springs provide a wide range of viscosity. (Ferranti Electric Inc., Dept. 958)

■ ANALOG COMPUTING COMPONENT accepts three variable inputs e_1, e_2, e_3, and provides as output e_1e_2/e_3. Accuracy as a multiplier, including drift, is said to be better than ±0.1 v in all four quadrants. A three-digit decade provides an adjustable voltage which serves as an adjustable scale factor for operations involving only two variables. Dynamic response may be set, for example, to give less than 1-deg phase shift at 1 kcy/sec or 3 db attenuation at 14 kcy/sec. Standard range of inputs and outputs is ± 50 v. No external equipment is necessary to obtain products, ratios, squares, square roots, or absolute values. (George A. Philbrick Researchers, Inc., Dept. 962)

■ VOLTAGE MONITORING DEVICES are available as indicators and relays. The indicator is an expanded-scale instrument graduated in arbitrary units and said to be accurate at the point monitored to ± 0.25 percent for d-c and ± 0.5 percent for a-c. Trip-point accuracy of the relay is claimed to be within ± 0.25 percent for d-c and ± 0.5 percent for a-c. A response delay of 75 msec is standard, but delay as high as 2 sec can be provided. (Voltron Products, Dept. 959)

■ DIGITAL MICROMETER scans up to 99 gaging points and prints dimensional data with accuracy ± 0.0001 in. · and identification number. Operation can be manual, semiautomatic, or completely synchronized with manufacturing and inspection processes. Optional outputs include digital display, card-punch input, or alarm. (Daytronic Corp., Dept. 969)

■ OSCILLOGRAPH records a laterally undulating track on a narrow plastic tape. The track is optically projected within the instrument to produce an enlarged image on its viewing screen. No processing is required. The tape is loaded into the instrument on 3-in. reels. According to the manufacturer, frequency response for direct recording is from d-c to 5000 cy/sec. A magnetic memory unit will be available as an accessory to permit higher frequencies to be recorded. A pickup head to permit playback of the record will also be available. (Microsound Inc., Dept. 967)

■ VOLTAGE REFERENCE uses a silicon diode element to provide output reference voltage either 8.4 or 16.8 v d-c. Voltage regulation is ± 0.01 percent for ± 10 percent line voltage variation. Temperature coefficient is ± 0.001 percent/°C from − 55° to + 100°C. Units are available for a-c or d-c operation. Output ripple of a-c types is less than 0.004 percent. (International Rectifier Corp., Dept. 964)

■ DEW-DURATION RECORDER uses a sensitive element of goldbeater's skin said to be unaffected by relative humidity conditions and to respond only to actual water deposition. The instrument is designed to be placed between rows of plants and is made of noncorroding materials. Recording is said to start and cease within 5 min of the appearance or disappearance of visible dew on foliage. The waxed-paper chart is driven by a spring clock at 1 rev/day for 7 days. (American Instrument Co., Dept. 960)

■ ALPHANUMERIC PRINTER accepts digital data from digitizers, magnetic or perforated tape, and electronic counters or computers and prints out at rates up to 48,000 digits per second. For logging digitized data from a series of analog-to-digital converters a scan and print-out rate of 200 three-digit numbers is said to be realizable. Up to 63 characters are available. Printing is on multiple-copy fanfold paper; up to four copies can be made. (Potter Instrument Co., Dept. 966)

■ PROGRAMER is a 13-channel tape device giving a program duration of 10.6 min at a tape transport speed of 3 in./sec. Designed to control up to 13 functions simultaneously, it provides electrical pulses at predetermined intervals. Pulses are produced by a brush which senses slots punched in 35-mm insulating tape. (Beattie-Coleman Inc., Dept. 961)

JOSHUA STERN
National Bureau of Standards
Washington, D.C.