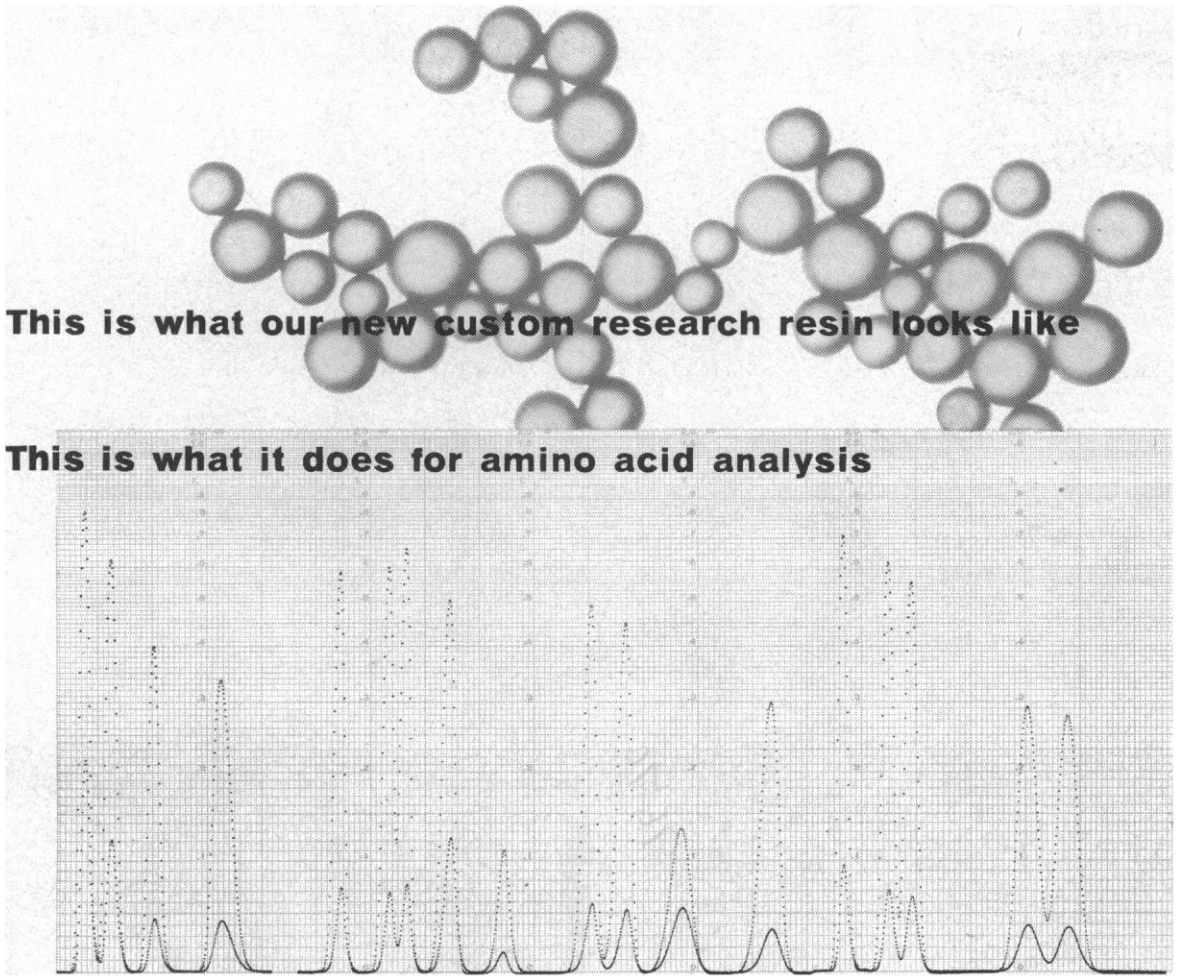
SCIENCE

27 November 1964
Vol. 146, No. 3648

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

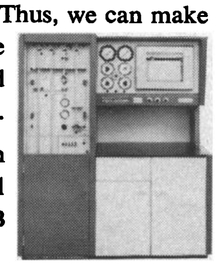
AIR POLLUTION



You can't really appreciate how good this new Beckman Custom Research Resin is just by looking at it. About all you can tell is that the particles are spherical like other beaded resins, and that there is a significant absence of fingernails, fractures, and fines.

However, as soon as you run an amino acid analysis with the new Beckman resin you'll realize what a major advance it is. First, back pressures are so low that you can greatly increase flow rates and shorten analysis times (we're currently running protein hydrolyzates in 4 hours, and there's no end in sight). Second, the resolution is exceptional (a point we have always stressed with our 120B Analyzer, and with our procedures). Third, you can use smaller samples.

What's our secret? We start with the raw materials, carefully control the polymerization, and form these perfect spheres—all under research conditions. Thus, we can make the chemical composition, the cross linkage, and the sizes of the spheres just the way we want—lot after reproducible lot. And our resin is immediately available, as many bottles as you wish.



A breakthrough? You'll think it is when you see this new resin perform. It comes as standard equipment on every new Model 120B Amino Acid Analyzer. For descriptions of the 120B and Custom Research Resin, ask for Data File 120-5.

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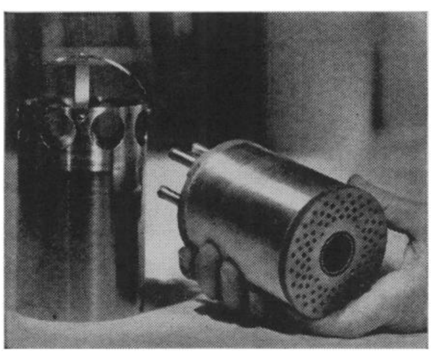
Report from

BELL LABORATORIES

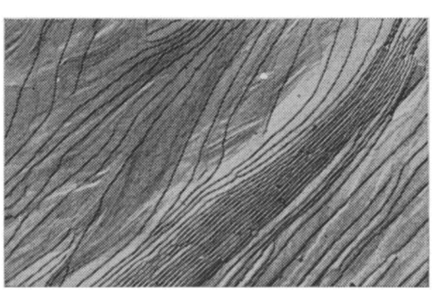
NEW MATERIALS FOR COMMUNICATIONS

At Bell Telephone Laboratories we believe that progress in communications technology depends directly on our ability to understand the fundamental behavior of materials, to synthesize new materials with special properties, to improve existing ones, and to specify their use in Bell System communications equipment. The six examples shown below illustrate research and development of this kind.

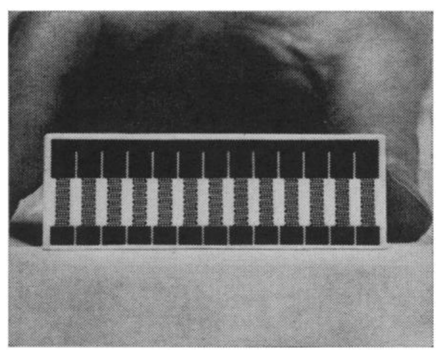
Bell Telephone Laboratories
Research and Development Unit of the Bell System



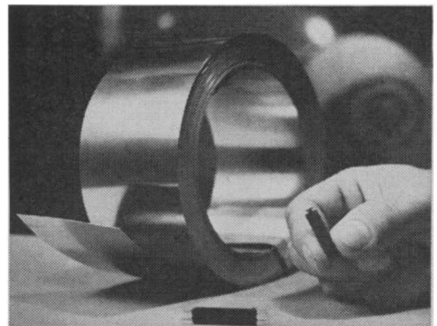
SUPERCONDUCTOR. Experimental 75 kilogauss superconducting solenoid. Wire consisting of compacted niobium and tin in a niobium jacket is wound and later heated to form niobium-tin compound (Nb_3Sn), which has a transition temperature of 18° Kelvin and a critical field greater than 200 kilogauss. Compound and wire-forming technique were developed at Bell Laboratories.



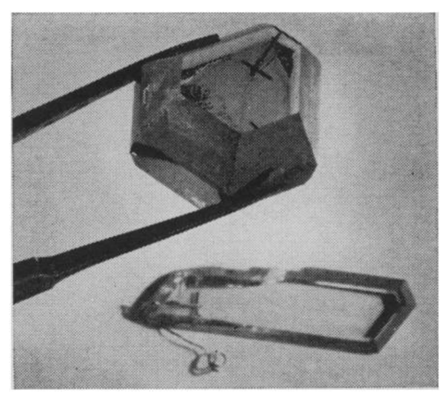
INSULATOR. Electron microscope photograph of polyethylene, 9800 diameters magnification, showing overlapping ribbon-like crystals, a structure characteristic of many polymers. At Bell Laboratories, studies of the formation of such groups of crystals have contributed to an understanding of the electrical and mechanical properties of these materials.



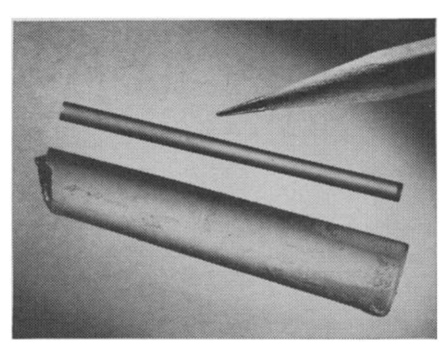
THIN-FILM RESISTORS. Tantalum thin-film resistors (zigzag patterns above) offer new possibilities for reliable, low-cost circuits. Bell Laboratories people discovered how to fabricate films routinely with values precise to one part in five thousand, and with expected aging during a 20-year life of less than one part in a thousand.



MAGNETIC MATERIAL. Remendur, latest member of a large family of high-performance magnetic materials developed at Bell Laboratories, is shown here in sheet form and as element of new telephone switch. A malleable, ductile cobalt-iron-vanadium alloy, Remendur has a remanence of 21,500 gauss.



SEMICONDUCTOR. Beginning in the 1930's Bell Laboratories people carried out extensive studies of semiconductors—studies that led to the invention of the transistor. Photograph shows crystals of zinc oxide, a semiconductor with piezoelectric properties, grown at Bell Laboratories by a hydrothermal method.



LASER MATERIAL. Among many materials developed at Bell Laboratories is nickel-doped magnesium fluoride, shown here as grown from melt and in polished rod form. Laser action in this material generates lattice phonons as well as a beam of coherent infrared photons.

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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

This aerial photograph of an industrial complex illustrates, on a small scale, how many individual sources combine to create a single volume of polluted air. The gradual loss of buoyancy of a heated effluent and the leveling off of plumes from single sources is depicted by the black and white plumes (upper center). These also show the gradual diffusion of single-source pollution as the result of atmospheric turbulence. See page 1119. [U.S. Public Health Service]

New IBM SYSTEM/360 fills all your scientific data processing needs

Solve problems faster

How long do you have to wait before you get an answer from your computer?

How often do you have to segment a big or complex problem and solve it a piece at a time?

How often have you wished for a system that would exactly fill your needs?

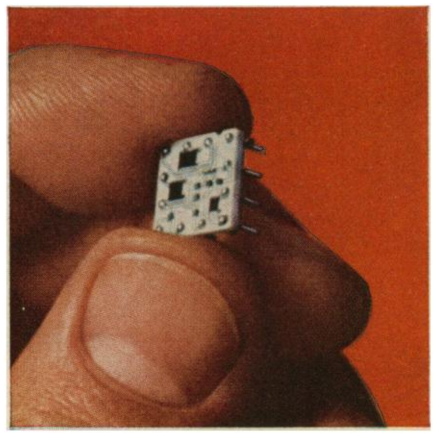
SYSTEM/360 can help you with these problems. This is a brand new approach to the design and the use of computers. It is an all-purpose binary system that you can tailor to handle anything from a simple regression analysis to real-time processing and control.

Major design innovations make all this possible.

Throughout SYSTEM/360, you'll find new smaller, faster micro-circuits like the one shown in the photo.

We manufacture the tiny chip transistors (only 0.025 inch on a side), use new graphic arts techniques to assemble them into printed circuits, then permanently seal each circuit module.

Memory is also news in SYSTEM/360.

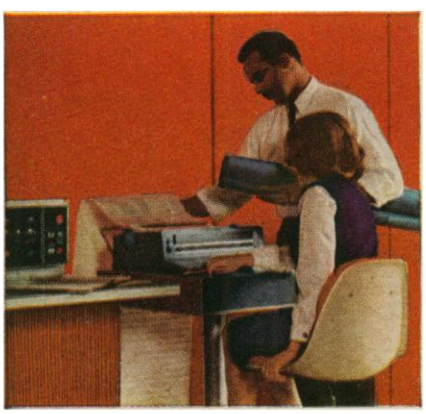


You can get the largest, low-cost, high-speed memory ever offered.

Main core memory comes in sizes up to 512,000 characters (8-bit characters that you can pack with 4-bit numerical characters). To this, you can hook on up to eight million more characters of 8-μs bulk core memory. You can directly address both main and bulk memory.

A completely new organization inside the central processor speeds processing, simplifies programming. The system works on several problems simultaneously and moves from job to job automatically. You can delete, change or add data in big blocks or a character at a time with simple programming instructions.

All this adds up to more thruput, better machine utilization and faster answers to problems.



Custom-fit the system to the job

With SYSTEM/360 you pick and choose from the broadest array of input/output devices and processing power ever offered in one system. You can select from tapes, direct-access storage, printers, communications terminals, card, paper tape and character readers and visual display devices.

You install only as much capacity and only those devices you need right now. You don't buy a bigger system than you need. You don't squeeze your problem into a system that's not quite fast enough or not quite big enough.

Even the programming system is modular. You can tailor it to fit your job.

When you want to add new applications, you can increase power or change the configuration without revising most of your programs. Virtually any program that works on a small configuration can work on a larger one. The same goes for your programming system and input/output devices.

SYSTEM/360 solves today's problems efficiently. It expands, without a lot of costly reprogramming, to solve tomorrow's problems.

It's an all-purpose computer

SYSTEM/360 helps out with linear programming, design engineering, statistical analysis, data acquisition and reduction, data communications and many other jobs.

The system gives you single-and-double-precision floating point arithmetic that handles anything from 10^{-78} to 10^{75} to 15-digit accuracy.

Two of these systems can share main memory, files, or tapes.

SYSTEM/360 comes with improved FORTRAN and COBOL compilers and provision for ASCII (American Standard Code for Information Interchange). It can handle any 8-bit code, either binary or decimal, and translate from one code to another.

While it's handling scheduled programs, SYSTEM/360 can take in data or messages from up to 256 communications lines and store them. Or it can interrupt the running program to process a priority message.

It protects the data in storage, the program being run and the information coming in.

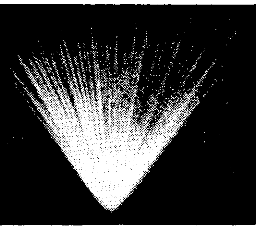
It answers inquiries in print or displays them on screens anywhere that answers are needed.

This new SYSTEM/360 speeds handling of communications, prevents delays during peak periods.

More information. There's lots more you'll want to know about SYSTEM/360. Call your IBM representative.

IBM®
DATA PROCESSING

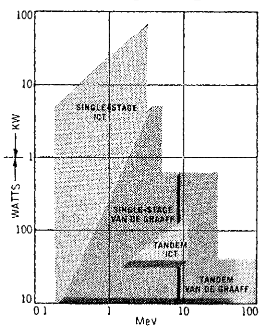
CHARGED PARTICLES



THE ICT CONCEPT:
new high-current machines emerging from HVEC research

Development of higher energy Van de Graaff particle accelerators which retain high beam precision, stability, and homogeneity, remains a continuing contribution by HVEC to "energy-oriented" research.

To provide even greater freedom of experimentation, HVEC is also anticipating the need for the higher beam intensities required in *power*-oriented research projects. Invented by Dr. R. J. Van de Graaff, the new Insulating Core Transformer (ICT) accelerator now provides high beam currents with all the desirable beam characteristics of Van de Graaff machines. As the graph shows, the high power levels available from the ICT accelerator now make possible a new realm of precision experimentation.



The Insulating Core Transformer

The ICT is essentially a three-phase power transformer with multiple secondaries, each of which is insulated from the other. Rectified current from the secondaries is series-connected to achieve total voltage. In the ICT, electrostatic and electromagnetic fields exist in the same space, as contrasted to the conditions in a coventional transformer. The result is a highly efficient dc power source capable of stable operation at elevated potentials *and* power levels.

A number of ICT accelerators and power generation systems are now available.

Single-Stage ICT Accelerators

Two types of single stage ICT accelerators have been developed for research use. The first incorporates an ICT power source coupled to the acceleration assembly through a coaxial cable.

	PROTON ENERGY (KeV)	CURRENT (MAX.) (Analyzed)	TANK HEIGHT Feet	TANK HEIGHT Meters	TANK DIAMETER Feet	TANK DIAMETER Meters
ICT 300	300	15 mA	4'4"	1.32	4	1.2
ICT 500	500	10 mA	5'3"	1.60	4	1.2

The second system utilizes a rigid transmission line to transmit electrical power to the accelerator terminal.

4 MeV ICT	ENERGY (MeV)	CURRENT	DIMENSIONS Length Feet	DIMENSIONS Length Meters
Positive Ions	1.5-4	3 mA	26'6"	8.08
Electron Conversion	1.5-3	10 mA	26'6"	8.08
3 MeV ICT Electrons	1.5-3	20 mA	29'	8.84

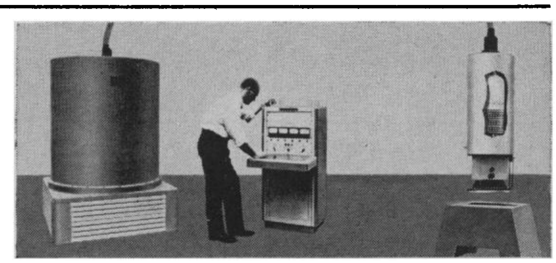
---

8 MeV ICT Tandem Accelerator

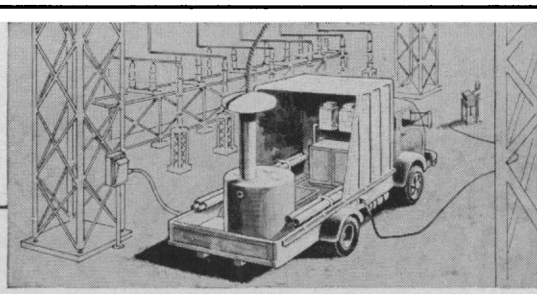
The 8 MeV ICT Tandem provides proton energies continuously variable from 3 to 8 MeV at a maximum guaranteed beam current of 2μA. The ICT power source is capable of providing 12 mA at 4 mv which, in combination with newly developed components emerging from HVEC, will enable the accelerator to keep pace with future research requirements. The 8 MeV Tandem is convertible to single-stage ion or electron operation.

ICT Electron Processing Systems

Developed primarily as high-current sources of electrons for industrial processing applications, these systems allow extreme flexibility of operation. Two models are available: 300 kv at 30 mA maximum beam current and 500 kv at 20 mA maximum beam current.



Series 7 ICT Power Supplies



ICT equipment has crossed many barriers to dc operation at high particle energies and currents. There is no indication that a ceiling exists to further advances of similar importance.

Available with output ratings ranging from 240 kv at 80 mA to 600 kv at 20 mA, these highly stable power sources are suitable for use in high energy beam separator systems, r.f. transmission systems, plasma research and high voltage testing programs.

For detailed information, please write to Technical Sales, High Voltage Engineering Corporation, Burlington, Massachusetts.

HIGH VOLTAGE ENGINEERING

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Shaping Educational Policy

The requirements of a complex, mobile, and highly interrelated society sometimes conflict with the constitutionally established principle that education is a state responsibility. In *Shaping Educational Policy* (McGraw-Hill, published 15 November), James Bryant Conant proposes that we resolve this conflict by creating a nationwide planning body. Policy is now made by such a welter of agencies—states, local boards of education, the organized teaching profession, public and private colleges, and a variety of organizations—that, short of a constitutional amendment, "we cannot have a national educational policy, but we might be able to evolve a *nationwide policy*." Dr. Conant recommends that an "Interstate Commission for Planning a Nationwide Educational Policy" be created by interstate compact and approved by Congress. The commission's recommendations would not be binding on any state, but could be expected to be strongly influential.

The timing is excellent, for, whether the proposed commission comes into existence or some other approach gains greater favor, 1965 clearly seems to be the right year for intensive efforts to develop better planning and greater coordination in the nation's heterogeneous educational system.

One sign that the time is right is to be found in the recent narrowing of the gulf that has existed between two opposed positions concerning the use of federal funds. Congressional appropriations for education have always been on a categorical basis—to support science, to improve instruction in foreign languages, to build laboratories, or for some other prescribed objective. Congress has not abandoned this principle, but in 1964 the categories eligible for federal assistance were significantly broadened. Loans are now available to superior students in any field instead of only to those who plan to teach or who excel in mathematics, science, engineering, or modern foreign languages. Grants can now be made to improve teaching of English, reading, history, geography, and civics, in addition to science, mathematics, and foreign languages. Grants or loans are now available to assist with the construction of a wide range of undergraduate and graduate teaching facilities.

In 1964, also, there was a lessening of insistence by some educational groups that federal education grants be made on a noncategorical basis and be available for use much as each state sees fit.

There are other signs of change. The proposal that a portion of the federal tax income be allotted to the states is gaining wider support. The President's majority in the recent election will encourage him to press forward on at least some parts of his "great society" concept. A new Federal Interagency Committee on Education was established a month ago to coordinate federal educational programs and policies.

Local administration of schools and colleges is too well established to be changed, but local planning will no longer suffice. Our population is too mobile; interrelationships are too complex; federal assistance is growing; demands upon the educational system are increasing.

Conant has proposed one means to achieve planning on a broad base. This is the time for other proposals to be brought forward, for 1965 is sure to see some lively discussions of nationwide educational planning, and may see some far-reaching decisions.—DAEL WOLFLE

ley, Calif. (W. Whaling, California Inst. of Technology, 1201 East California St., Pasadena)

21–23. **Biology of Marine Microorganisms**, conf., Univ. of California, Berkeley. (R. Newton, Letters and Science Extension, Univ. of California, Berkeley 94720)

26–29. Society of **Systematic Zoology**/American Soc. Zoologists/Herpetologists' League, annual, Univ. of Tennessee, Knoxville. (J. G. Rozen, Jr., Dept. of Entomology, SSZ, American Museum Natural History, Central Park West and 79th St., New York, N.Y.; A. G. Richards, ASZ, Dept. of Entomology, Univ. of Minnesota, St. Paul 55101; J. M. Legler, HL, Dept. of Zoology, Univ. of Utah, Salt Lake City)

26–31. **American Assoc. for the Advancement of Science**, annual, Montreal, Canada. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

27–29. American **Philosophical** Assoc., Boston, Mass. (L. E. Hahn, Dept. of Philosophy, Southern Illinois Univ., Carbondale 62903)

27–30. American **Statistical** Assoc., Chicago, Ill. (D. C. Riley, ASA, 810 18th St., NW, Washington, D.C. 20006)

28–30. American **Economic** Assoc., annual, Chicago, Ill. (H. F. Williamson, AEA, 629 Noyes St., Evanston, Ill.)

28–30. American **Geophysical** Union, Seattle, Wash. (W. W. Kellogg, Rand Corporation, 1700 Main St., Santa Monica, Calif.)

28–30. **Linguistic** Soc. of America, New York, N.Y. (A. A. Hill, Post Office Box 8120, University Station, Austin, Tex. 79712)

28–30. Western Soc. of **Naturalists**, Univ. of Washington, Seattle. (I. A. Abbott, Hopkins Marine Station of Stanford Univ., Pacific Grove, Calif.)

30. **Scientific Research** Soc. of America, Cleveland, Ohio. (D. B. Prentice, 51 Prospect St., New Haven 11, Conn.)

January

5–7. **Glass Formation, Phase Equilibria, Nucleation and Crystal Growth**, symp., Sheffield, England. (D. Hawksworth, Soc. of Glass Technology, Thorton, 20 Hallam Gate Rd., Sheffield 10)

5–8. **Solid State Physics**, 2nd annual conf., H. H. Wills Physics Laboratory, University of Bristol, England. (Administrative Assistant, Inst. of Physics and Physical Soc., 47, Belgrave Square, London, S.W.1)

6–8. **Industrial Electronics and Control Instrumentation**, 13th annual conf., Philadelphia, Pa. (E. Weiss, Sun Oil Co., Marcus Hook, Pa.)

6–9. **Psychopharmacological** Conf., Czechoslovak Medical Soc., Psychiatry Section, Jesenik Spa. (M. Vojtechovsky, Budejovicka 800, Pavilion A1, Prague, Czechoslovakia)

8–9. **Orthopaedic** Research Society, New York, N.Y. (R. A. Calandruccio, 869 Madison Ave., Memphis, Tenn.)

9–14. American Acad. of **Orthopedic Surgeons**, annual, New York, N.Y. (H. K. Hart, AAOS, 29 E. Madison, Chicago 2, Ill.)

11–14. **Civilian and Military Uses of Aerospace**, conf., New York, N.Y. (I. B. Laskowitz, New York Acad. of Sciences, 2 E. 63 St., New York)

12–14. **Reliability and Quality Control**, symp., Miami, Fla. (H. D. Hulme, Westinghouse R&D Center, Bldg. 601-1346, Churchill Boro, Pittsburgh, Pa.)

12–15. **Crustacea**, symp., Cochin, India. (Marine Biological Assoc. of India, Marine Fisheries P.O., Mandapam Camp, S. India)

14. American **Genetic** Assoc., Washington, D.C. (W. R. Singleton, Biology Bldg., Univ. of Virginia, Charlottesville)

18–20. **Solar Radiation Simulation**, intern. conf., Los Angeles, Calif. (H. F. Sander, Inst. of Environmental Science, 34 S. Main St., Mount Prospect, Ill.)

19–20. **Die Design and Press Tooling** Conf., American Soc. of Tool and Manufacturing Engineers, Hartford, Conn. (M. Zapico, Asst. Conf. Director, ASTME, 10700 Puritan Ave., Detroit 38, Mich.)

20–22. **Instrumentation**, College Station, Tex. (P. T. Eubank, Chemical Engineering Dept., Texas A&M Univ., College Station)

20–23. National Soc. of **Professional Engineers**, New Orleans, La. (P. H. Robbins, 2029 K St., NW, Washington, D.C. 20006)

22. **Bibliographical** Soc. of America, New York, N.Y. (Mrs. H. C. Ralph, P.O. Box 397, Grand Central Station, New York 10017)

22–1. **Earthquake Engineering**, 3rd world conf., Auckland and Wellington, New Zealand. (Administrative Secretary, Third World Conf. on Earthquake Engineering, P.O. Box 5180, Wellington)

New Products

General-purpose pH meter, intended for fast *p*H and millivolt measurements, potentiometric and dead-stop titrations, is designed for use in industrial, educational, and medical laboratories. The product has a measuring range from 0 to 14 *p*H units and 0 to ±1400 mv. Readings are made on a 7-inch mirror scale taut-band suspension meter. Relative accuracy is ±0.05 *p*H and repeatability of ±0.02 *p*H and ±2.0 mv is possible. Manual temperature compensation covers 0 to 100°C. Connectors are provided for automatic temperature compensation, recorder output, and polarizing current for Karl Fischer and other titrations. The transistorized line-operated power supply eliminates the need for batteries. Instrument drift is less than 0.01 *p*H per 24 hours. The instrument can be used with grounded or ungrounded solutions and the electrode input jacks will receive either Corning or other electrodes. Model 7 comes with an accessory kit which includes all the basic equipment required to operate the instrument, including the Corning triple-purpose (which functions as a general-purpose) *p*H electrode, a low sodium error, or a high-temperature electrode.—D.J.P. (Corning Glass Works, Dept. S365, Corning, N.Y.)

Titration kit, designed for use in the classroom, consists of an analytical redox *p*H meter, burette and stopcock, protected *p*H probe, multipurpose stand, buffer kit, and manual. The large scale meter has a continuous 0 to 14 *p*H scale readable to 0.05 *p*H and a millivolt scale, −1400 mv to + 1200 mv, readable to 2 mv. Temperature compensation from 0 to 100°C is selected by means of a front panel knob. The 14½-inch, 25-ml burette is graduated in 0.1 ml and has a Teflon stopcock. The rugged glass *p*H probe, completely covered with polyethylene, is virtually unbreakable, a requirement for student use. The multipurpose stand is a magnetic stirrer unit with a support rod for the burette-probe assembly. The beaker sits on the stirrer surface and the burette-probe assembly is lowered into place. The *p*H meter is held by a separate stand to bring it up to a convenient height. Three 50-ml polyethylene bottles are supplied with the buffer kit which provides three packages each of powdered buffer salts of 4, 7, and 9 *p*H. Each package makes 500 ml of solution. Experiments convenient to try with this kit, along with a series of problems, are given in the manual supplied with each Titra-Kit.—D.J.P. (Analytical Measurements, Inc., Dept. S362, 490 Morris Ave., Summit, N.J.)

A dual-purpose accessory for all Beckman infrared spectrophotometers facilitates studies with **attenuated total reflectance** (ATR) and **variable angle reflectance** (VAR) on the same instrument. This accessory, which clamps into the existing sample compartment track of the IR-4, 5A, 7, 8, 9, 10, 11, and 12 spectrophotometers, provides the necessary optics and angle adjustment for performing both these methods. ATR is a method for determining the absorption properties of samples which (i) have strong absorption bands and require very short path lengths or (ii) are virtually opaque. In this method, the sample is placed in intimate contact with the back face of a prism. The infrared beam travels into the prism and is partially reflected off this back face. However, part of the beam enters a few microns into the sample, where absorption occurs to an extent depending upon the sample composition. The amount of absorption is proportional to the ratio of the index of refraction of the sample to that of the prism, and this ratio is a function of wavelength. Therefore, a record of percent transmission as a function of wavelength is obtained which is similar to but not exactly the same as a standard absorption curve. In addition to dependence upon wavelength, the amount of absorption depends on the angle of incidence of the infrared beam, and for this reason the prism angle can be adjusted between 25° and 60° so that the critical angle can be utilized. In addition, a variety of prisms of different refractive indexes are available to match that of the sample. In variable angle reflectance, properties of thin film coatings of inorganic and organic materials and surfaces of various materials are studied by obtaining curves of specular reflectance as a function of wavelength. Here, again, the feature of this instrument is the ability to vary the angle at which the incident beam strikes the sample, in this case, over a range from 15° to 80°. Although this method has not so far been of much use to the biologist, the convenience with which the two methods can be tried and interchanged in this accessory may bring some new biological applications.—D.J.P. (Beckman Instruments, Inc., Dept. S359, 2500 Harbor Blvd., Fullerton, Calif.)

Lamp housing, for high-pressured compact arc lamps of up to 1000 watts, is completely enclosed with the exception of one entrance and one exit port. This construction permits recirculation of a selected gas such as nitrogen, making it possible to utilize all of the ultraviolet radiation from the arc lamp. An internal fan recirculates the gas in the system. The lamp housing also features an ultraviolet transmitting quartz optic (*f*/1.5) in a lever-operated focusing sleeve, and a compartment for light or heat filter insertion. An adjustable spherical first surface reflector mounted in back of the arc lamp serves to increase light output efficiency and even-out the field. The housing is of heavy-gauge aluminum and utilizes a vertically adjustable base. One side of this housing is easily and completely removable by means of thumb screws, to facilitate lamp installation or replacement. Power supply connections to the lamp are provided through two terminals insulated by large porcelain insulators. Size is approximately 5 by 5 by 10 inches.—D.J.P. (Schoeffel Instrument Co., Dept. S363, 15 Douglas St., Westwood, N.J.)

The material in this section is prepared by the following contributing writers:

Denis J. Prager (D.J.P.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

Joshua Stern (J.S.), Basic Instrumentation Section, National Bureau of Standards, Washington 25, D.C. (physics, computing, electronics, and nuclear equipment).

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither *Science* nor the writers assume responsibility for the accuracy of the information.

Address inquiries to the manufacturer, mentioning *Science* and the department number.