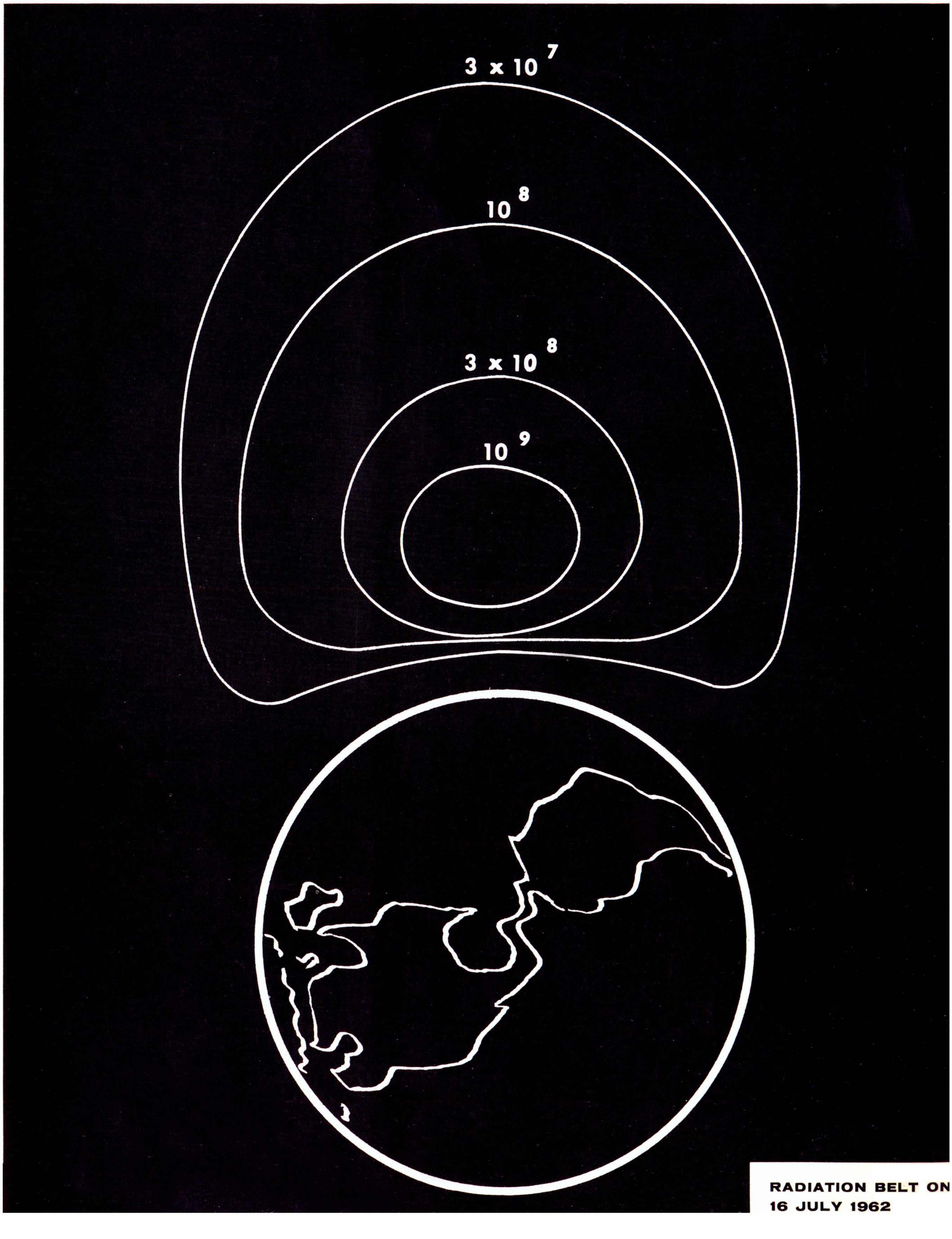
SCIENCE

5 October 1962

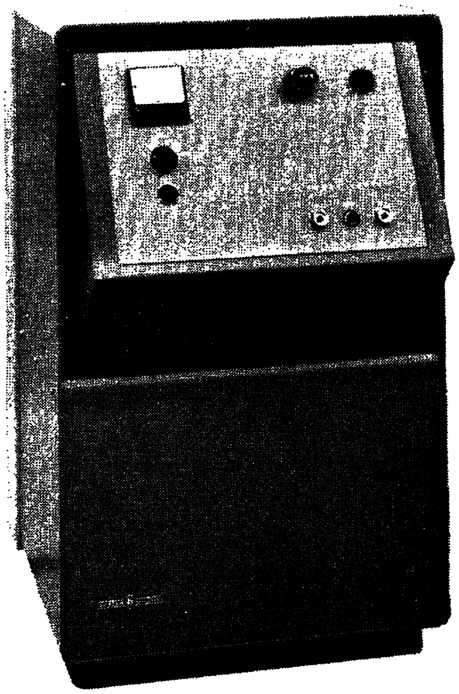
Vol. 138, No. 3536

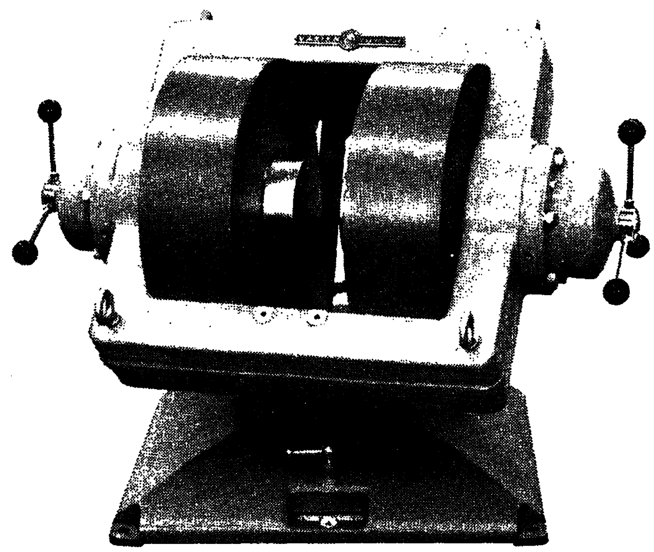
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



RADIATION BELT ON
16 JULY 1962

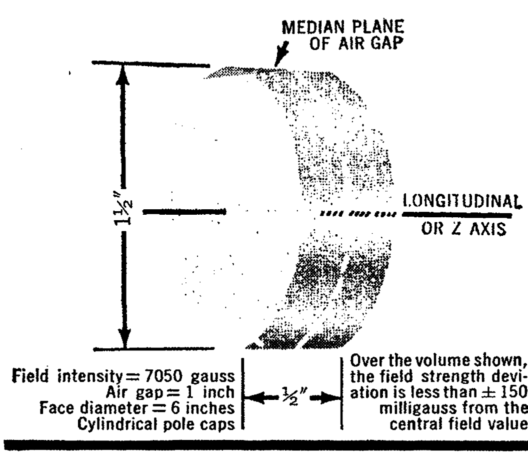
NEW/HIGHER PERFORMANCE PER DOLLAR!





Looking for a compact magnet system which sets new highs in performance at a new, low price? Here it is.

It's a Varian V-3700 series 6-inch magnet matched to the economical new 4Kw solid-state V-2600 Power Supply. This low impedance system provides a higher degree of field intensity and field homogeneity than any other 6- or 7-inch system.



VOLUME OF HOMOGENEOUS MAGNETIC FIELD WITHIN ONE INCH AIR GAP OF V-3703 ADJUSTABLE AIR GAP MAGNET

FEATURES WORTH LOOKING INTO

- Continuous operation at full 4Kw for fields to 35 Kg.
- Compact, water cooled power supply with continuously adjustable current has unsurpassed regulation.
- Choice of magnets with continuously adjustable or fixed air gaps.
- Fixed, rotating, and movable magnet mounts available.
- Most versatile sweep unit commercially available, remote control panel, and other options.

Write today for complete specifications on these new 6-inch magnet systems. We'll also include information on Varian's compact 9-inch magnet systems.

Instrument Division
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PALO ALTO 18, CALIFORNIA

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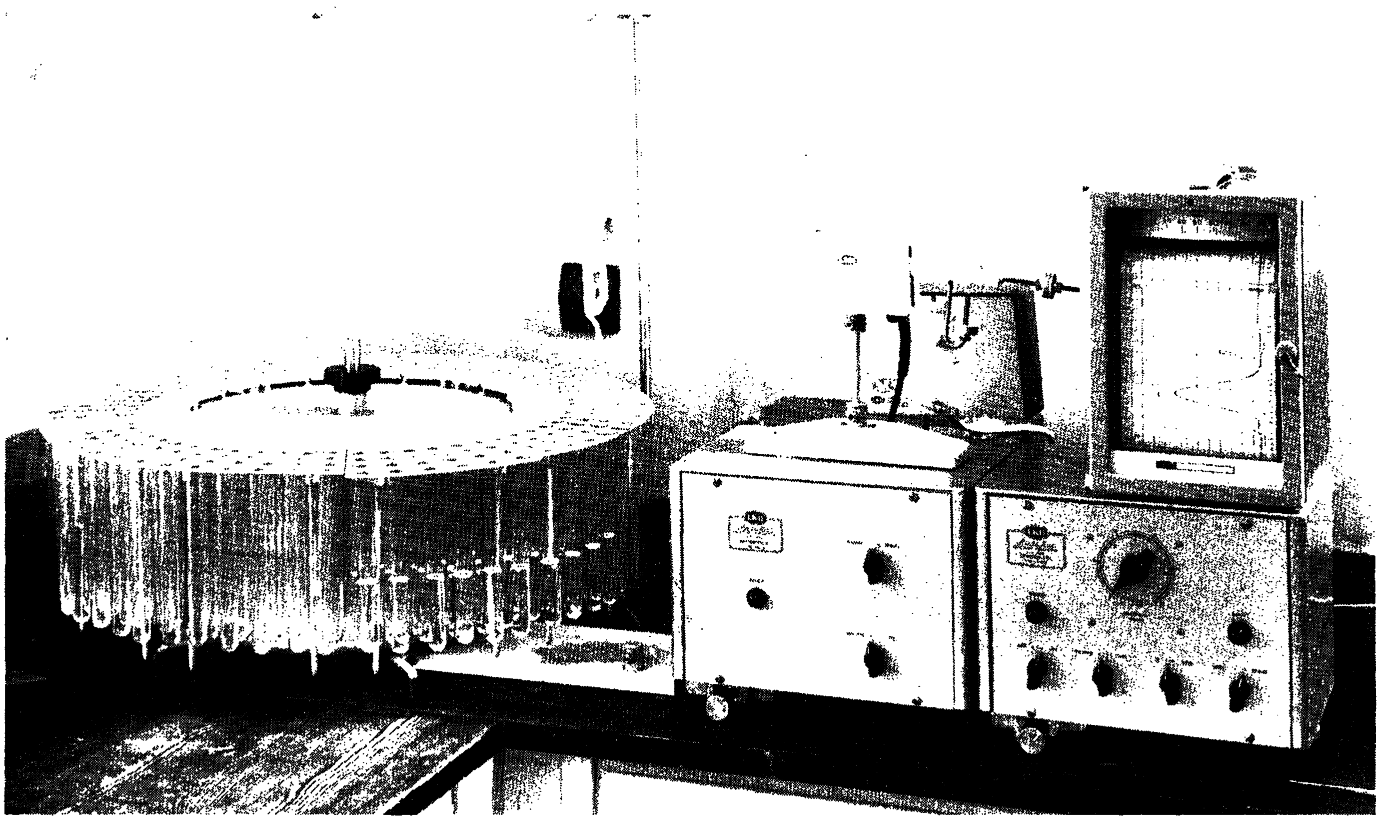

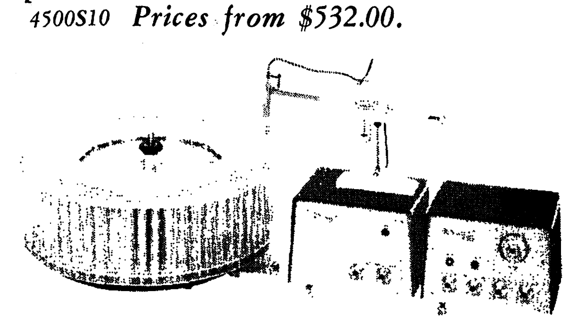

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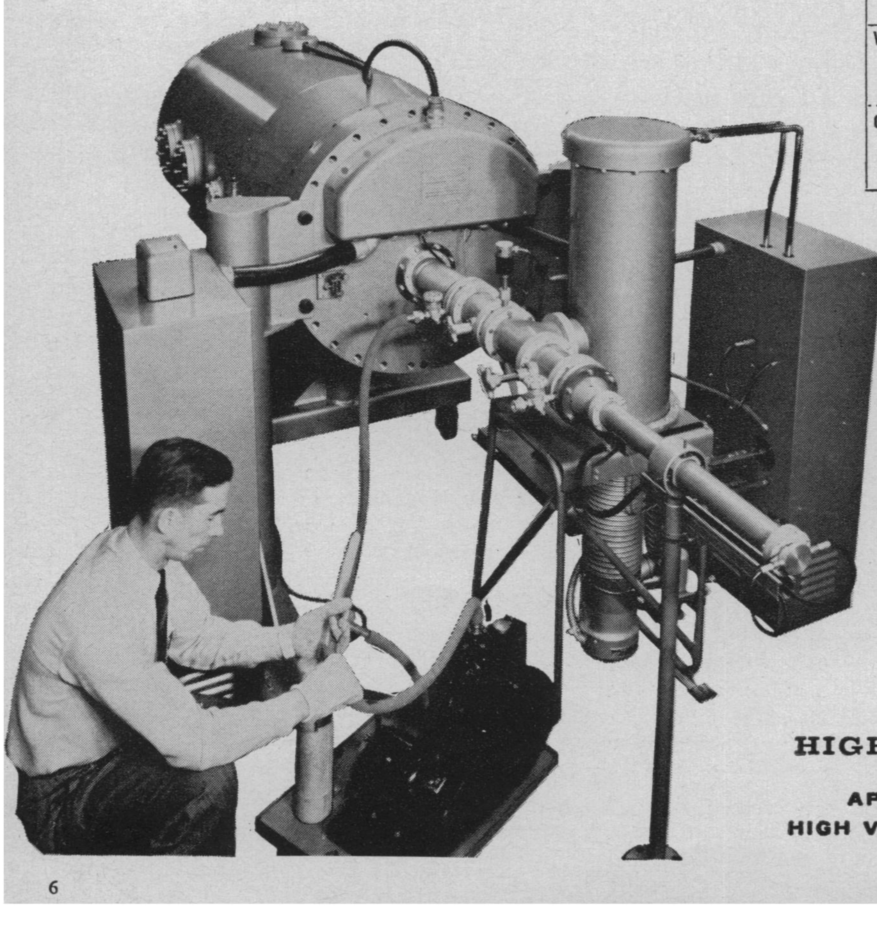
SCIENCE

Cover The artificial radiation belt created by the high-altitude nuclear explosion of 9 July. The numbers represent the electron flux per square centimeter per second. For a report on the symposium at which the results of the tests were discussed, see page 53.

A SMALL ACCELERATOR WITH MANY APTITUDES FOR RESEARCH AND TEACHING

The Van de Graaff ANS-2000 Accelerator is instantly convertible from positive ions to electrons and features maximum versatility for the minimum investment.*

*Basic unit under $45,000



"Instant" Electron Operation

Push button electron operation. Electron output at 0.75 to 1.50 Mev is 1 to 25 μa. This is achieved by extracting electrons directly from the r.f. positive ion source. In addition, 250 μa of electrons can be obtained by an electron conversion kit, which involves removing the pressure tank and replacing the positive ion accelerator tube and source.

Optional Accessories

MULTI-NEUTRON TARGET SELECTOR . . . . Experimenters can choose a tritium, beryllium or deuterium target without breaking the vacuum. Six useful neutron-producing reactions available. Neutron output is 4 x 10^{10} neutrons per second.

PULSING . . . . Nanosecond, microsecond and millisecond pulsing kits.

BEAM ANALYZING AND STABILIZING SYSTEM . . . . A three-port magnet (25° left — straight-through — 25° right) capable of handling a beam of mass energy 12. A slit system at the exit ports provides stabilization to ±2 kv by feeding back an energy variation signal to the accelerator stabilization system.

MULTIPLE ION SOURCE GASES . . . . Up to three ion source gas cylinders may be installed (two are standard). Different ions may be accelerated without removing the tank.

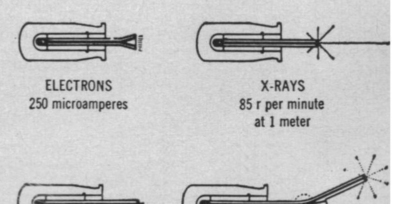
VACUUM SYSTEM (Getter Ion Pump) . . . . Offered as an alternate to the standard mercury-diffusion pump for the basic accelerator under certain operating conditions.

15" UNIFORM ELECTRON SCANNING SYSTEM

VERTICAL MOUNTING

Performance Ratings

	POSITIVE IONS	"INSTANT" ELECTRONS	with ELECTRON CONVERSION
ENERGY RANGE	0.5 to 2.0 Mev	0.75 to 1.5 Mev	0.5 to 2.0 Mev
CURRENT RANGE between 0.75 and 1.5 Mev	10 to 150 μa	1 to 25 μa	1 to 250 μa
above 1.5 Mev	decreasing to not less than 10 μa at 2.0 and 0.5 Mev	—	1 to 250 μa
below 0.75 Mev			1 to 250 μa
VOLTAGE STABILITY (peak-to-peak) Ripple / Drift	±10 Kv / ±20 Kv	±10 Kv / ±20 Kv	±5 Kv / ±40 Kv
OVERALL VOLTAGE STABILITY with stabilizing magnet	±2 Kv	—	—



HIGH VOLTAGE ENGINEERING
BURLINGTON, MASSACHUSETTS, U.S.A.
APPLIED RADIATION CORPORATION
HIGH VOLTAGE ENGINEERING (EUROPA) N.V.

5 October 1962, Volume 138, Number 3536

SCIENCE

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Annual subscriptions: $8.50; foreign postage, $1.50; Canadian postage, 75¢. Single copies, 35¢. School year subscriptions: 9 months, $7.00; 10 months, $7.50. Cable address: Advancesci, Washington.

Whose Responsibility?

Congress this year authorized payments of up to 20 percent to cover the indirect costs on research grants from the National Institutes of Health, thus departing from the 15 percent limit imposed in each of the past several years. Indirect costs of up to 25 percent were authorized on grants from the National Science Foundation and the National Aeronautics and Space Administration.

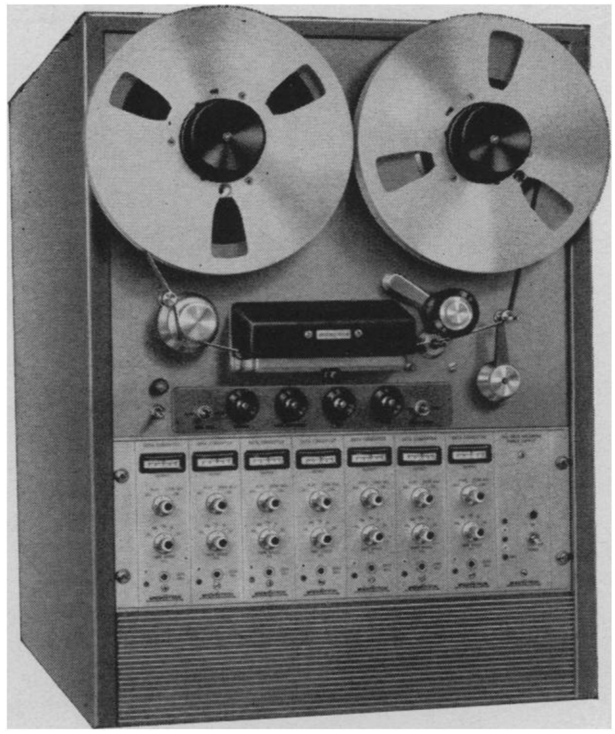
These actions will be a source of satisfaction on many campuses, for a recent survey by the National Science Foundation showed that actual indirect costs average about 30 percent [*Science* **136**, 291 (1962)]. But the satisfaction should be accompanied by sober consideration of the fact that a number of congressmen are beginning to get restive over what they consider to be a lack of adequate controls over the expenditure of the large amounts of money they annually appropriate for research. Congressmen know that they cannot judge the merits of individual research proposals or fields of research. Moreover, they recognize the principle that scientific investigators should be allowed the greatest possible freedom of action in carrying out their research. But their concern over expenditures is altogether proper. They have a right to feel assured that the money they appropriate is wisely and properly used.

Thus they raise questions when an investigator devotes 10 percent of his time to a particular project and then charges the grant with the total cost of attending the annual meeting of his scientific society. They are even more concerned when the expenses of attending an international congress in Europe are charged to the grant. They question the amounts spent for furniture and equipment. They want to know why two grants to the same university or department should both call for the purchase of an electron microscope. They want to know how closely the institution and the granting agency audit a grantee's accounts. There is no fear that all grantees are dishonest, but there is fear that investigators, their institutions, and the grant-making agencies are sometimes careless, that proper fiscal controls have not been adopted, that "the moral obligations of the scientist as a trustee of public funds" have not been formulated and impressed upon all concerned.

So far, these concerns have been most clearly expressed by a subcommittee of the House Committee on Government Operations in a series of hearings and reports dealing with the National Institutes of Health and going back over the past couple of years. But NIH is not alone; other agencies also have large appropriations for research and training, and they too face the prospect of similar inquiries.

How should expenditures be controlled? In the hearings of the past two years, members of the subcommittee took the position that NIH should maintain equipment inventories, establish tighter regulations, and make more detailed analyses of proposed and actual expenditures. Officers of the NIH countered that these responsibilities should rest primarily with the grantee institutions and offered the argument that higher indirect cost allowances would enable those institutions to maintain better controls.

The decision is not yet made, and discussions will undoubtedly continue. This situation leaves the universities some option. Unless they can convince Congress that they understand, accept, and enforce "the moral obligations of the scientist as a trustee of public funds," it seems altogether likely that Congress, through legislation or through instruction to the granting agencies, will establish centralized means to enforce these obligations. Which do the universities prefer?—D.W.



MNEW FROM MNEMOTRON!*

We are silent about the "M" in Mnemotron but not about our new 700 Series Data Recorder. With good reason. For one, it brings the size and cost of data recording systems down to sensible proportions if your data is analog voltage from DC to 5000 cycles per second. And its features would not embarrass even the costliest instrumentation recorder. Here are a few:

COMPACTNESS. A complete 7 channel record/reproduce system uses less than two feet of rack space. A 14 channel system adds less than seven inches more.

ACCURACY. Input-output characteristic is linear within 0.2 per cent with Mnemotron unique Pulse Frequency Modulation (PFM) data conversion technique.

FLEXIBILITY. As many data channels as you need with a choice of channel format. For greatest operating economy, choose up to 7 channels on 1/4 inch magnetic tape, 14 channels on 1/2 inch tape, standard IRIG spacing and track width of 7 channels on 1/2 inch tape.

INTEGRATED RECORD/REPRODUCE MODULES. A single solid-state PFM Data Converter has all the record/reproduce electronics for each channel. Simple rotary switching lets you select data conversion for 3 tape speeds. No additional plug-ins needed.

ISOLATED INPUT CIRCUITS. Input terminals of each channel are isolated from all the others to readily accept data from floating, unbalanced or differential sources.

VERSATILITY. 700 Series plug-in accessories expand instrumentation capability. Typical: Electrocardiogram preamplifiers for recording directly from electrodes. Pulse Record unit for recording trigger pulses, time markers, or stimulus pulses in medical research . . .

PRICE. 7 Channel System from $6,495

COMPLETE SPECIFICATIONS. Send for your copy today.

*To answer the many inquiries, Mnemotron comes from Mnemosyne, Greek Goddess of Memory.

MNEMOTRON CORPORATION

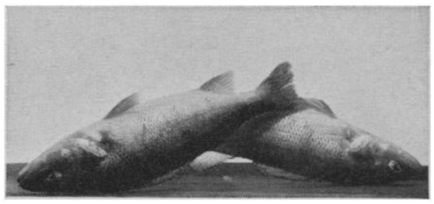
45 South Main St., Pearl River, New York, 914 PEarl River 5-4015, Cables: Mnemotron, TWX: H99

Subsidiary of Technical Measurement Corporation, North Haven, Conn.

Kodak reports on:

a fish anesthetic . . . the sonic, the ultrasonic, and audible snaps . . . boron-barium-lanthanum-thorium-strontium glass with neodymium

What a screening program can turn up



These perch are asleep. One of them is breathing 57 times a minute and the other 80. The water in which they are sleeping contains *Quinaldine* (EASTMAN P216) and is at 75°F. We started at 5 p.p.m. with the slower-breathing fish. When he was still awake after 25 minutes, we brought the quinaldine level up to 7.4 p.p.m. and introduced the second fish. Within 10 minutes they were both asleep.

They have been sleeping for 4 hours. When we rap the tank, they make short, vigorous darts and doze off again. They seem limp when handled gently.

As soon as the picture was snapped, we put them in fresh water. Within one minute they were swimming smartly. Within 10 minutes they calmed down into the normal upright position. What they would have eventually died of if returned to the lake, how many healthy descendants they would have spawned, and whether they would have been good to eat we do not know.

We were a little surprised to learn that Bruce Muench of the Illinois Department of Conservation has found that such a relatively simple and cheap compound as quinaldine anesthetizes fish with no evidence of damage; but then chloroform, which is known to anesthetize people, is even simpler.

We don't consider this particularly entertaining and will drag our feet about filling orders for quinaldine from home addresses. People like mosquito-abatement officials who have fish to transport can get prompt service from Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company), which also gives qualified investigators prompt service with some 3900 other EASTMAN Organic Chemicals.

Adhesive findings

Mr. Guy V. Martin, 110 Yale Blvd., S. E., Albuquerque, N. M., has reported a piece of valuable information about EASTMAN 910 Adhesive.

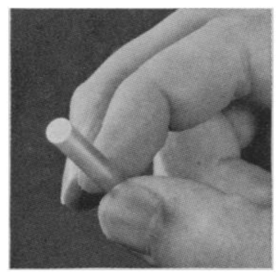
He has found it vastly superior to soft solder for transmitting sonic and ultrasonic vibration at temperatures from ambient to 200°F. When he feeds the energy through a solder bond from a transducer of laminated nickel sheets to an application tip, the solder deteriorates progressively and the transmission drops steadily. An EASTMAN 910 bond acts differently. Without apparent change, it transmits three to four times as long as solder takes to reach disintegration.

When the 910 bond finally snaps, it does so all at once with an audible snap. In the case of aluminum bonded to the nickel, rupture always takes place between the adhesive film and the aluminum. With other metals, plastics, ceramics, or glass bonded to the nickel, the rupture divides itself between one interface or the other and doesn't appear within the film.

Most of Mr. Martin's investigations were done in the 19-20 kc range, with electrical power inputs up to 200 watts. He has been down to a few cycles/sec and up to 60 kc. He believes the adhesive will work well at much higher frequencies. He wonders if somewhere it is being used in building up high-frequency ultrasonic ceramic transducers. We wonder too.

Mr. Martin claims that for some 30 years Kodak has been very obliging in furnishing him helpful information from time to time. We claim that in volunteering his adhesive findings, he has now amply repaid us. We feel we could afford to mention to anyone confronted with supersonic bonding problems that Mr. Martin conducts a business in metallurgical consultation and custom scientific instruments at the aforementioned address. EASTMAN 910 Adhesive is obtainable in a sample kit for $5 from Eastman Chemical Products, Inc., Kingsport, Tenn. (Subsidiary of Eastman Kodak Company). It develops great strength within a few seconds and requires no curing or drying.

Laser logic



It was a thrill to hear that this laser rod, unclad though it was, commenced action at a threshold of only 4 joules at room temperature.

Emission: 1.06μ, by transition of Nd^{3+} from $4F_{3/2}$ to $4I_{11/2}$ (not down to ground state, which is $4I_{9/2}$).

Price: $395 for 2″ x ¼″ cylinder. More for larger sizes, which are available.

Time to technological obsolescence: inevitably short.

Reputation of supplier: decent.

Name of supplier: Eastman Kodak Company, Apparatus and Optical Division, Rochester 4, N. Y.

Delivery: very fast to the first few early birds who would be uncomfortable to let this one whistle by without a close look; stretching out thereafter.

Premises:

In the rare earths the 4f levels are shielded by the 5s electrons and don't depend on the influence of a crystal field to define their energy in the way that Cr^{3+} levels depend on a crystal field. Therefore they can work in glass. Advantages of glass over crystals are 1) optical homogeneity, 2) potentially larger size, 3) potentially lower cost, 4) the 25 years of practical experience we have had from our commercial pioneering of rare-earth glasses for photographic lenses.

While people ultimately interested in machine tools, communications, and weapons are still feeling out the ground rules of laser engineering, our neodymium-boron-barium-lanthanum-thorium-strontium glass is a good first choice because 1) it emits at a wavelength convenient to phototubes, phosphors, and photography; 2) neodymium requires no refrigerants, since its fluorescence doesn't return the ion to the ground state; and 3) threshold for laser action comes at much lower energy input than neodymium needs in silicate glass. (Whether low threshold implies high over-all efficiency at converting electrical power to coherent radiation needs to be cleared up.)

Instead of silvered ends, customers will prefer dielectric filters tuned to reflect ~100% of the 1.06μ radiation at one end and 98% at the other end because 1) by interferometric tests in the visible, where the filters are wide open, one can check for homogeneity, end flatness, and end parallelism without removal of the coating; 2) the ends operate solely by interference and don't soak up energy to cook themselves on.

Prices subject to change without notice.

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

5–17. World **Meteorological** Organization, South-West Pacific Regional Assoc., Noumea, New Caledonia. (Secretariat, WMO, Geneva, Switzerland)

7–10. **Acoustical** Soc. of America, Seattle, Wash. (W. Waterfall, Amer. Inst. of Physics, 335 E. 45 St., New York 17)

7–10. **Corrosion** of Metals, symp., Kanpur, India. (Defense Research Laboratory, Kanpur)

7–10. Fetal and Infant **Liver** Function and Structure, conf., New York, N.Y. (E. T. Minor, New York Acad. of Sciences, 2 E. 63 St., New York 21)

7–10. **Geological** Soc. of America, Houston, Tex. (F. Betz, Jr., GSA, 419 W. 117 St., New York, N.Y.)

8–9. **Operations** Research Soc. of America, Philadelphia, Pa. (G. D. Shellard, New York Life Insurance Co., 51 Madison Ave., New York 10)

8–10. American Soc. of **Cytology** (formerly Inter-Soc. Cytology Council), annual, St. Louis, Mo. (P. A. Younge, 1101 Beacon St., Brookline 46, Mass.)

8–10. **Gerontological** Soc., Miami Beach, Fla. (R. W. Kleemeier, Dept. of Psychology, Washington Univ., St. Louis, Mo.)

8–13. International Office of **Epizootics**, American regional conf., Mexico City, Mexico. (R. Vittoz, 12 rue du Prony, Paris 17e, France)

9–8. Dec. United Nations **Educational, Scientific, and Cultural** Organization, general conf., Paris, France. (UNESCO, Place de Fontenoy, Paris 7e)

11–16. World **Medical** Assoc., general assembly, New Delhi, India. (L. H. Bauer, 10 Columbus Circle, New York 19)

11–17. **Veterinary** Medicine, Pan American congr., Mexico City, Mexico. (J. Santivanez, P.O.B. 1697, Coral Gables 34, Fla.)

11–22. **Plastics**, intern. fair and convention, Göteborg, Sweden. (Interfair, Inc. AB, Intern. Trade Fair, S. Tullgatan 4, Malmö C, Sweden)

12–13. **Genetics** Symp., Columbia, Mo. (Director, Postgraduate Medical Education, M176 Medical Center, Univ. of Missouri, Columbia)

12–14. **Paleontological** Soc., Houston, Tex. (H. B. Whittington, MCZ, Harvard Univ., Cambridge 38, Mass.)

12–15. **Magnetism** and Magnetic Materials, conf., Pittsburgh, Pa. (Inst. of Radio Engineers, Office of the Professional Groups Secretary, 1 E. 79 St., New York 21)

12–16. Australasian **Corrosion** Assoc., annual conf., Auckland, New Zealand. (Conference Secretary, ACA, Box 995, Auckland)

12–16. Conservation and Management of Temperate **Marshes and Wetlands**, conf., Arles or Saintes-Maries-de-la-Mer, France. (L. Hoffman, Station Biologique de la Tour de Valat, Par Le Sambuc (B. du Rh.), France)

12–16. Problems of Methodology of **Agricultural** Problems, conf., U.N. Economic Commission for Europe, Geneva, Switzerland. (UNECE, Palais des Nations, Geneva)

12–17. Czechoslovak **Medical** Congress, Prague. (K. Răska. Czechoslovak Medical Soc. J. E. Purkyně, Sokolská 31, Prague)

12–24. Aeronautical Fixed **Telecommunications** Network, European-Mediterranean regional meeting, Paris, France. (Intern. Civil Aviation Organization, Intern. Aviation Bldg., 1080 University St., Montreal 3, P.Q., Canada)

13–15. **Birth Defects**, science writers' seminar, Ann Arbor, Mich. (Science Information Div., National Foundation, 800 Second Ave., New York 17)

13–15. Institute of Radio **Engineers**, Northeast research and engineering meeting, Boston, Mass. (L. G. Cumming, IRE, 1 E. 79 St., New York 21)

13–18. American **Rocket** Soc., annual meeting and space flight exposition, Los Angeles, Calif. (ARS, 500 Fifth Ave., New York 36)

13–22. **Soil**, intern. conf., Wellington, New Zealand. (ISC, Secretary General, P.O. Box 8001, Wellington)

14–17. Society of **Naval Architects** and **Marine Engineers**, annual, New York, N.Y. (Secretary, SNAME, 74 Trinity Place, New York 6)

15–17. Cold **Metal** Working, intern. conf., Budapest, Hungary. (Hungarian Soc. of Mechanical Engineers, Szabadság tér 17, Budapest 5)

15–18. American **Anthropological** Assoc., Chicago, Ill. (S. T. Boggs, 1530 P St., NW, Washington 5)

15–18. International Federation of **Blood Donors'** Organizations, congr., Monaco. (V. Formentano, Largo Volontari del Sangue 1, Milan, Italy)

16–17. American **Mathematical** Soc., Tallahassee, Fla. (AMS, 190 Hope St., Providence 6, R.I.)

16–17. **Communications**, symp., Montreal, P.Q., Canada. (A. B. Oxley, Canadian IRE Symp. on Communications, Box 802, Station B, Montreal)

17. American **Mathematical** Soc., Los Angeles, Calif. (AMS, 190 Hope St., Providence 6, R.I.)

18–21. American **Speech and Hearing** Assoc., New York, N.Y. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington 6)

18–21. **Brain** Mechanisms for External Inhibition (closed meeting), Los Angeles, Calif. [Air Force Office of Scientific Research (attention: SRL), Washington, D.C.]

19–20. Mid-America **Electronics** Conf., Kansas City, Mo. (J. Warfield, Dept. of Electrical Engineering, Univ. of Kansas, Lawrence)

19–21. European **Packaging** Federation, congr., Paris, France. (EPF, 3 rue La Boétie, Paris 8e)

19–23. **Radioactive Dating**, intern. symp., Greece. (Intern. Atomic Energy Agency, 11 Kärntner Ring, Vienna 1)

19–26. Paris Intern. **Dental** Sessions, Paris, France. (G. Delbart, 3 place de la Gare, Mantes, S.-et-O., France)

20. Manufacturing **Chemists'** Assoc., mid-year conf., New York, N.Y. (MCA, 1825 Connecticut Ave., NW, Washington 9)

20–24. **Fish Diseases**, intern. symp., Turin, Italy. (R. Vittoz, Intern. Office of Epizootics, 12 rue de Prony, Paris 17e, France)

22–23. International Waste **Rubber** and **Plastics** Federation, conf., Antwerp, Bel-

gium. (R. G. Kirkpatrick, Moorgate Hall, Moorgate, London, E.C.2, England)

22–24. Central Assoc. of **Science and Mathematics Teachers**, St. Louis, Mo. (J. Kennedy, Indiana State College, Terre Haute)

22–24. National Council for **Geographic Education**, Chicago, Ill. (L. Kennamer, Univ. of Texas, Austin)

22–27. **Automation** and **Instrumentation**, congr., Milan, Italy. (Federazione delle Associazioni Scientifiche e Techniche di Milano, Via del Politecnico 10, Milan)

22–27. **Thermotechnology**, intern. conf., Milan, Italy. (A Barbieri, Via Marcona 15, Milan)

22–3. Latin American **Forestry** Commission, Santiago, Chile. (U.N. Food and Agriculture Organization, Regional Office, Casilla 10095, Santiago)

23–24. American **Mathematical** Soc., Chicago, Ill. (AMS, 190 Hope St., Providence 6, R.I)

23–24. American **Physical** Soc., Cleveland, Ohio. (K. K. Darrow, APS, Columbia Univ., New York 27)

23–24. American Soc. of **Animal Science,** Chicago, Ill. (C. E. Terrill, Animal Husbandry Research Div., Agricultural Research Center, Beltsville, Md.)

24–25. American College of **Chest Physicians**, Los Angeles, Calif. (ACCP, 112 E. Chestnut St., Chicago 11, Ill.)

26–28. **Atomic** Industrial Forum, annual clinical meeting, Los Angeles, Calif. (Circulation and Records Dept., AMA, 535 N. Dearborn St., Chicago 10, Ill.)

25–30. American Soc. of **Mechanical Engineers**, New York, N.Y. (ASME, 345 E. 47 St., New York 17)

25–30. **Radiological** Soc. of North America, annual, Chicago, Ill. (M. D. Frazer, 1744 S. 58 St., Lincoln, Neb.)

26–27. **Combustion** Inst., western states section, Sacramento, Calif. (G. Fenech, Combustion Inst., 16902 Bollinger Dr., Pacific Palisades, Calif.)

26–28. **Atomic** Industrial Forum, annual, Washington, D.C. (R. Barlow, AIF, 850 Third Ave., New York 22)

26–29. American **Nuclear** Soc., Washington, D.C. (O. Bizzell, Isotope Technology, Development Branch, Div. of Isotopes Development, U.S. Atomic Energy Commission, Washington 25)

27–28. **Medical** Conf., North Atlantic Treaty Organization, Paris, France. (NATO, Information Service, Port Dauphine, Paris 16ᵉ)

27–29. **AtomFair**, American Nuclear Soc.–Atomic Industrial Forum, Washington, D.C. (R. Barlow, Atomic Industrial Forum, 850 Third Ave., New York 22)

27–30. **Biological** Future of Man, symp., London, England (by invitation only). (Ciba Foundation, 41 Portland Pl., London, W.1)

28–30. **Human Factors** Soc., annual, New York, N.Y. (G. E. Rowland. Rowland and Co., Box 61, Haddonfield, N.J.)

28–30. National Foundation **Birth Defects Centers**, conf., Miami, Fla. (Science Information Div., National Foundation, 800 Second Ave., New York 17)

28–30. Reinforcéd **Plastics.** intern. conf., London, England. (British Plastics Federation, 47–48 Piccadilly, London, W.1)

(*See 14 September issue for comprehensive list*)