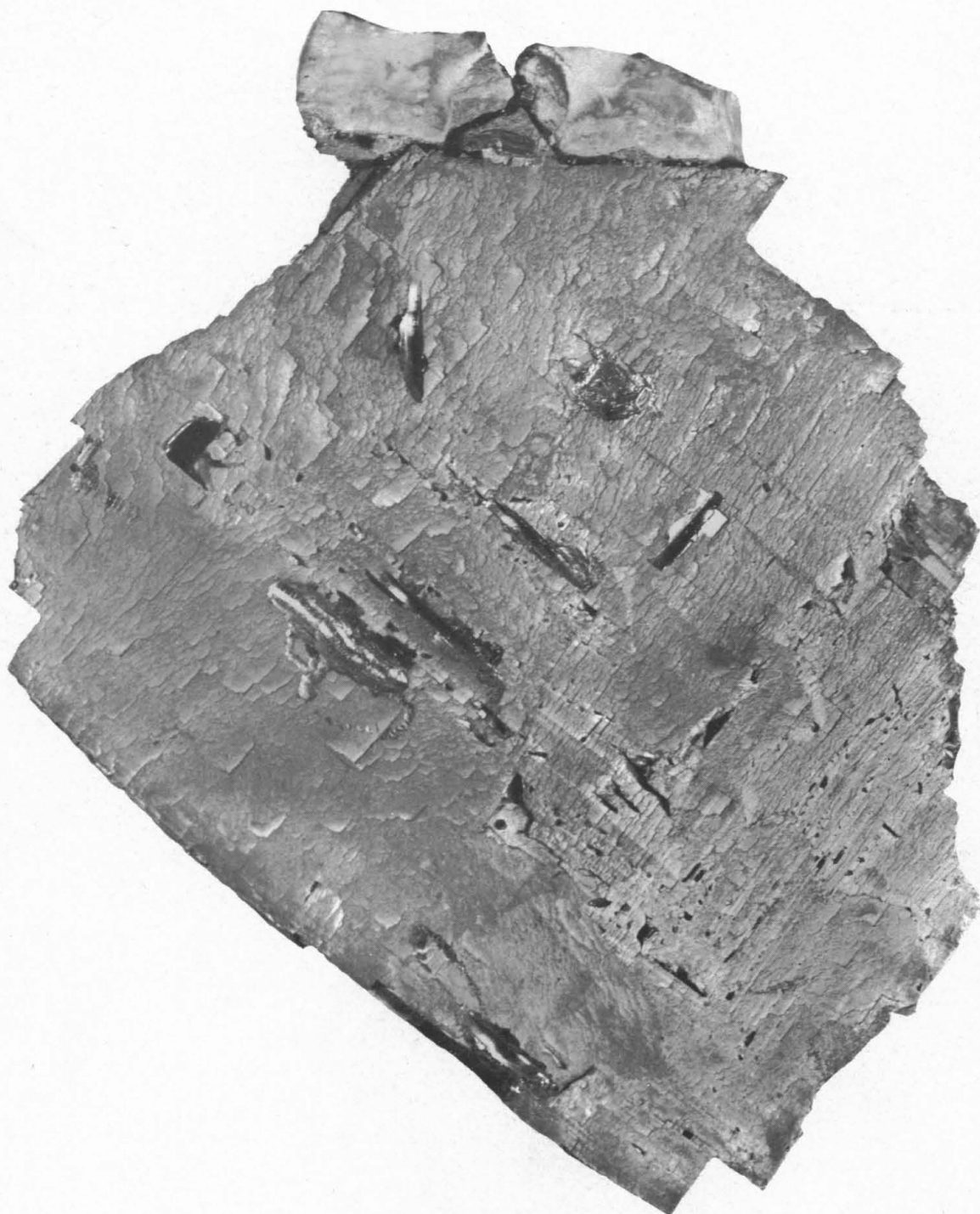


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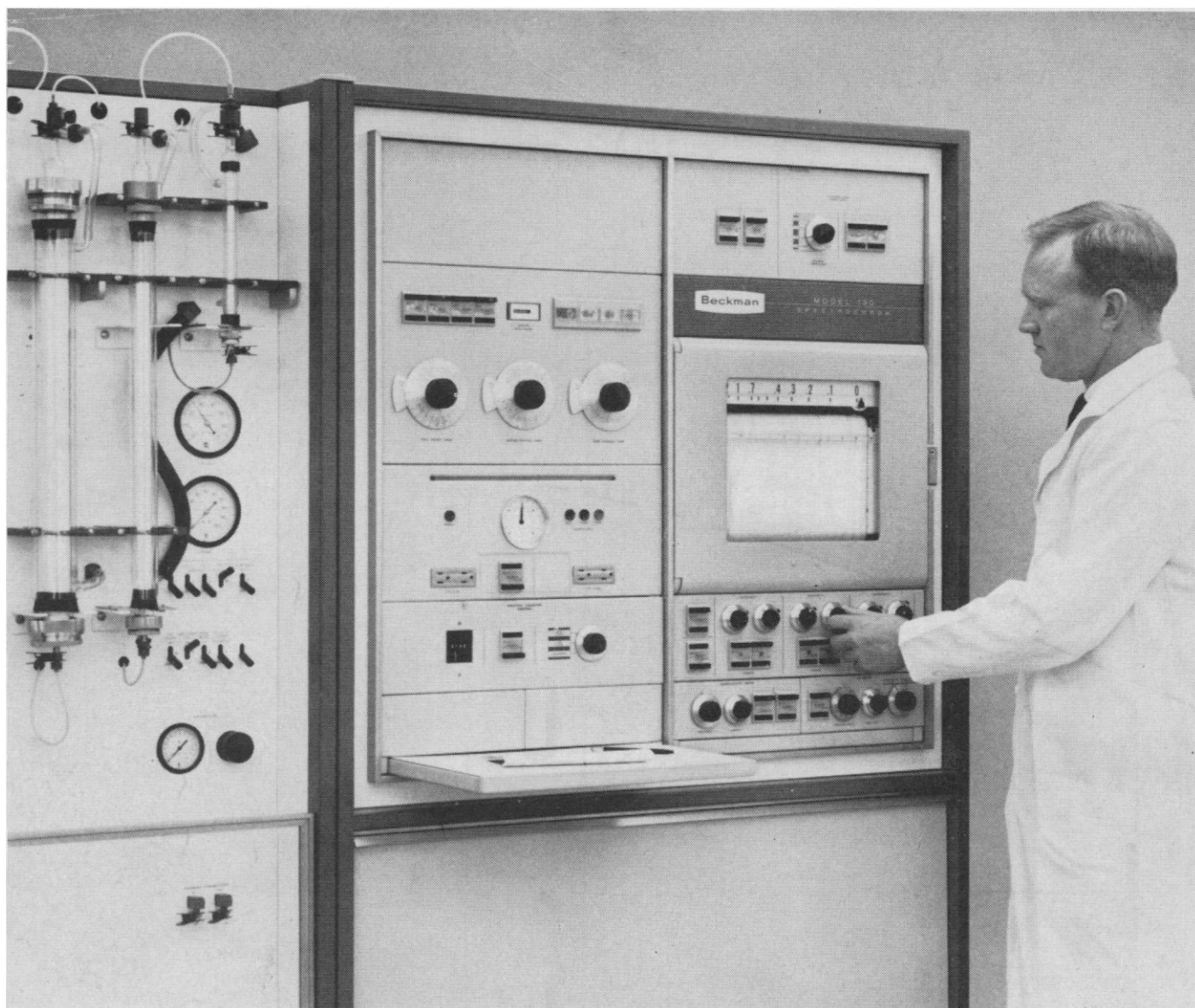
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Vol. 142, No. 3592

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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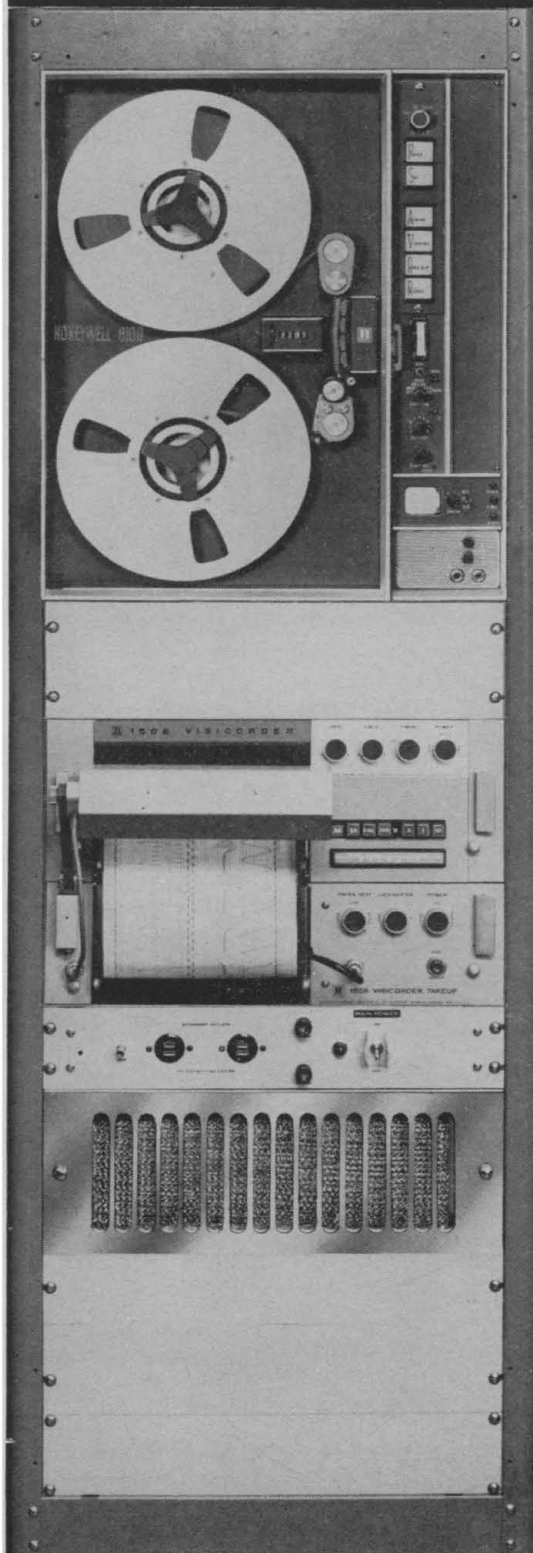
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1 November 1963

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COVER

Natural cubic crystal of lead sulfide which has been sawed, etched, and sampled. Light and dark bands record stages in growth of crystal outward from wallrock. The slots are sites where samples were cut from individual growth zones for measurement of lead isotope variations ($\times 1.6$). See page 574.



1963's oldest graduating class

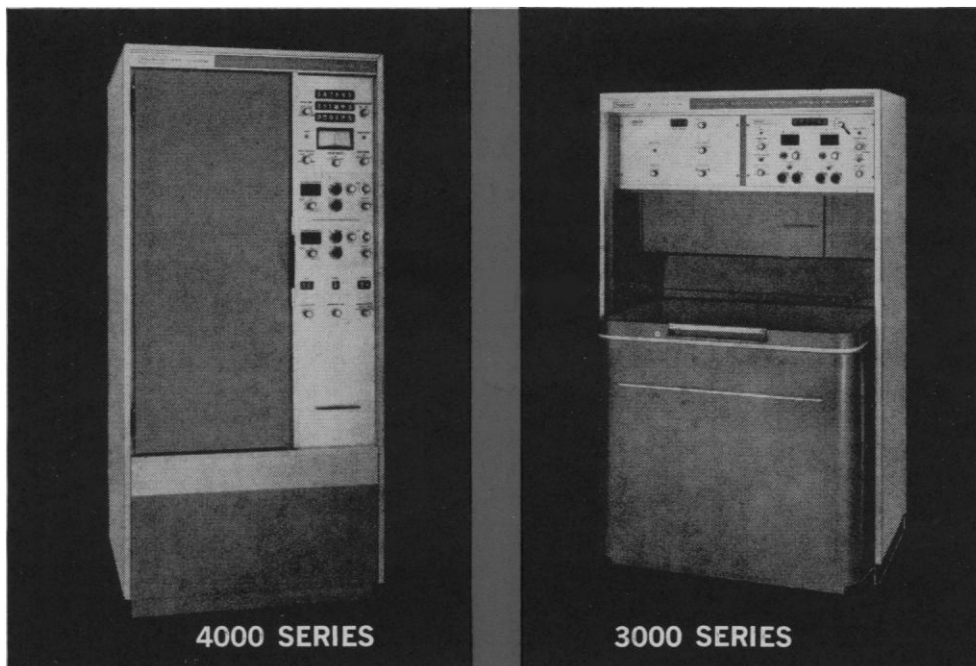
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The "figure of merit" used in quantitative evaluation of the counting performance of liquid scintillation spectrometers is the factor of efficiency squared divided by background (E^2/B)*. The instrument with the highest E^2/B can achieve a desired statistical accuracy in the shortest counting time, or it can collect data to the greatest accuracy in a given time.

New Tri-Carb Spectrometers have an E^2/B approximately 100% greater for tritium and 50% greater for carbon-14 than older type liquid scintillation spectrometers. These high figures of merit have been accomplished by both:

- (a) Increasing efficiencies
- (b) Reducing backgrounds

INCREASED EFFICIENCIES

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A specially designed optical chamber maximizes light collection by transmitting the greatest number of photons from the liquid scintillation sample to the photocathodes of a pair of carefully selected and matched photomultiplier tubes. The use of 13-dynode phototubes obviates the need for pre-amplifiers and permits the use of high speed electronic circuitry for Pulse Summation. This results

in a twofold improvement in the signal-to-noise ratio. Result: higher efficiencies than ever before possible with this type of counting equipment.

LOWER BACKGROUNDS

Background is significantly reduced by the improved electronics and by superior shielding of the detector. Ultra-high-speed coincidence resolving time (30 nanoseconds) virtually eliminates background contribution from "accidentals", even when using more efficient photomultiplier tubes with inherently higher dark noise.

Great care is taken to select only radioactively clean material for the detector shield. A minimum of 2 inches of lead is provided in all directions, including the ends. "Graded shielding" of lead, cadmium and copper is especially effective in reducing background from environmental radiation.

By increasing efficiencies and reducing background, new Tri-Carb Spectrometers achieve the highest possible E^2/B . Thus, they permit the most accurate collection of data in a given counting time or, alternatively, the most rapid collection of data to a given accuracy, thereby effectively increasing actual counting capacity.

Higher E^2/B is just one of many significant new features available in Packard Tri-Carb Spectrometers. Ask your Packard Sales Engineer for complete details, or write for Bulletin.

*N.B. Since there are substantial variations in standards (especially tritium) prepared in different laboratories, it is important to use the same standard and blank in comparing the performance of two instruments.



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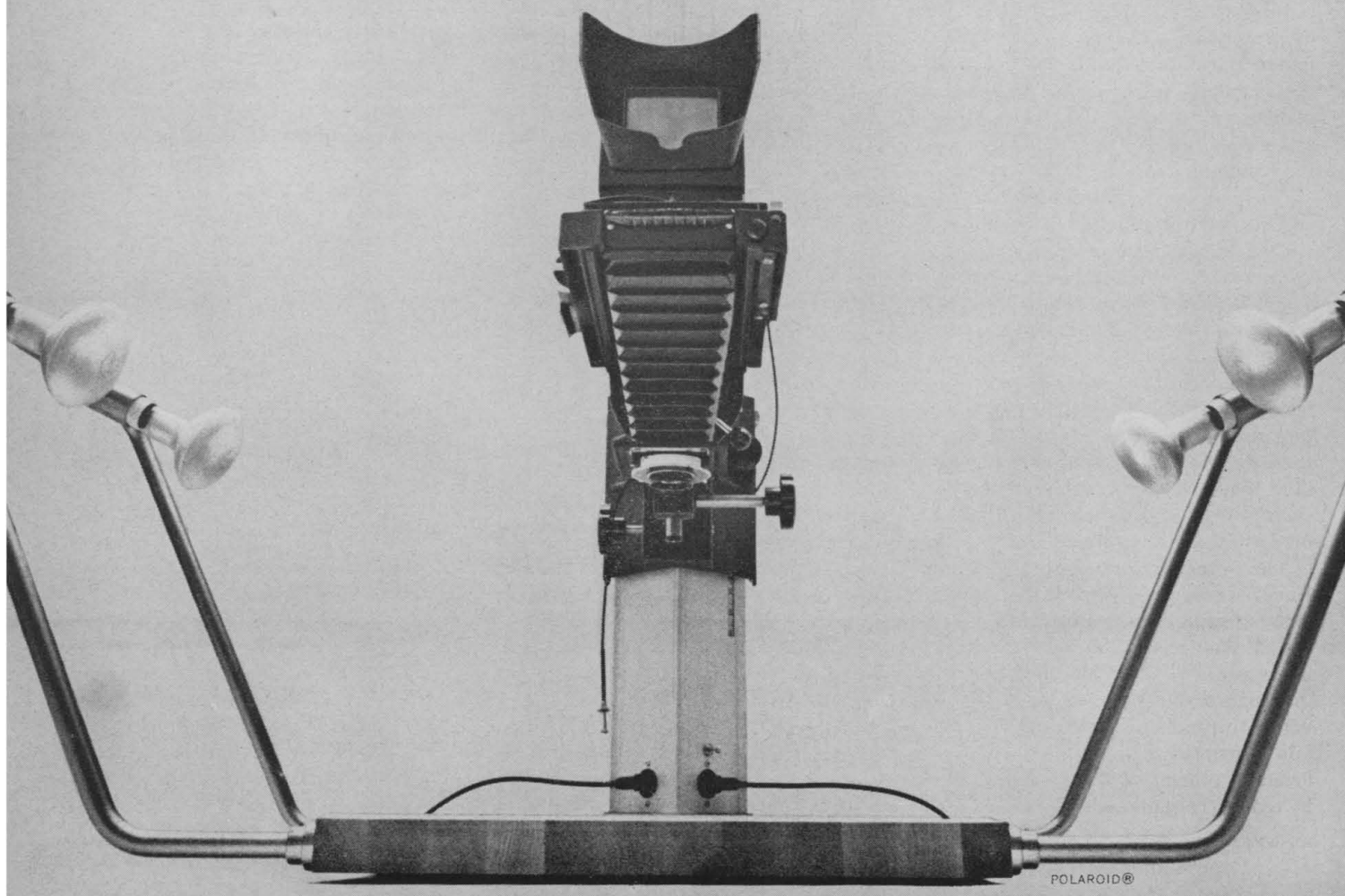
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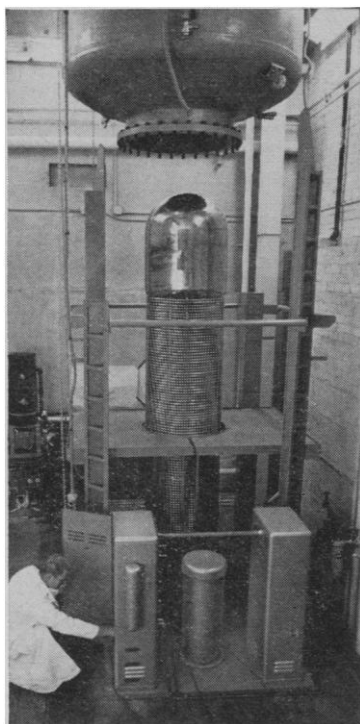
HIGH VOLTAGE ENGINEERING CORPORATION ... "CHARGED PARTICLES"

Particle Accelerators and Space Research

The effect of radiations encountered in space on instruments, devices and materials is of major concern to space research. Steady progress in man's ability to predict these variables is being made through the basic studies of High Voltage Engineering accelerator customers.

Van Allen Radiations in the Laboratory

Three different High Voltage machines demonstrate the scope of radiation research with accelerators. The first one is the KN-4000. This is the largest single-stage unit of convertible nature. It delivers either 1 milliamperes of electrons, or 400 μ amperes of positive ions up to a very stable 4 million electron volts.



All the basic radiations are produced by the 4 million-electron-volt Van de Graaff accelerator — d-c or pulsed operation.

The KN-4000 machine produces a continuous beam of H^+ , D^+ , or He^+ ions. Singly-charged ions of many gaseous elements may also be accelerated. The beam is mono-energetic, well collimated, and controllable over a wide range of energy and current. It is suitable for a variety of physics research and applied radiation investigations.

The KN-4000 can also produce better than 5×10^{12} thermal neutrons per second with the $B^9(d,n)B^{10}$ reaction, and thermal fluxes up to 10^{10} neutrons/cm²-sec. X-ray output exceeds 3×10^5 rads/hr., one foot from a gold target. By producing energetic gamma rays using a deuteron beam on a boron target, secondary electrons of useful intensity may be attained at well over the rated energy of the accelerator.

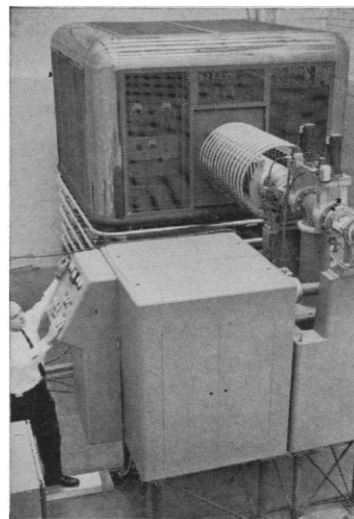
The KN-4000's capability to produce either positively charged protons or negatively charged electrons makes it readily possible to duplicate the radiations of the Van Allen belts.

Simulating the Impact of Spacial Dust

Micrometeoroids? Here's another area of Space Research where the accelerator appears to be useful. The machine in question is the standard 2 MeV Van de Graaff voltage generator modified by the customer to accelerate micron-size iron particles to velocities of 30,000 ft/sec.

A micrometeoroid accelerator test system, to be completed this summer, will provide and accelerate to hyper velocities micron-size particles of iron and other materials. This simulated "space dust" will impact on materials and equipment in vacuum. Physical, chemical and other changes in these targets will then be carefully determined.

Ion Physics Corporation will be developing special micrometeoroid



Air insulated 100-500 KV accelerator delivers 10 milliamperes of protons or deuterons d-c or pulsed operation.

sources for use as 4 million volt injectors for even higher velocity devices.

Neutron Effects Simulated

The KN-4000 and the 2 MeV Van de Graaff are already making names for themselves in space research. New and higher current machines are on the way. The 100-500 Kv air-insulated positive ion machine pictured above, for example, has neutron burst simulation as its raison d'etre. It will produce 10 milliamperes of deuterons or molecular hydrogen H_2^+ for total fast neutron output of 2×10^{12} /sec. in dc operation with suitable targets, or it may be pulsed in the nanosecond or microsecond region.

High Voltage is prepared to provide detailed performance information on these machines. Or, is ready to explore with you totally new applications for accelerators in Space Research. Write telling us what you have in mind. **Technical Sales, High Voltage Engineering Corporation, Burlington, Massachusetts.**



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The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

Tightening Federal Budgets

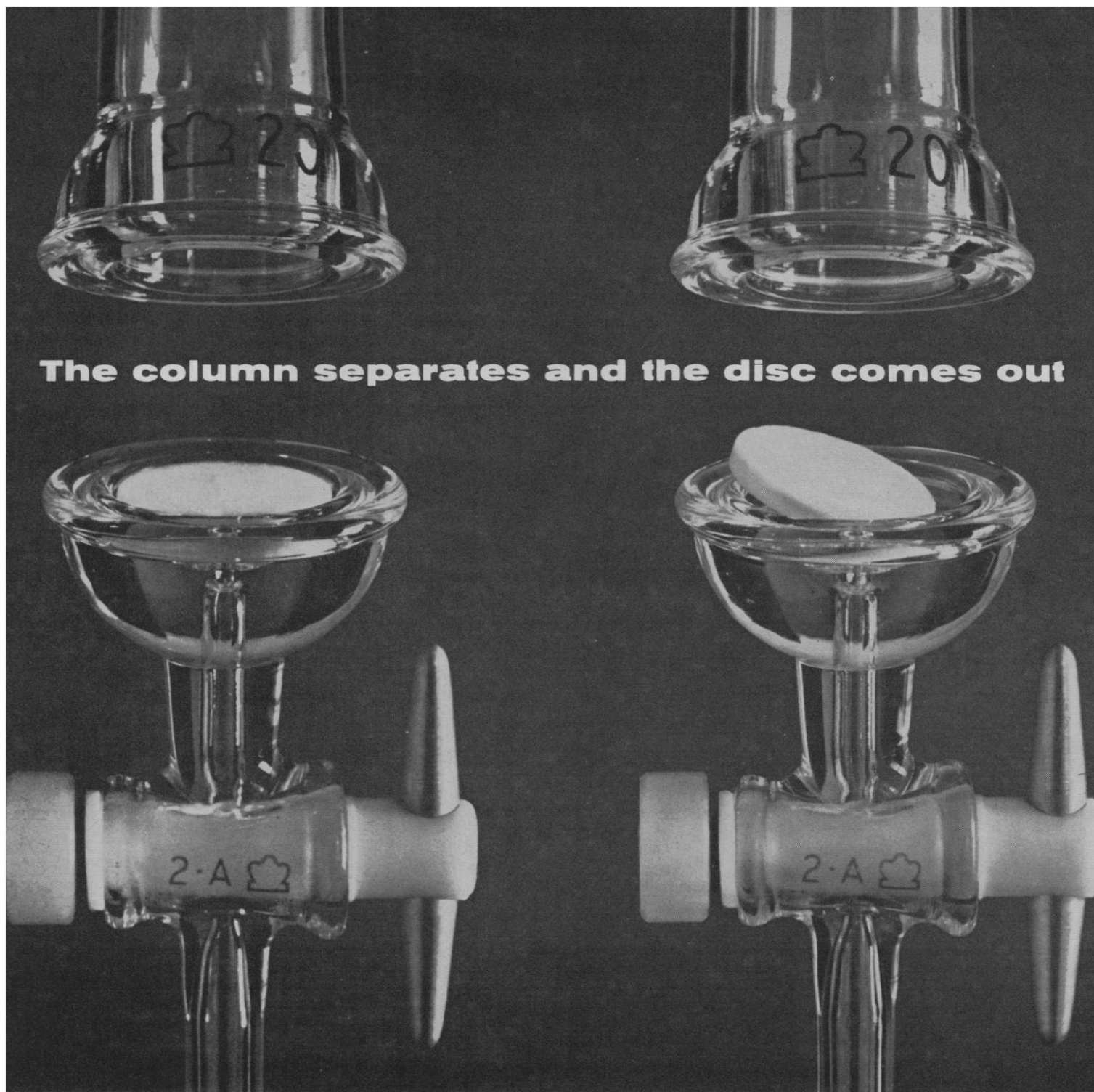
Last month William Carey, executive assistant director of the Bureau of the Budget, warned the 17th National Conference on the Administration of Research that the rapidly increasing research and development budgets of the past two decades have brought us to a level at which "reaction is at last setting in. It is apparent in the scientific community. . . . It is apparent also in the Executive Branch of the Federal Government, where the budgetary pinch is becoming acute. And it is perhaps most spectacularly apparent in the Congress, where a mounting wail of frustration and uneasiness is being reflected in a rash of proposals to bring science and technology to heel."

We have not reached a ceiling; most of the scientific and technical agencies will have more money for 1964 than they had for 1963. But Carey's warning must be taken seriously nevertheless. The House of Representatives recently supplied jolting evidence by cutting the 1964 budget of the National Science Foundation by a whopping 45 percent and by forbidding that agency to start any new programs.

The Senate is now considering the NSF budget and, as it has in some other years, may vote a larger appropriation that will require a compromise between House and Senate levels. The Senate may do this, but so far it has had little encouragement to go above the House level; congressional files of telegrams and correspondence contain little evidence that scientists are objecting to the reduction in the NSF budget or to the restrictions on NSF operations.

The House action constitutes an immediate test of how scientists will react to a sudden cessation of the growth trends of past years. But Carey's paper, which was presented before the House acted, went beyond specific budgets to deal with a problem that results from a slowing down of the rate of growth: the necessity of developing rational means of assigning priorities. Someone will have to adjudicate the competing claims of Big Science and little science; apportion funds among fields; weigh the relative merits of spending for research, for facilities, and for the improvement of teaching; and decide how much is justified for high-energy physics, for oceanography, for radio astronomy, and for other fields in which the costs for basic facilities are high. Some fur may fly before the decisions are reached, but in the process issues will be illuminated more clearly than they have been in the past. This will be good, but the decisions will still be painful.

In all of this there are two clear warnings. One is that unless the university and research scientists, the cognizant agencies (NIH, NSF, and others), and the President's scientific and budgetary aides learn to collaborate effectively in making the necessary decisions on priority, Congress will make those decisions. The other is that the spokesmen for science are going to have to do their homework more thoroughly. We have grown lazy during the period of rapidly increasing appropriations. From now on it will be foolish to approach Congress with anything other than a strong and soundly documented case.—D.W.



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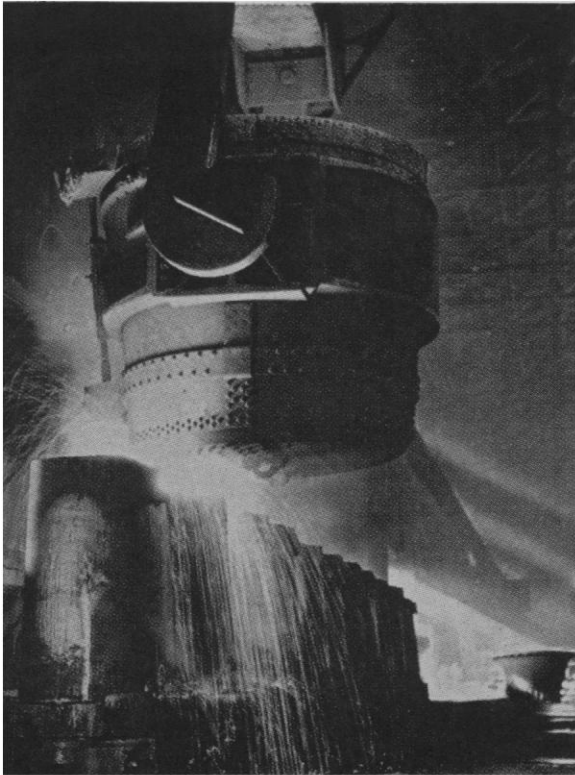
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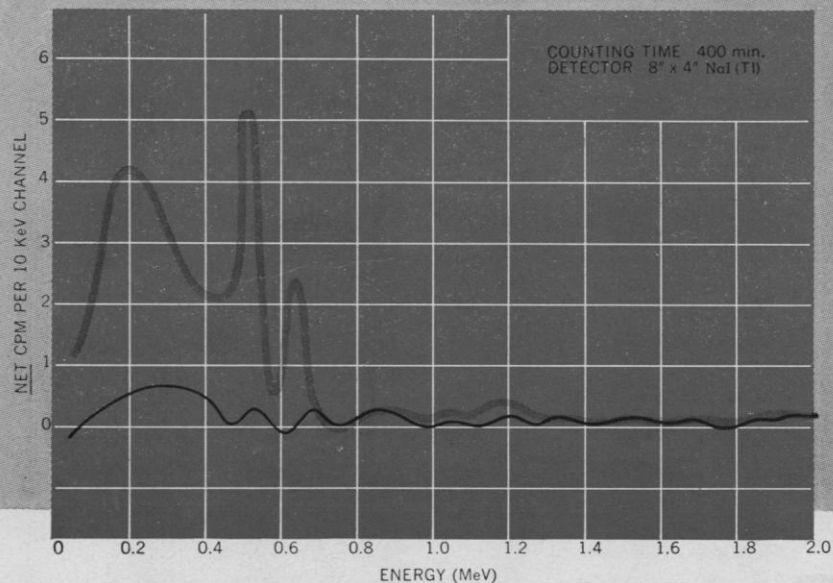
PACKARD CLEAN STEEL is produced in modern facilities under carefully controlled conditions.

CLEAN STEEL . . . steel which contains negligible radioactivity has been the object of long and determined search to provide suitable shielding material for large, low-level counting facilities. Battleship plate (and other old scrap) has been available in limited supply and generally in odd sizes and shapes. Frequently it can be obtained only in curved or tapered plates, and construction with such material (particularly armor plate) is difficult and expensive.

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Standard Packard Whole Body Counting Facilities—with Liquid or Crystal Detectors are illustrated and priced on the opposite page. *Custom designed* liquid and crystal facilities are also available from Packard on a single-source responsibility basis. We invite your inquiry.

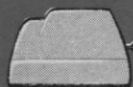
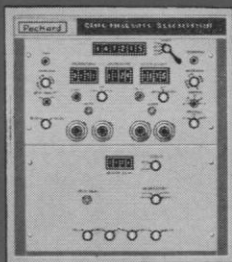
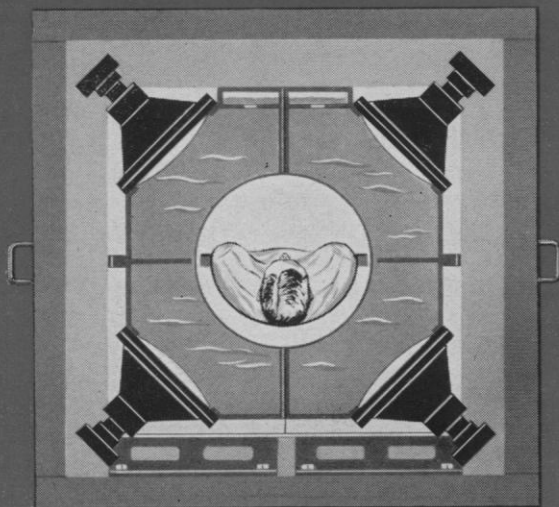
Comparison of the background radioactivity of a typical sample of current commercial production steel (upper curve) and sample of Packard **CLEAN STEEL** (lower curve)



for Low Level Counting Facilities

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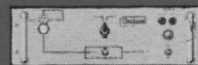
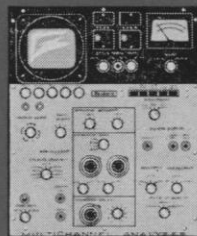
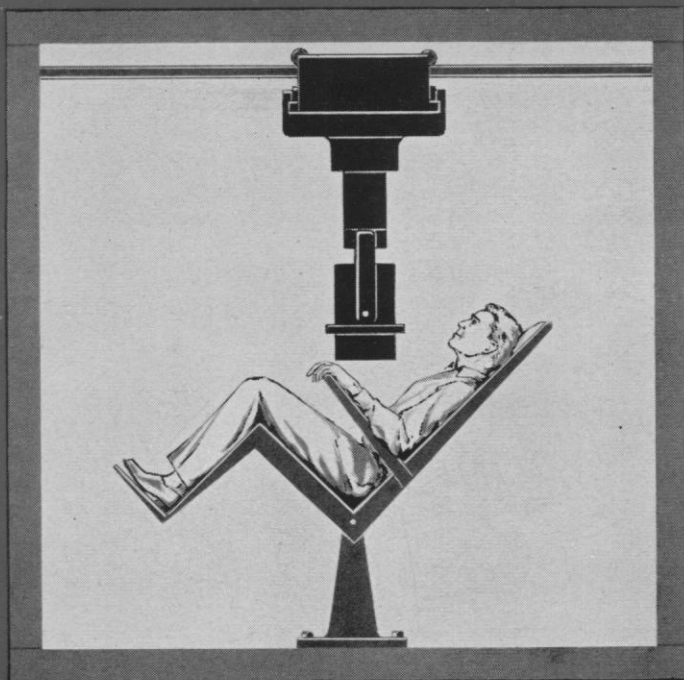
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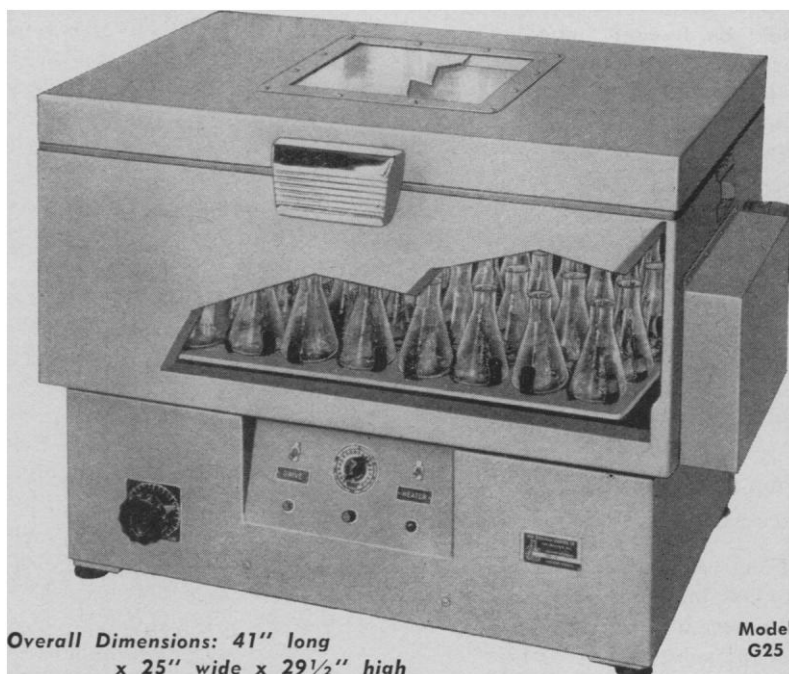
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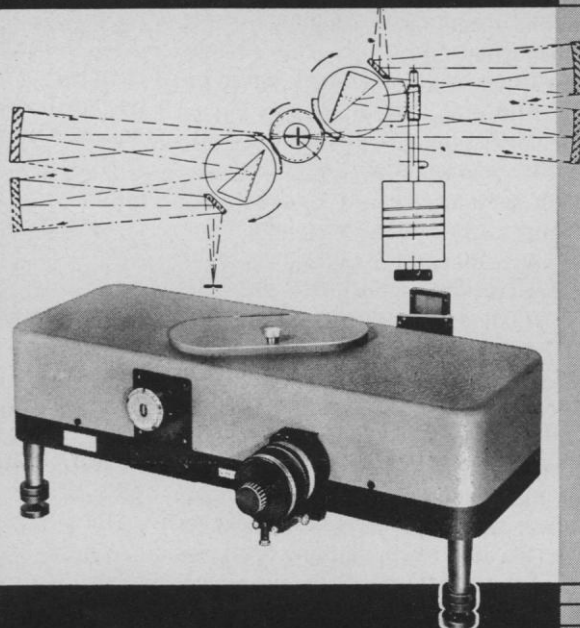
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