Proceedings Issue

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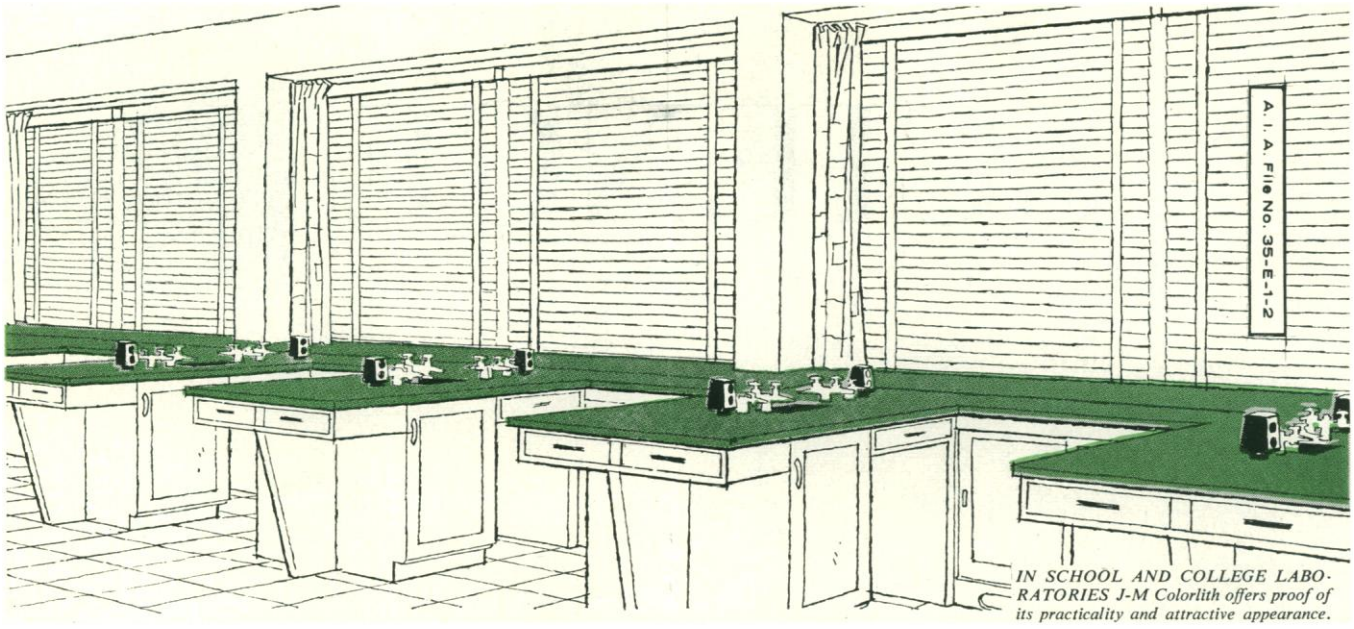

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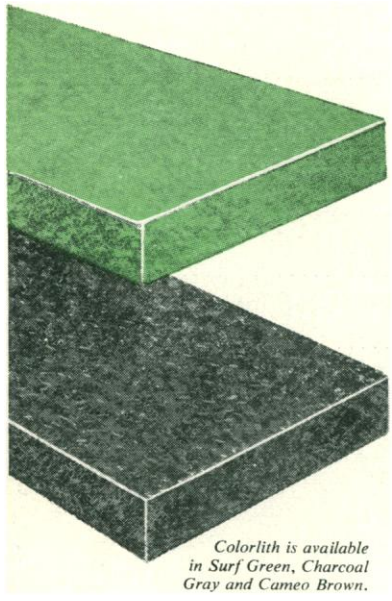

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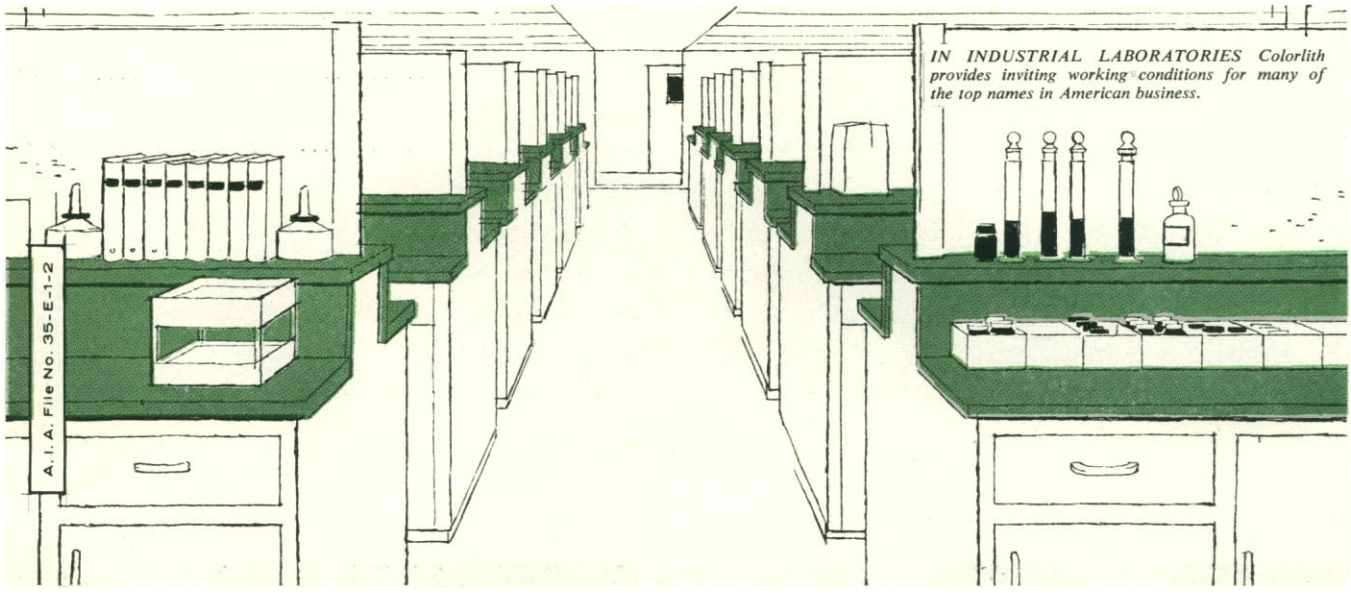

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The place of the Particle Accelerator in Basic Research...

Particle Accelerators in Biological Research—III

High-energy charged particles are of great value in the study of biological matter. The effects of ionizing radiation can provide information that is invaluable in the development of models to describe the structure and organization of living matter.

Energy-transfer Mechanism

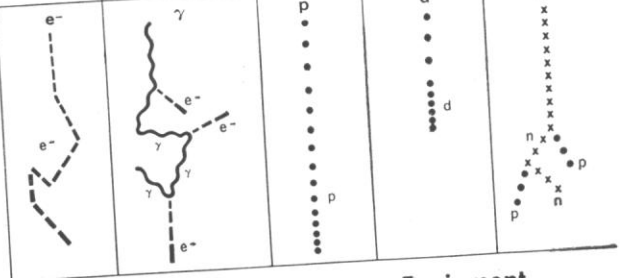
The basic mechanisms by which incident energy is transferred to the target material are of importance. These mechanisms include the "direct effect", which can be described by the target theory of Lea and others, and the "indirect effect" where the energy is absorbed by the solvent and subsequently transferred by radiation-produced intermediates to the solute. Both of these effects take place within the living cell, as shown by irradiation in the wet and dry states. A knowledge of the kinetics of the indirect effect can be important to consideration of the biological effects of ionizing radiation.

Effects of Light and Heavy Particles

The physical structure of microorganisms such as bacteria and viruses has been studied extensively with ionizing radiation. Light particles, such as electrons or x-rays, are easily scattered in matter and may strike the organism from any direction. Analysis of the inactivation from this type of radiation can give a radio-sensitive volume.

Heavy particles, on the other hand, are not easily scattered and travel in straight lines until they are stopped. Analysis of the inactivation data will give a radio-sensitive cross-section for the organism. From data of this type it has been possible to formulate models that agree with structures developed by other experimental methods.

Characteristics of particles obtainable from Van de Graaff accelerators

	electron	x-ray	proton	deuteron	neutron
Mev	μa	r/min—100cm	μa	μa	n/sec.
1	250	20	50	50	2×10^{10}
2	250	75	50	50	10^{11}
3	1000	1200	200	200	1.2×10^{12}
Typical particle trajectory in target material					

Effects on Man

In addition to fundamental studies on biological materials, there is a great need for better understanding of the effects of ionizing radiation on man. Extensive studies under way on the effects of radiation on animals are providing data that, extrapolated to man, will help greatly in our current problem of providing protection for persons working in radiation environments such as radiation clinics, reactor facilities, and research laboratories. Knowledge of the tolerance dose and the relative biological effects of all the types of ionizing radiation is essential for our safety and for the fulfillment of the ultimate promise of the atomic age.

Necessary Equipment

The radiation equipment necessary to gain this knowledge depends on the major field of interest. The equipment should be variable in energy, should produce all of the particles which are of interest, and should have sufficiently high outputs to produce data in a reasonable period of time. The Van de Graaff® is such a tool. The energies and types of particles it can provide are shown in the table above, with diagrams of their typical modes of energy transfer in matter. The particle energy can be varied from the maximum shown to approximately one tenth of this value. The current is continuously variable from a remote control station. Installation is relatively simple, and the ease of operation and flexibility make it an ideal source of ionizing radiation for biological research.

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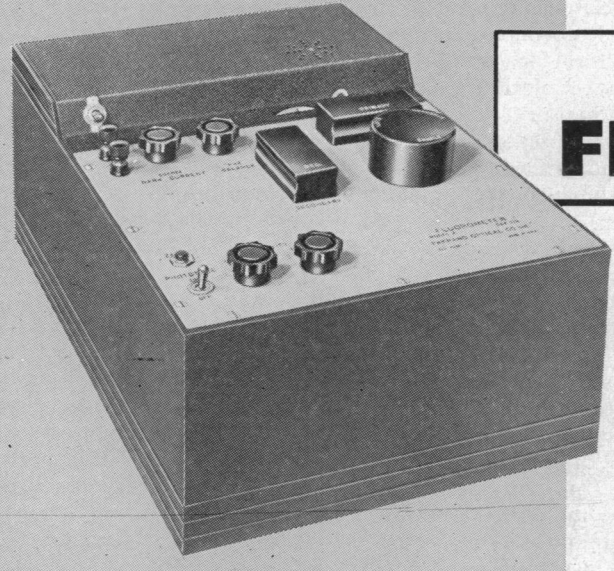

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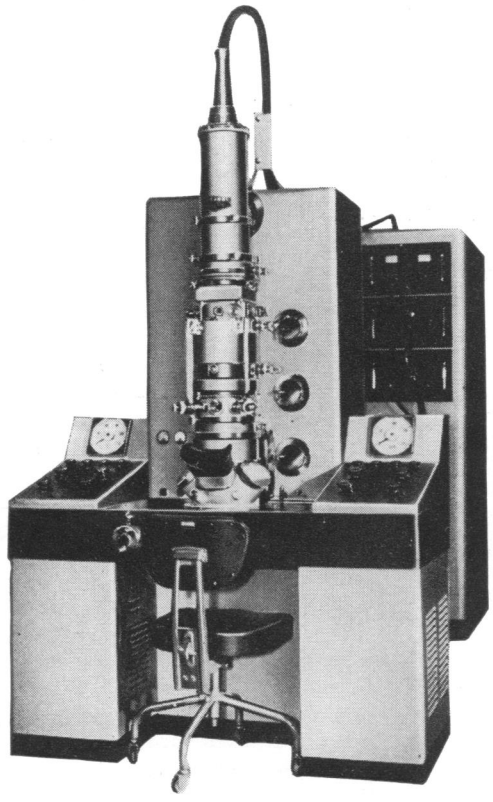

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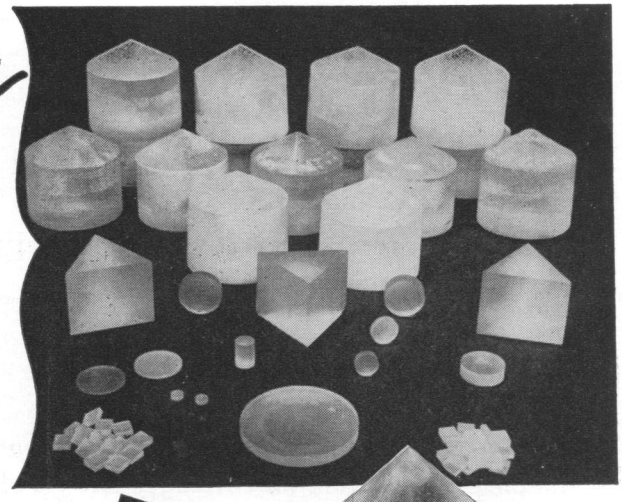

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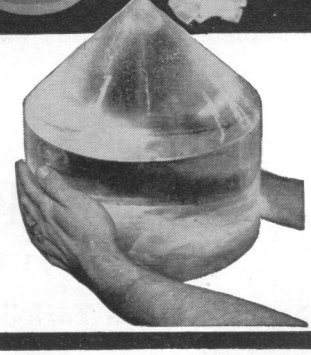

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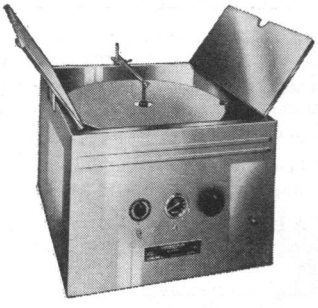

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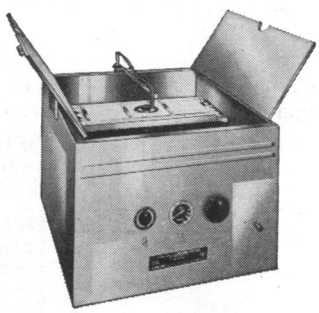

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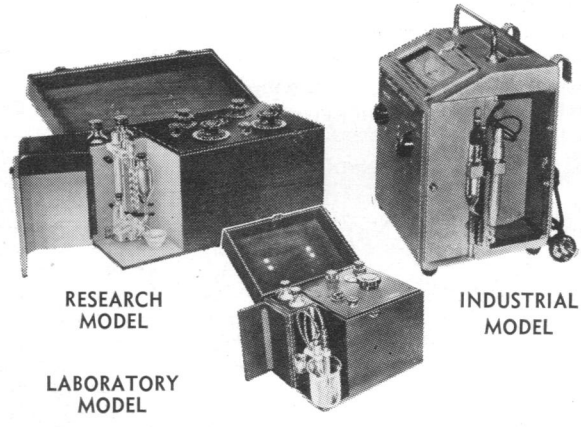

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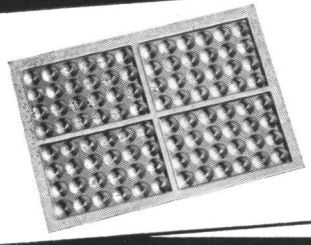

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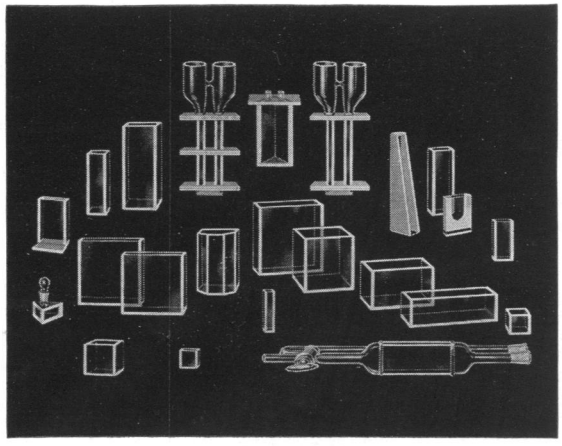

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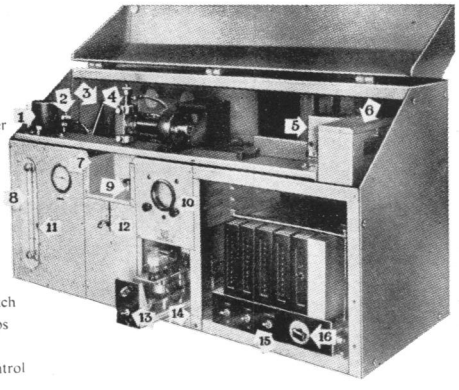

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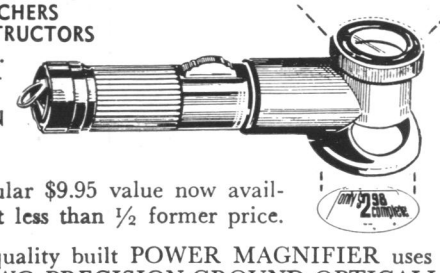

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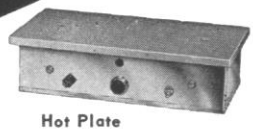

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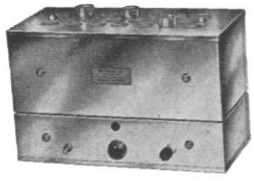

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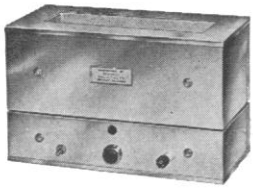

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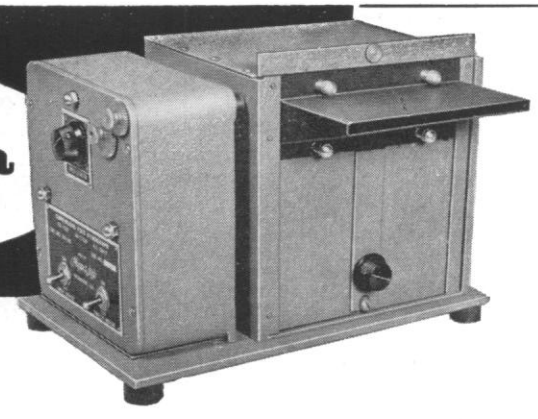

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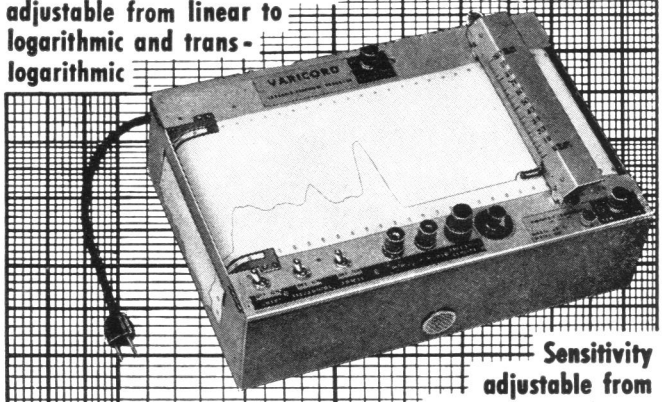

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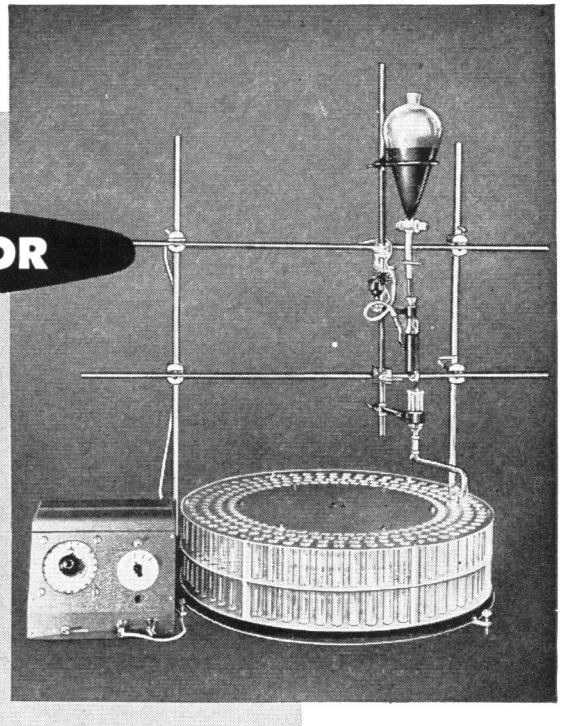

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This precision apparatus is a valuable aid to accurate fraction measurement and collection in chromatographic analysis. Operated by a heavy-duty capacitor motor, the RINCO Fraction Collector provides completely automatic operation for any desired period. NO MERCURY, CHEMICALS OR ELECTRIC CURRENT COME IN CONTACT WITH YOUR SAMPLE. When utmost accuracy is required, fractions are measured with manometer assembly, as in diagram.

3 Receiver Tables Available — Interchangeable with One Indexer

24" Diameter—holds 237 tubes (18 mm. x 150 mm.)
18" Diameter—holds 60 tubes (25 and 29 mm.)
14" Diameter—holds 120 tubes (1 to 5 ml, 10 ml, 20 ml, and 50 ml.)

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