



First prize in the laboratory equipment category went to E. W. Mueller of Pennsylvania State University for this field ion microscope which is capable of resolving individual atoms in crystal lattice.

Photos by R. Marcley

First prize in the demonstration equipment category went to the entry submitted by Peter Eppenstein of Rensselaer Polytechnic Institute. Submitted on colored overlays of circuit diagrams for overhead projection were breadboards with miniature components which served as functioning circuits.

1961 competition for

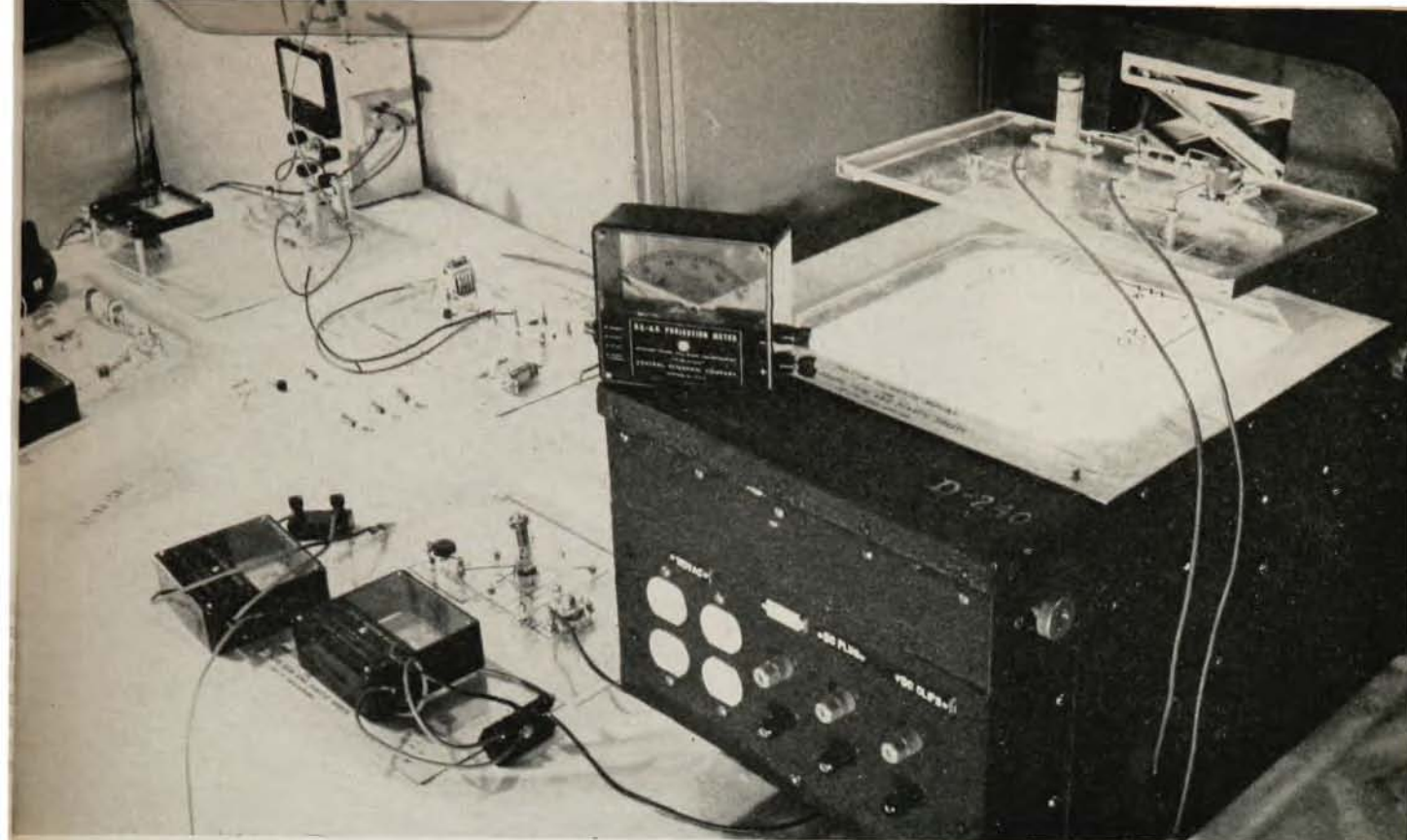
PHYSICS TEACHING APPARATUS

By Paul Kramer and Nat Weiner

IF one judges by attendance and enthusiasm, many physicists look forward to the apparatus competitions held under the auspices of the Committee on Apparatus for Educational Institutions of the American Association of Physics Teachers every two years as a part of the joint meeting of the AAPT and APS in New York. Fifty-four pieces of new and improved apparatus for undergraduate college physics were exhibited at the Hotel New Yorker this year from February 1 to February 4. Supported by a grant from the Central Scientific Company, the competition was intended primarily

to inspire and give recognition to inventive ingenuity in the development of new laboratory and demonstration equipment for physics teaching. With public recognition went certificates and three cash prizes of \$500, \$200, and \$100 in each of two categories: equipment used in demonstration lectures in undergraduate college physics and equipment used in undergraduate physics laboratories. A number of honorable mention awards were also made.

To those who visited the 1961 exhibit and viewed an orderly accumulation of functioning equipment on a



sea of white tablecloths, a brief recounting of the behind-the-scenes effort that made it possible may be interesting. The Committee on Apparatus¹ named Paul Kramer of Pratt Institute to serve as director of the competition. Francis Bitter of Massachusetts Institute of Technology, George W. Hazzard of General Electric Company, and Mark W. Zemansky of The City College of New York were invited to serve as judges. N. Weiner of Staten Island Community College and J. Lane and H. Bredekamp of the Department of Physics at The City College of New York assisted the director. Howard A. Robinson of Adelphi College, the director of the 1959 competition, had established procedures with such care and attention to detail that the 1961 competition seemed to move effortlessly along much the same lines. Since some apparatus was being shipped from quite a distance, arrangements were made to obtain accessory equipment, such as vacuum pumps and oscilloscopes, from New York sources. Tektronix made two oscilloscopes available, and Cenco lent vacuum pumps and other equipment. It was the task of the competition staff to transform a mountain of crates, containing the fifty-four pieces of apparatus that were to be set up, into a working exhibit within twenty-four hours.

The usual logistics and operational problems arose. A thermoelectric pump failed to arrive and was finally traced through Michigan to New Jersey. Accessories and supplies had to be improvised. Repairs to equipment

had to be made on the spot and with the somewhat limited instrument-shop facilities of the Hotel New Yorker! But the story ends happily because the exhibit was set up and the judging done in time for many hundreds of physicists to see it.

FIRST prize for laboratory equipment was awarded to E. W. Mueller of Pennsylvania State University. His exhibit was a very ingenious and much-simplified version of the field ion microscope capable of showing the atomic structure of the surface of a tungsten single-crystal needle tip to a magnification of one million. In operation, the equipment can display on the screen the image of individual atoms as they form the lattice of a metal crystal.

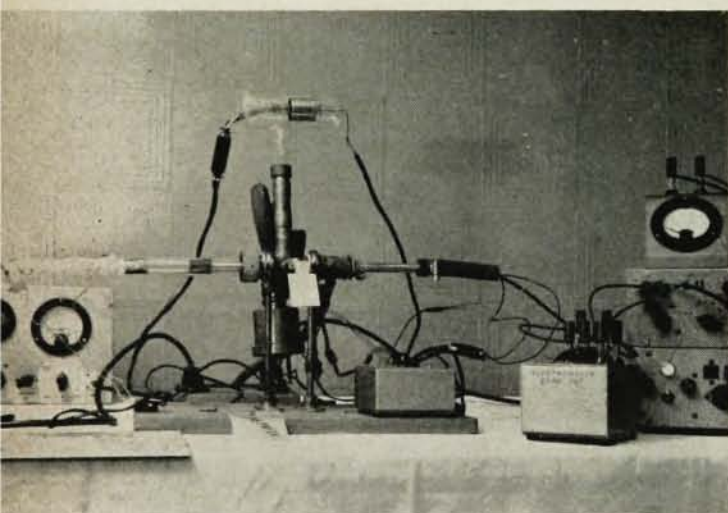
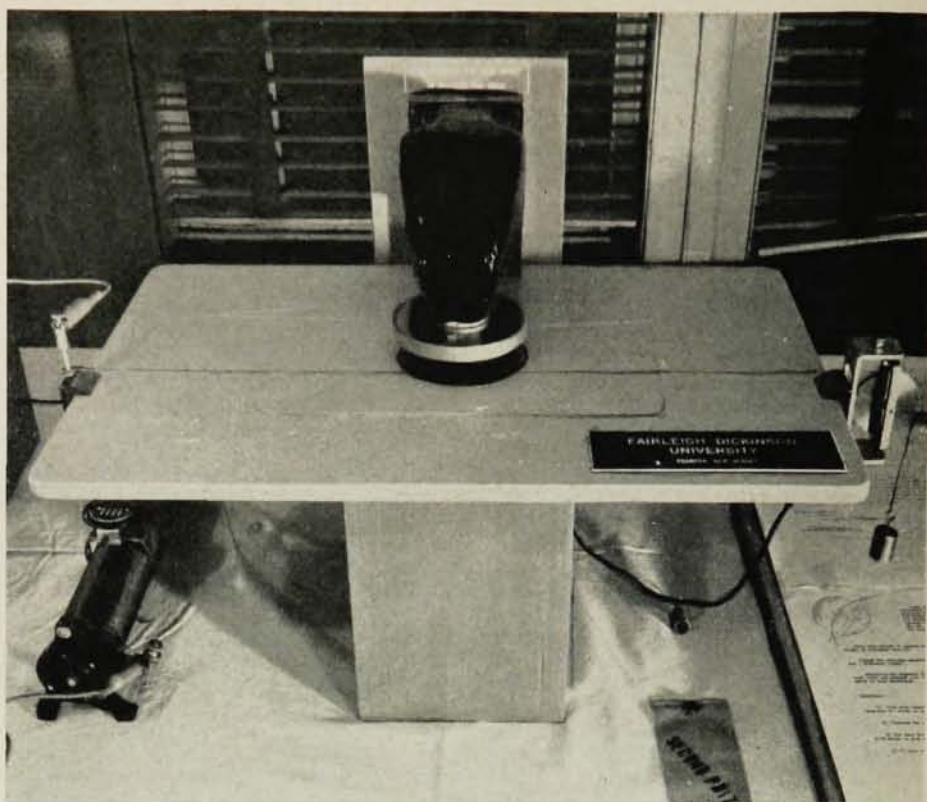
Second place in the laboratory equipment category was awarded to the late Charles Zucker of Fairleigh Dickinson University. His entry, an apparatus for measuring a magnetic field, consisted of a straight wire placed in the field. Upon passing current through the wire, it bows. A weight attached to one end of the wire renders the system in equilibrium. From the knowledge of the current, radius of the arc, and equilibrium force, the magnetic field strength is determined.

A molecular-beam apparatus to determine the molecular diameter (or collision cross section) of molecules in a gas, submitted by John G. King of Massachusetts Institute of Technology, received third prize.

AN attention-getting demonstration of electrical-circuit diagrams, made of transparent colored overlays and optically projected by an overhead projector, received first prize in the demonstration equipment category. The apparatus included superimposed working cir-

¹ The members of the AAPT Committee on Apparatus for 1960-61 were: Sanborn C. Brown, Massachusetts Institute of Technology, Chairman; Harald Jensen, Lake Forest College; William C. Kelly, American Institute of Physics; Harry F. Meiners, Rensselaer Polytechnic Institute; Thomas D. Miner, Garden City High School; H. V. Neher, California Institute of Technology; H. A. Robinson, Adelphi College; Howard P. Stabler, Williams College.

Second prize in the laboratory equipment division went to the late Charles Zucker of Fairleigh Dickinson University for this wire method of measuring the magnetic field.



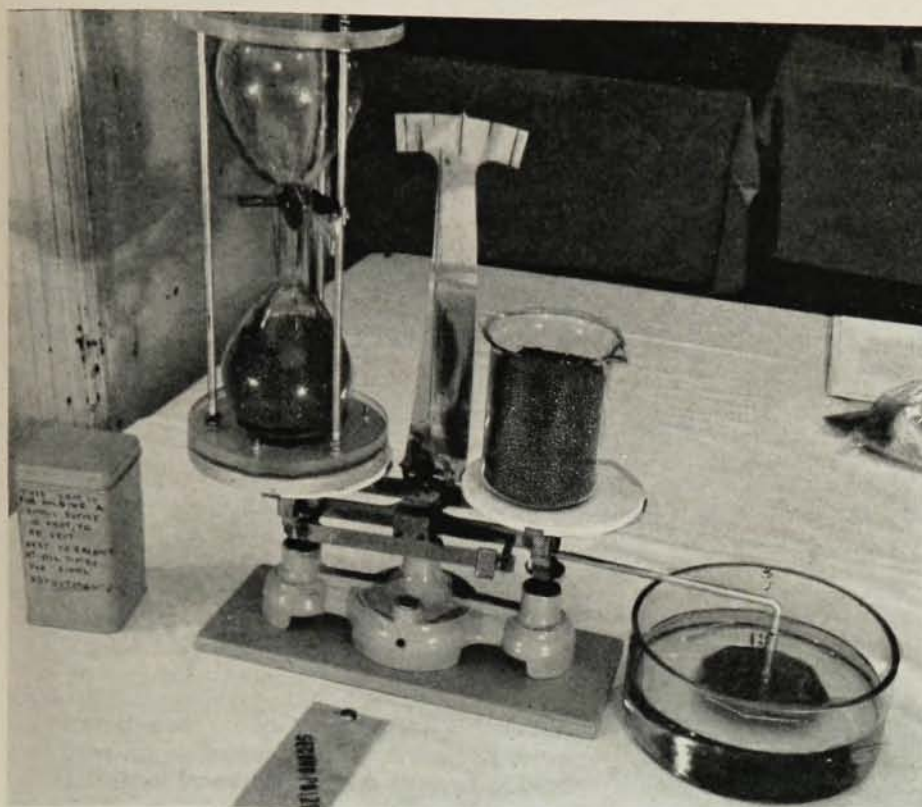
A molecular beam setup for determining the collision cross section of molecules in a gas, entered by John G. King of the Massachusetts Institute of Technology, received third prize in the laboratory equipment category.

circuits, mounted and wired on lucite bread-boards. The winner was Walter Eppenstein of Rensselaer Polytechnic Institute.

A simply constructed, but quite provocative, demonstration of conservation of linear momentum took second place in this competition. Paul Whiting of the University of Minnesota used an hour-glass system containing lead shot, a critically damped equal-arm balance, and a beaker containing sufficient shot to balance statically the hour-glass system to demonstrate the principle.

The third place in the competition went to H. V. Neher of California Institute of Technology for a very sensitive apparatus for demonstrating the pressure of light, utilizing a vane, half bright and half darkened, suspended by a calibrated quartz fiber.

HONORABLE mention for laboratory equipment went to H. Bichsel of the University of Southern California for a dramatic demonstration of alpha-particle range and energy as measured by a silicon solid-state detector. F. Steigert and H. Kraybill of Yale University received honorable mention for laboratory equipment consisting of assorted mechanical oscillating systems with varying dimensions to test the dependence of the period of oscillation on the dimensions of the system and the mass of the oscillating member. H. V. Neher developed an improved Busch tube capable of determining e/m for the electron into the relativistic

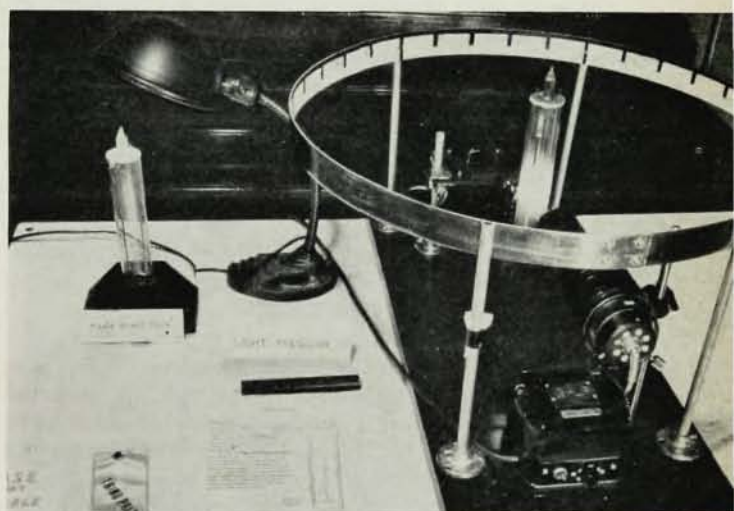


Second place in the demonstration equipment category was taken by Paul Whiting of the University of Minnesota. The arrangement demonstrated the principle of conservation of linear momentum.

region. A. G. Dockrill and L. R. Thurston of the University of Michigan presented a versatile apparatus for studying collisions in two dimensions. A. Capecelatro and M. Mainardi of Newark College of Engineering received the fifth of the honorable mention awards in this category for apparatus that permitted the determination of the pulley reaction of an Atwood's machine.

Five honorable mentions were awarded for lecture equipment entries. W. C. Elmore of Swarthmore submitted a unique piece of apparatus for demonstrating the velocity of light. E. M. Hafner of the University of Rochester used an electronic analogue and an oscilloscope to illustrate a Ptolemaic system and a Copernican system. A combination of turntable and pump was used to demonstrate cyclonic circulation in the equipment submitted by M. J. Pryor of the State University of New York at Albany. R. A. Regalbuto of Georgetown University demonstrated the flexibility of pegboard, sheet metal, pegs, and a light source in teaching the principles of geometrical optics. In mechanics, Peter L. Tea, Jr. of The City College of New York submitted apparatus comparing a cycloidal pendulum with a simple pendulum to show the constancy of period for a cycloidal pendulum and the dependence of period on amplitude for a simple pendulum.

It goes without saying that every entry that was exhibited had merit, so that each of the items exhibited deserved commendation. Visitors certainly displayed considerable interest in all of the entries.



Light pressure can be demonstrated and measured by means of the special light-pressure tubes included in this third-prize winner in the demonstration division submitted by H. V. Neher of the California Institute of Technology.