The AAPT APPARATUS COMPETITION 1963

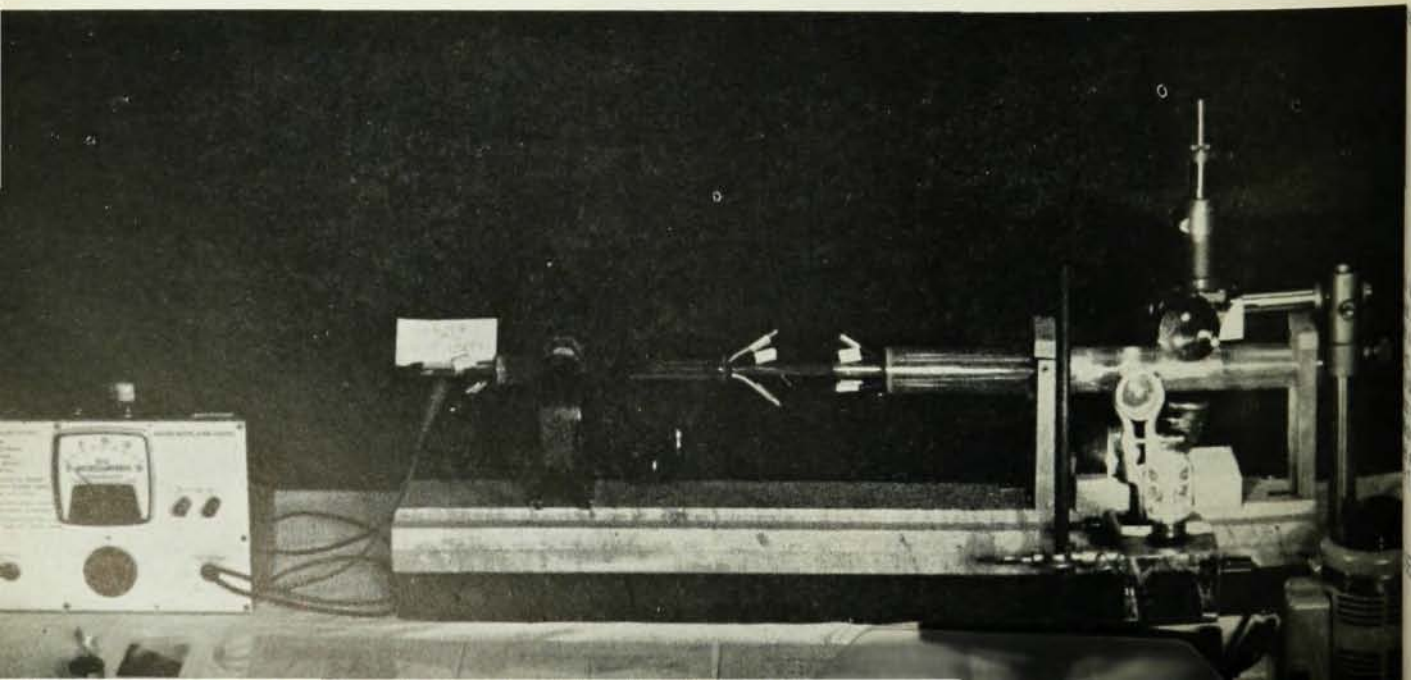
A Report by ***Marcel Bardon***

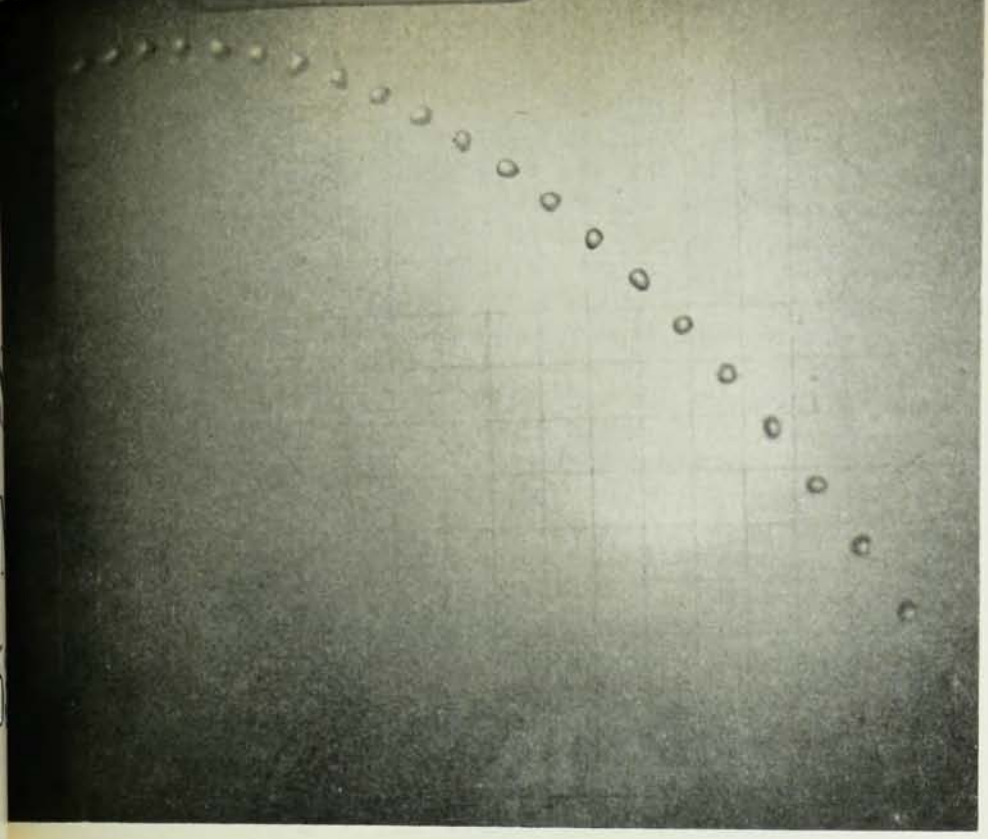
THE Third Biennial Apparatus Competition once again attracted the interest of many of the visitors and participants at the joint meeting of the American Association of Physics Teachers and the American Physical Society held in New York in January. This competition for new and improved apparatus for undergraduate college physics laboratories and lecture demonstrations is conducted by the AAPT Committee on Apparatus.[1]

[1] The members of the AAPT Committee on Apparatus for Educational Institutions for 1962–63 are Allan M. Sachs, Columbia University, chairman; Walter R. French, Jr., Nebraska Wesleyan University; John G. King, Massachusetts Institute of Technology; 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; and W. C. Kelly, American Institute of Physics, Secretary. The committee named Marcel Bardon, Columbia University, to serve as director of the competition.

This year, the competition was supported by a grant from the Welch Scientific Company, as had been the first one held in 1959. The competition, which was separated into two categories, laboratory experiments and lecture demonstrations, offered first, second, and third prizes of $500, $200, and $100 in each category, as well as honorable mention awards. About forty entries were accepted for exhibition, most of them coming from colleges throughout the country, one from a national laboratory, two from industrial laboratories, and one from a high school.

The first afternoon, evening, and part of the next morning of the exhibition were taken up by the thorough and careful work of the judges, Robert O. Pohl of Cornell University, Alfred G. Redfield





Pulsed water-drop parabola produced by the recirculating vibratory pump system, executed by Harold M. Waage, Princeton University, won first prize in the lecture demonstration category. The water stream, displayed with a strobe light, is broken into seemingly stationary drops. (*Photo by S. Tramm*)

of IBM Watson Laboratory and Columbia University, and Byron Youtz of Reed College. All entries were displayed anonymously during the judging and were each considered with great care in determining which best met the requirements of the competition, for example: merit as a teaching device, simplicity and reliability of design, reliable performance, originality, etc.

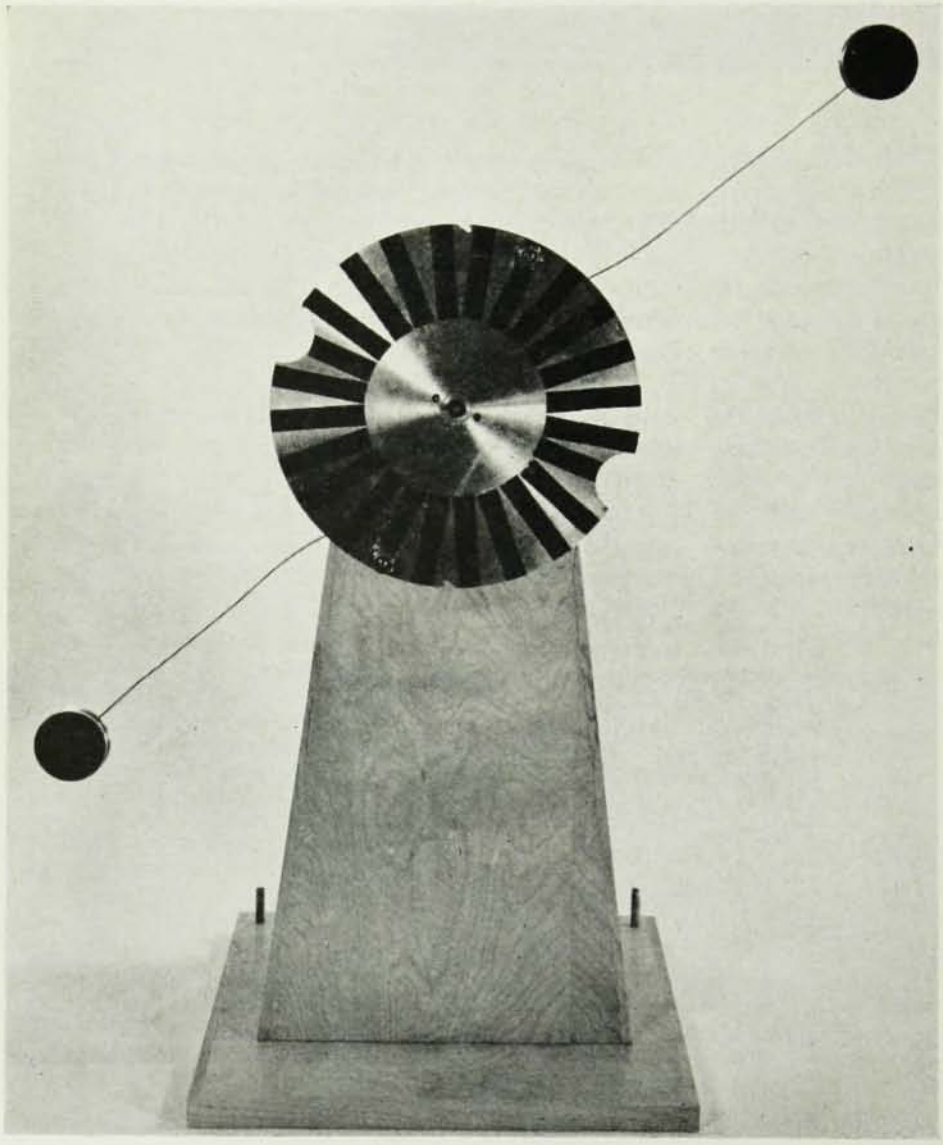
The judges found many excellent entries in the laboratory category with many vying for the prizes; so much so that two entries finally shared third prize, and four honorable mentions were awarded. In the lecture-demonstration category, however, the judges decided not to award a third prize at all, because they found only two entries that really satisfied the needs of a good lecture demonstration, as well as representing original designs of substantial interest. They did find many worthwhile entries, and awarded six honorable mentions but, except for the two prize-winning entries, they felt these were not really clear and effective demonstrations of a physical principle that a lecturer might wish to show in an undergraduate college physics course.

The first prize in the lecture-demonstration category was awarded to Harold M. Waage of Princeton University for a simple recirculating vibratory pump system producing a pulsed water-drop parabola, suitable for display with a variable strobe rate by shadow projection. The parabolic water stream, broken up into seemingly stationary drops, made an arresting sight for the visitors at the exhibition. The second prize went to Gary D. Gordon of the Radio Corporation of America for his clear demonstration of the "de-spin mechanism" provided by two weights which, flying off at the end of restraining cables from a rapidly rotating disc, carry off the angular momentum and energy, leaving the disc completely stopped. The judges were most impressed by the striking effectiveness of this demonstration as a lecture aid.

In the undergraduate-laboratory category, the first prize was awarded to A. P. French of the Massachusetts Institute of Technology for his apparatus to measure the pressure of light from a lamp by observation of the deflection of an aluminum vane suspended on a glass fiber inside a glass tube. The apparatus also contains a calorimeter can in

First prize in the laboratory experiment category was awarded for this apparatus, entered by A. P. French of the Massachusetts Institute of Technology, which measures the pressure of light. The glass tube on the right contains an aluminum vane suspended on a glass fiber whose deflection, damped by a magnet, can be measured with a low-power microscope. (*Photo by T. W. Williams, III*)

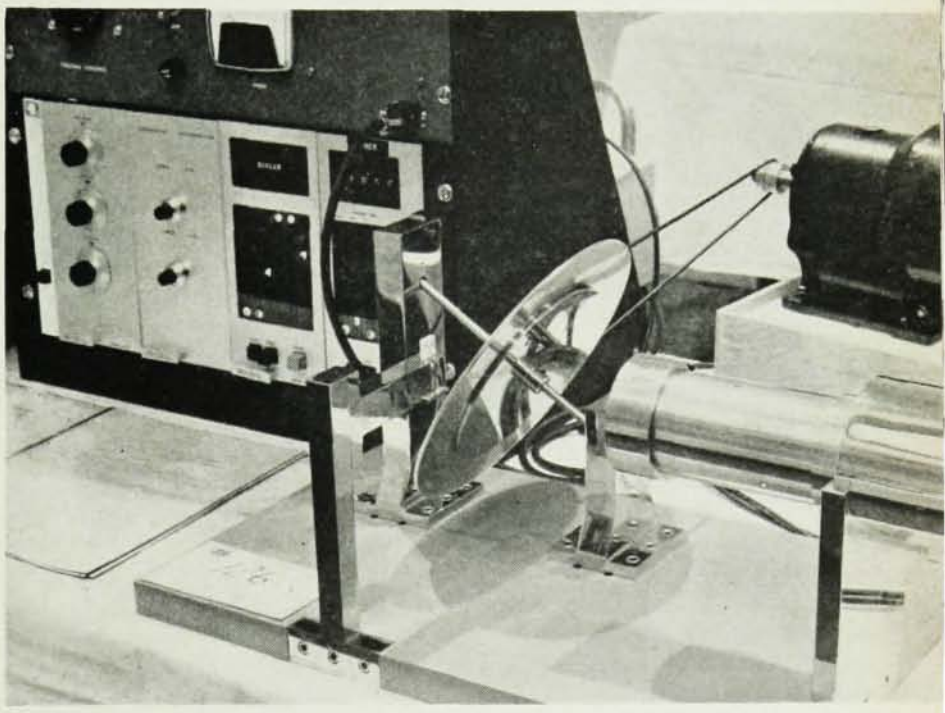
which the power carried in by the beam of light can be directly compared with calibrated electrical power. Also of interest is the simple construction with soft-glass tubing and solder-glass joints. The second prize went to R. B. Leighton of the California Institute of Technology for his air-supported, nearly frictionless motion of metal blocks in a long trough for the study of collisions, vibrating systems, normal modes, one-dimensional gas, etc. Apart from its value in allowing quantitative measurements of phenomena otherwise obscured by frictional effects, the apparatus also appeared to provide considerable interest and enjoyment to the crowds watching the unusual phenomena of "frictionless" motion. The third prize was split in a two-way tie between Alan J. Bearden of Cornell University for his Mössbauer effect experiment, and Kenneth W. Billman of the Massachusetts Institute of Technology for a mechanical resonance apparatus. For the Mössbauer effect, the radiation is provided by Co^{57} in a crystalline environment. The absorber to show resonance absorption, Fe^{57}, is in a tilted disc whose rotation provides relative motion between source and absorber, allowing measurements of the change in the resonance conditions by counting with a scintillation counter. The effect of an internal magnetic field, causing splitting of the nuclear energy levels, can be seen with this equipment with sufficient statistics in an ordinary laboratory period. K. W. Billman's me-



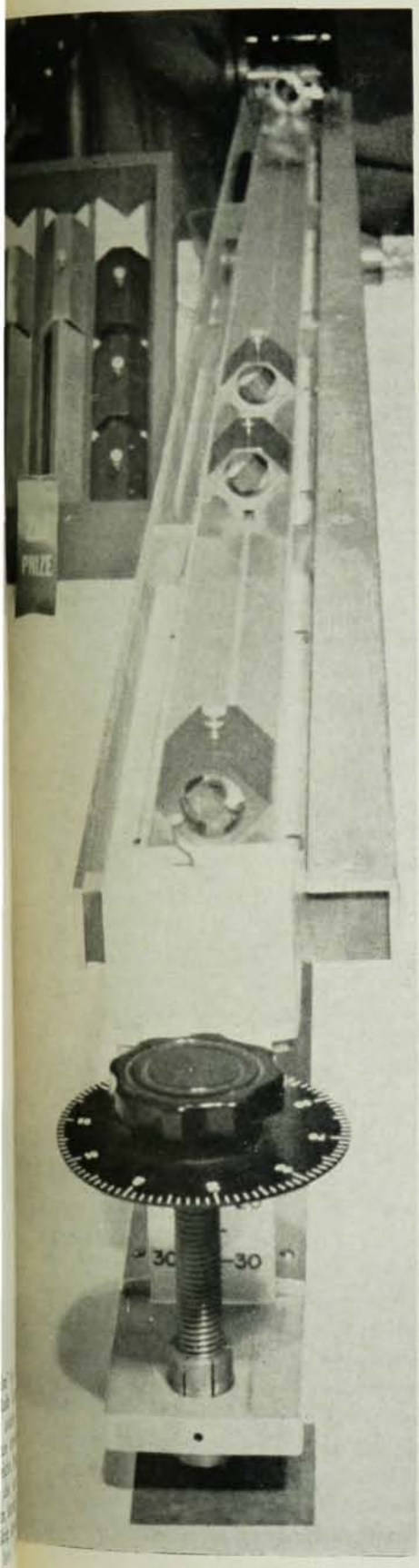
"De-Spin Mechanism" by Gary D. Gordon of the Radio Corporation of America was awarded second prize in the lecture demonstration category. Two weights flying off a rapidly spinning disc carry away angular momentum, leaving the disc stopped in a striking demonstration of conservation laws. (*Photo by RCA*)

chanical resonance apparatus made ingenious use of a cheap phonograph turntable as a variable-speed driver for a forced linear oscillator of simple design which can be used to study free or damped oscillations, where the parameters of the oscillator, the amplitude of drive, and the damping can be varied, and phase measurements can be made.

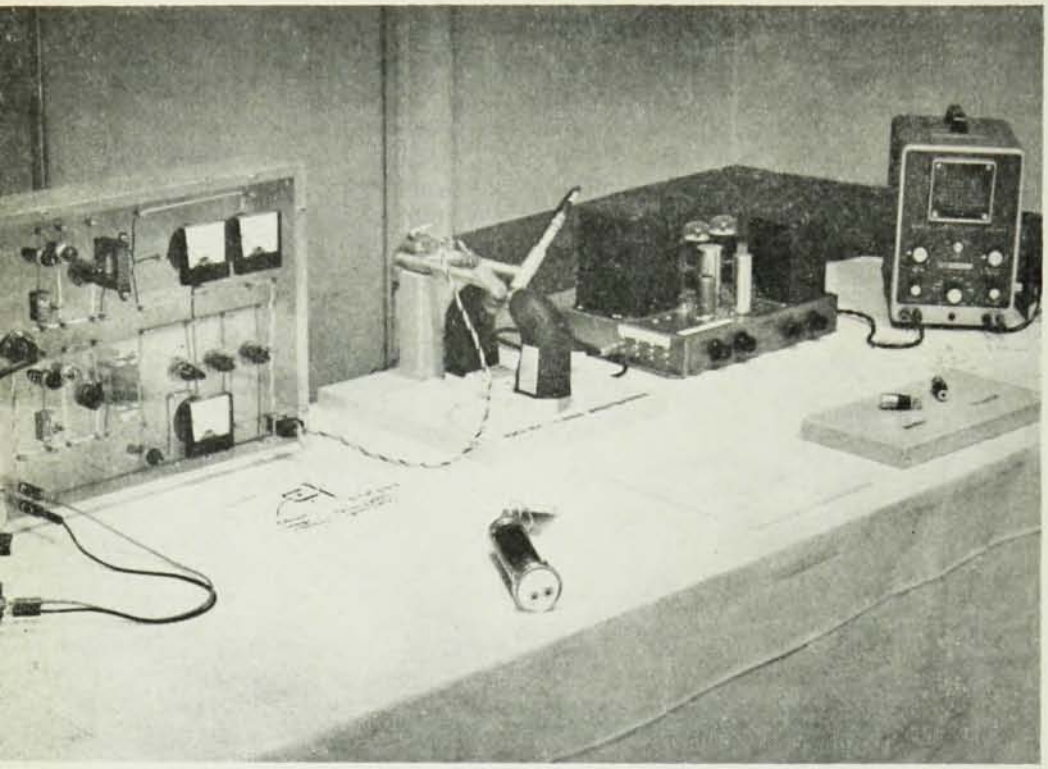
In addition to these four prize-winning contestants in the laboratory category, four others received honorable mentions: C. L. Andrews of the State University of New York at Albany, for his elegant and compact set of three complete microwave interferometers set up for measurements as Lloyd's Mirror, Michelson's interferometer, and a grid detection interferometer; John W. Dewdney of Har-



Apparatus for experiments on Mössbauer effect, entered by Alan J. Bearden of Cornell, tied for third prize in laboratory category. Tilted disc containing Fe^{57} acts as absorber for radiation from Co^{57} source. Its rotation provides relative motion between source and absorber for measuring changes in resonance conditions as observed in scintillation counter in cylinder at right. (*Photo by S. Tramm*)



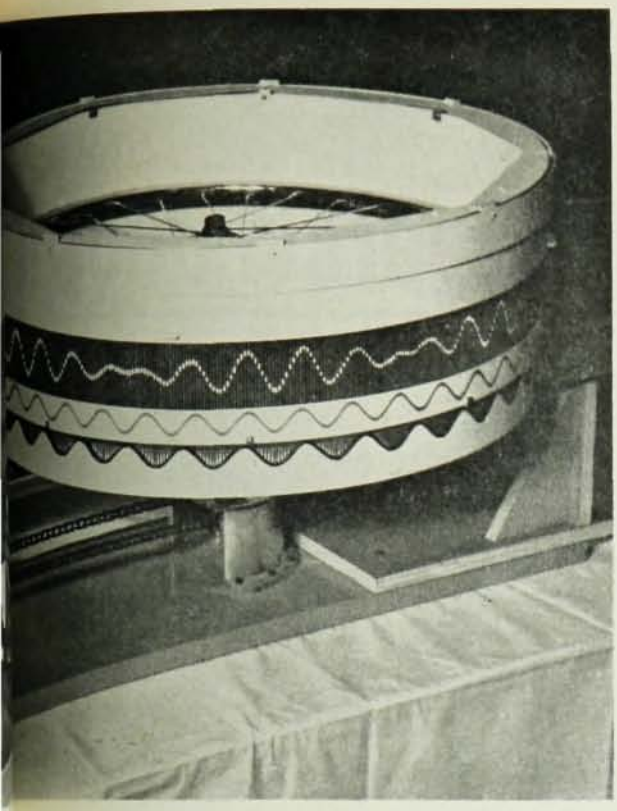
Trough with holes for compressed air (used for "frictionless" motion of metal blocks) won second prize in the laboratory category for R. B. Leighton of Caltech. It allows measurements of collision phenomena and studies of vibrating systems, normal modes, one-dimensional gas, etc., without having the phenomena obscured by frictional effects. (*Photo by T. W. Williams, III*)



Honorable mention was awarded for small mass spectrograph, shown in the center of the photo together with the simple auxiliary electronics. This "poor man's spectrograph," entered by John W. Dewdney of Harvard University, is assembled from plumbing parts, rubber stoppers, darning needles, washers, razor blades, etc. (*Photo by S. Tramm*)

vard University, who demonstrated a small mass spectrometer made from such simple constituents as plumbing parts, rubber stoppers, darning needles, washers, and razor blades; Robert B. Brode of the University of California at Berkeley, for his attraction disc electrometer giving precise, absolute measurements of electrostatic force; and Perry Sprawls of Emory University, for his simple apparatus giving direct measurements of magnetic-circuit parameters with magnetizing coil and fluxmeter.

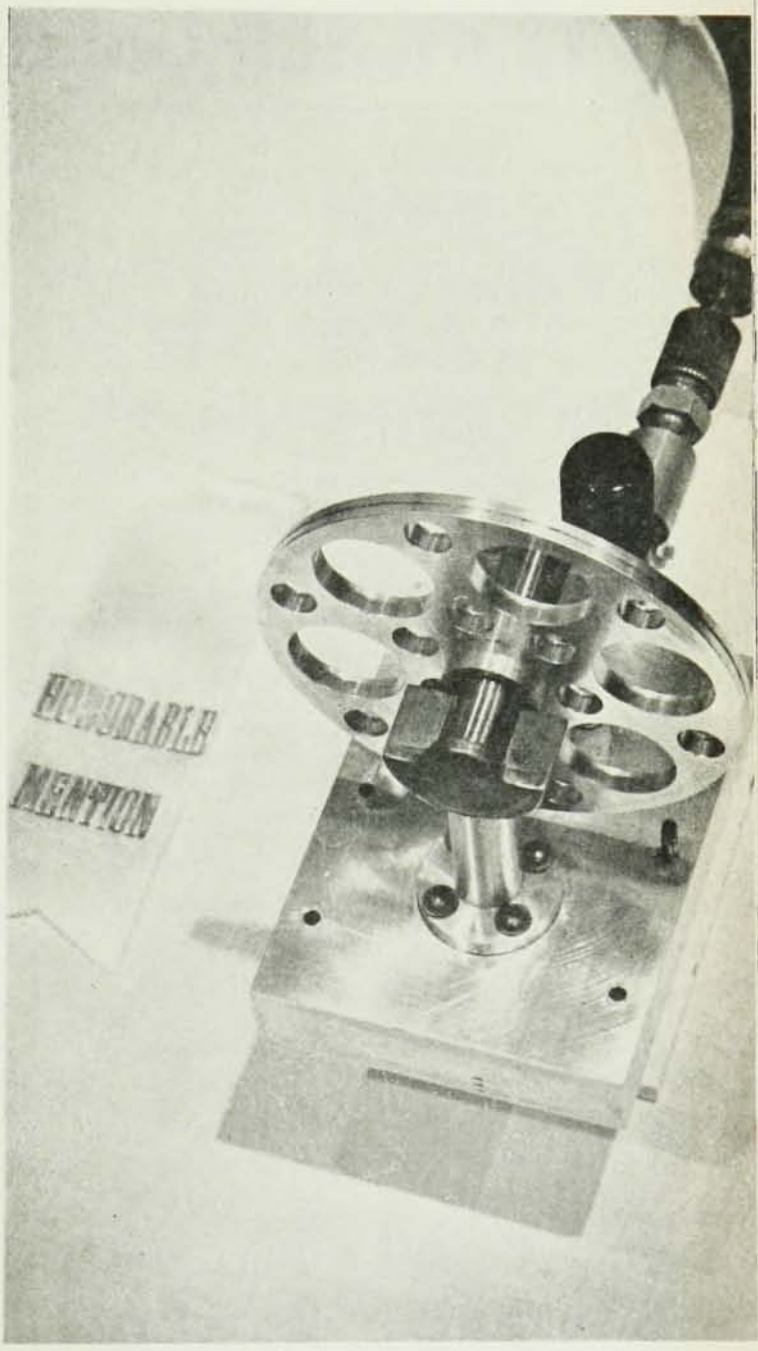
In the lecture-demonstration category, six honorable-mention awards were presented. They went to: Hans Bichsel of the University of Southern California, for an air-supported "frictionless" pulley demonstrated as an Atwood Machine; E. M. Hafner of the University of Rochester, for an oscillator and scaler unit for rapid automatic measurement of the dependence of period on amplitude of a pendulum; Malcolm Correll of the University of Colorado, for a mechanical analog for group velocity and standing waves produced by two continuous wave trains of different wavelengths and variable phase velocities; Thomas Fischer of Xavier University, for an optical pump demonstrating effects of polarization of light and very small magnetic fields, as well as optical-pumping phenomena; David J. Rose of the Massachusetts Institute of Technology, for his analog demonstration of plasma confinement simulated by a ball rolling on metal



An honorable mention was awarded for this apparatus by Malcolm Correll of the University of Colorado. This mechanical analog, made of bicycle chains and gears and a cylindrical array of knitting needles, gives a clear demonstration of standing waves and group velocities for the sum of two continuous wave trains of different wavelengths and variable phase velocities. (*Photo by T. W. Williams, III*)

sheets bent with greater curvature at the ends than at the middle; and Guenter Schwartz and Lewis V. Eckhart of Florida State University, for their "curving baseball" model in which a fan is used to provide an airstream against a rotating ball demonstrating the sideways motion, reversible according to direction of rotation.

The many persons who submitted entries in this competition, going through the paper work which was necessary for selecting the apparatus and preparing for the exhibition, and then sending in their equipment, have made a significant contribution to the AAPT's program of making new and improved apparatus available to physics teachers. For the achievement of setting up some forty entries and demonstrating them, a large part of the credit goes to T. W. Williams, III, and to several hard-working assistants.



Air-supported "frictionless" pulley, demonstrated as an Atwood Machine by Hans Bichsel of the University of Southern California, also received an honorable mention award. (*Photo by T. W. Williams, III*)