¼ of an inch deep. The fan-wheel consists of four wooden paddles and is 6 inches in diameter. This wheel and the smaller pulley are mounted on a ⅜ inch shaft which is likewise turned down to ⅛ inch journals. The boxings in which the journals run are simply pieces of iron ⅛ of an inch in thickness, with holes drilled to fit the journals, and the iron pieces are fastened to the inside of the case. The water-wheel is separated from the rest of the apparatus by an air-tight tin partition to confine the water, which is conveyed to this wheel by two tubes consisting of mouth-blowpipes cut off at the small extremity to attain an inside diameter of $^3/_{32}$ of an inch. These are placed through the edge of the case in such a way that the water from one strikes the paddles just a little below the axis at an angle of 45° to the horizontal plane of this axis, and from the other lower down and nearly parallel to this plane. The best effect is attained when the stream strikes the center of the paddle, when the paddle is exactly at a right angle with the stream. Ordinarily it has been found necessary to employ only one stream of water. Ample provision must be made for the escape of the waste water.

The fan is enclosed in a galvanized iron compartment, and is somewhat like the fan used by the blacksmith. It should have an outlet air tube with an inside diameter of ½ inch. By attaching a Y-tube to this, two blasts can be used as easily as one. A thick-walled rubber tube, about ¼ of an inch in diameter has been found to be the most efficient belt. The bearings must obviously be kept well lubricated to secure easy action.

CHEMICAL LABORATORY, CORNELL COLLEGE, May 8, 1903. FRANK L. HANN.

Rapid Determination of Phosphorus in Steel.—If the yellow precipitate, obtained from 1 gram of drillings, as usual, by shaking in an Erlenmeyer flask, be transferred together with the liquid to a 7-inch test-tube and, after standing one-half hour (a highly essential precaution), be whirled in a centrifugal machine, the supernatant liquid may be poured away and the last drops drained off without any danger of any of the precipitate being carried with it. This is a fact of considerable practical importance as it enables us to dispense with the filtration and prolonged washing which are the most tedious and laborious part of the Handy method. The liquid still adhering to the precipitate and walls of the test-tube after the first decantation and draining, amounts to an error of

about 0.12 per cent. of phosphorus according to Handy's method. But if the test-tube be then nearly filled with water, stoppered and the contents well mixed, again whirled, and the liquid again poured and drained off, the error is reduced to less than 0.001 per cent. The precipitate is then dissolved in standard alkali, and titrated with standard acid as in Handy's method. The Götz method, on account of its inexactness, seems to find but little use. For the method here described, 1 gram of steel is dissolved in 50 cc. of nitric acid (sp. gr. 1.135), the solution boiled, a little solid permanganate added, again boiled, decolorized with sugar or ferrous sulphate, cooled, 10 cc. of strong ammonia and 50 cc. of molybdate solution added, and the mixture shaken as usual in an Erlenmeyer flask. GEORGE AUCHY.

NEW BOOKS.

ELEMENTARY CHEMISTRY. BY ROBERT HART BRADBURY, A.M., PH.D., Teacher of Chemistry, Central Manual Training School. Phila., etc. New York: D. Appleton and Company, 1903. Price, $1.25.

The author offers this volume for the use of students in colleges and secondary schools. It consists of two parts—a descriptive portion of 328 pages, and a second part of 157 pages, devoted to the experimental work.

The book is well written and presents its facts clearly and accurately.

The arrangement is that which this particular teacher has found productive of the best results with the students in his charge.

"The theoretical portion is interwoven with the descriptive matter . . . . No generalization is presented until after a particular case of it has been carefully described . . . . More stress is laid upon the mechanism of chemical changes . . . than upon particular facts . . . . It is far more important that the student should understand the behavior of crystal hydrates in general . . . than that he should memorize the number of molecular weights of water in the formulas of innumerable salts."

The author acknowledges his great indebtedness to Ostwald's publications and to the influence upon him of the school of which this scholar is the leading exponent.