adopting the results of so-called experiments. It must be evident that the efforts of the Krupp party are directed to spread an impression that his system of constructing guns and projectiles has some mysterious property of reducing the resistance of the air. Now it is perhaps fortunate that the English experiments were made when the Service guns did not shoot quite so steadily as they do now, because all the observations were made near the gun when the motion of the shot was most nearly in the direction of motion. Although one gun was an extremely good one—we will suppose that the average of the four guns gave coefficients slightly above those due to perfectly steady motion in direction of the axis of the shot. Let us consider now what actually takes place on a long range. The elevation we will suppose 10°, and also that the shot leaves the muzzle with perfect steadiness. The tendency of the shot is to preserve the parallelism of its axis, but the curvature of the trajectory soon causes the axis of the shot to be inclined to the direction of motion. The resistance of the air then acts *obliquely* on the shot, and so tends to place the axis in the direction of motion. If it succeeded in accomplishing this feat at any instant, all would be out of order the next moment. In this way the axis is kept *nearly* in the direction of motion. Our shot would perhaps fall at an angle of 12°, making 22° as the angle through which the axis of the shot had been turned during its flight, by the *oblique action* of the resistance of the air. This oblique action of the air causes other disturbances, as "drift," &c. Thus if in the English experiments the shot moved with their axes at times slightly inclined to the direction of their motion they would give coefficients more nearly corresponding to the conditions of their motion on long ranges than if they had been obtained from shot moving with the axis exactly in the direction of their motion.

Afterwards Capt. Ingalls treats of the general properties of trajectories, the rectilineal motion of shot, and the calculation of tables. He explains the methods of calculating trajectories adopted by Euler, Bashforth, Niven, and Siacci. Numerous examples are given to illustrate and explain these methods, and examples taken from Bashforth's treatise are worked out by approximate and other methods.

The work concludes with three ballistic tables adapted for the calculation of trajectories by Siacci's approximate method. Table I., for spherical shot, is based upon Mayevski's coefficients (1872); Table II., for elongated projectiles, is based on Bashforth's coefficients; and Table III. is said to be copied from Didion, who copied from Euler. This table is given by Otto for every minute up to 87° 0′, which is its most complete form.

OUR BOOK SHELF

Illustrations of the Indigenous Fodder Grasses of the Plains of North-Western India. (Roorkee: Nature-printed at the Thomason Civil Engineering College Press, 1886.)

THIS is an atlas of forty plates, the representations in which are most natural and life-like, the characteristic habit of each species being effectively shown. About half the plates are accompanied by diagrams of the spikelets or florets. Of the 40 selected species, 7 belong to Andropogon, 7 to Panicum, 3 to Eleusine, 3 to Eragrostis, and 2 each to Aristida, Cenchrus, and Paspalum. The 14 remaining genera, represented each by 1 species, include, amongst others, Saccharum, Setaria, Sorghum, and Sporobolus. All the species shown are extra-British, excepting *Cynodon Dactylon*, Pers. [and *Panicum Crus-Galli*, L.]. Of these grasses none perhaps is of greater current interest than *Sorghum halepense*, Pers., known amongst English-speaking peoples as "Johnson grass," respecting the drought-withstanding capacity of which very favourable reports continue to be received from Australia and from the Western United States. Mr. J. F. Duthie, under whose careful supervision the work has been published, states in a short introduction that "the increasing demand for reliable information concerning the various grasses used in this country, either as fodder or forage, has induced me to collect materials for the preparation of a work embodying all the available information on this very important subject." This admirable atlas is a contribution in the direction indicated, and the descriptive letterpress, which Mr. Duthie promises to have ready by next cold season, will be welcomed by those—and their number is rapidly increasing—who are interested in the economic study of the Gramineæ.

W. FREAM

Exercises on Mensuration. By T. W. K. Start. (London: Sampson Low and Co., 1886.)

A WRITER who invariably mis-spells "hypotenuse" speaks of squaring two numbers and "subtracting the results," and treats of the area of a triangle before the area of a rectangle, does not deserve success. Yet so unsuited for non-technical schools is the scope of most of the existing books on mensuration, that a little manual like this of 32 pp. has an excellent chance in the struggle for existence. We hope the present edition may be rapidly sold, and followed by a second edition thoroughly revised. T. M.

Lectures in the Training Schools for Kindergartners. By Elizabeth P. Peabody. (Boston: D. C. Heath and Co., 1886.)

IN these eight lectures, which have been addressed during the past nine or ten successive years to training classes for Kindergarten teachers in Boston and elsewhere, Miss Peabody explains the system of Froebel, and the principles on which it rests. The very first sentence of the first lecture shows the serious view entertained by Miss Peabody of the duties of such teachers: "Whoever proposes to become a Kindergartner according to the idea of Froebel, must at once dismiss from her mind the notion that it requires less ability and culture to educate children of three, than those of ten or fifteen years of age. It demands more."

Le Mouvement scientifique et industriel en 1885. *Causeries scientifiques.* Par Henry Vivarez. (Paris: Librairie Centrale des Sciences, 1886.)

THIS volume is a republication of a number of sketches on scientific subjects contributed weekly to the journal *La Gironde*, with a view to keeping the readers of that periodical *au courant* with the progress of science in its various branches. They are therefore popular, and are made as entertaining as possible. The writer has the gift, so common amongst his countrymen, of rendering the most technical and abstruse subject clear and interesting. The "Causerie" is peculiarly a French device in journalism: hitherto it has been mainly devoted to literature and the drama. M. Vivarez has applied it with much success to science. It would be absurd to speak of this as a work of science, but it certainly is a work in which the latest results of science are explained and illustrated for the million.