THE VISITING BRITISH FLEET.

(Continued from page 396.)

COMPARISON OF ARMORED CRUISERS.

	Drake.	Pennsylvania.	Berwick.	Charleston.
Length	500 ft.	502 ft.	440 ft.	423 ft.
Beam	71 ft.	70 ft.	66 ft.	65½ ft.
Draft	26 ft.	26½ ft.	24½ ft.	23¼ ft.
Displacem't.	14,100 tons	13,400 tons	9800 tons	9700 tons
Horsepower	31,450	27,750	22,680	21,000
Speed	24.1 knots	22.4 knots	23.6 knots	21.5 knots
Coal	2500 tons	2000 tons	1600 tons	1500 tons
Belt	6 to 3 ins.	6 to 3½ ins.	4 to 2 ins.	4-in. partial
Gun position	6 to 5 ins.	6½ to 5 ins.	5 to 4 ins.	4 ins.
Total weight of armor	2700 tons	2219 tons	1800 tons	854 tons
Guns	2 9.2-in. 16 6-in. 15 small	8 8-in. 14 6-in. 46 small	14 6-in. 10 3-in. 8 small	14 6-in. 18 3-in. 34 small
Torpedo tu's	2 submerged	2 submerged	2 submerged	—
Complement	900	882	678	564

and draft 24½ feet, the displacement being 9,800 tons. She carries a belt which extends from the bow to the wake of the after barbette, and ranges in thickness from 2 inches to 4 inches. Her armored deck is 2 inches thick, and she has 4 inches of side plating on the lower deck amidships, which decreases to 2 inches at the bow. The armament of fourteen 6-inch guns is carried in two two-gun turrets, one forward and one aft, and in ten armored casemates. These vessels have all easily maintained 23 knots an hour on trial, and they carry a good coal supply. As compared with our own "Charleston," they are better protected, carrying about 1,800 tons of armor as against 850 tons, and they have a higher speed by about a knot and a half. The armament in both cases is about the same, but in each case it is not as powerful as it should have been, the Japanese armored cruisers like the "Asama," of the same displacement, carrying four 8-inch guns and fourteen 6-inch, being greatly superior in gun power. The British have remedied this weakness in the six later ships of the "Devonshire" class, by mounting an armament of four 7.5-inch guns and six 6-inch guns, besides increasing the protection at the water line from four to six inches.

Analysis of Fertilizers.

The methods recommended by the International Commission are similar to those in use for the determination of phosphoric acid and potash. According to the Zeitschrift für Angewandte Chemie, the commission proposes for nitrogen the Kjedahl-Jodlbacier or Schloesing-Grandear methods as to nitrates; the distillation with magnesia for ammonia, and the Jodlbacier process for total nitrogen in presence of nitrates, and for organic nitrogen in the absence of nitrates. In the latter case the operation may be also conducted by combustion with soda lime. Fodder is to be cut up, broken, sifted, and the following determinations made: Water: Desiccation at 100 deg. C. during three hours for 5 grammes. Crude protein: The percentage in nitrogen is to be multiplied by 6.25, the Kjedahl method. Assimilable nitrogenized principles: The method of Kuhn is to be applied; the gastric juice may be replaced with commercial pepsin. Fats: Exhaustion of 3 grammes of dried matter at 95 deg. C. in the stove by means of ether, and weight of the residue after evaporation of the solvent. When the operation is on the seed-cakes of siccative oils, the desiccation is to take place in a current of hydrogen or of lighting gas. In case molasses is present, it is necessary to first exhaust the water, then dry, and finally estimate the fat. Extractive nitrogenized principles: These are to be estimated by difference. Ligneous principles: Three grammes of substance free from grease are to be boiled successively with 200 cubic centimeters of sulphuric acid (1.25 per cent) and 200 cubic centimeters soda lye (1.25 per cent). Each boiling, continued for half an hour, is to be followed by washing with boiling water. Ash: Five grammes of matter are to be incinerated, the ash analyzed, with a determination of the silica, if the percentage appears abnormal.

The Current Supplement.

The current Supplement, No. 1559, opens with an article on the peat industry of the United States by A. Frederick Collins. Charles H. Stevenson writes on otter furs. A most thorough discussion of modern turbine pumps is presented. The paper on the perception of the force of gravity by plants is concluded. J. H. Morrison presents another installment of his historical review of the iron and steel hull steam vessels of the United States, selecting as his subject steel shipbuilding. One of the most notable papers read before the South African meeting of the British Association for the Advancement of Science was a paper by Prof. W. E. Ayrton on the distribution of power. This is abstracted in the current Supplement. A. Rigaut presents a lucid explanation of Catalysis. The stature of man at various epochs is considered by A. Dastre in a thoughtful article.

Correspondence.

A Letter from the Inventor of the Hargrave Kite.

To the Editor of the Scientific American:

The untiring efforts of Prof. Langley and his staff in their work on the flying machine cannot be overestimated. No doubt every scrap of experience is safe in the archives of the Smithsonian Institution.

The difficulties encountered are in no way exaggerated, and must steel the hearts of those who can foresee the results that shall certainly ensue.

Plank the dollars, and wire in again while the men are around who helped to amass our present stock of knowledge.

Do not worry and be jealous about what particular spot on the globe the first machine jumps off. Japan or the Argentine is just as likely as Washington, D. C.

Law. Hargrave.

Woollahra Point, Sydney, N. S. W., September 29, 1905.

A Teacher of Physics on "Teaching Physics."

To the Editor of the Scientific American:

In reply to Mr. Perkins's article on teaching physics, printed in your issue of October 21, I should like to speak on behalf of the pupils and the teachers.

Mr. Perkins says that he "set an examination in physics based upon a well-known college textbook, with questions of a fundamental character, and no more difficult than those asked of freshmen who have completed the first year's college course," and that the results were most discouraging. I infer from the article that these questions were for pupils who had taken physics in our ordinary secondary schools. If so, why should the questions be based upon a college textbook when such pupils have studied only high-school textbooks? And why should they be such as are asked of freshmen, when the average high-school pupil is two years younger? A number of the subjects mentioned, such as angular velocity, susceptibility, and diffraction gratings, are ordinarily not taught at all to high-school pupils, and are not even mentioned in many of the textbooks used; while, for good reasons, many of the other subjects are merely glanced at in passing. At the same time, physics is ordinarily taught in the third year in the high schools, and the difference between a pupil ready for the fourth year in the high school and one ready for the second year in college depends not only upon the two years difference in age and maturity, but upon the fact that the college pupil has had two years more of vigorous school training; that one of those years has been perhaps his most ambitious year, the freshman year in college; that he has been thrown among older persons instead of younger; and that physics has occupied one-third of his attention instead of one-fourth, as in the high school. Furthermore, the freshman taking his closing examination is among familiar surroundings, is usually answering questions set by one who has been his instructor in the subject, and he has just finished the course; while the applicant for college admission is among strangers, under distracting influences, the style of the questions may be unfamiliar, the subjects emphasized may have been slighted by his own teacher, and his course was finished over a year before.

It may be said that the teacher is at fault, at least in not presenting all the subjects mentioned, or in presenting them poorly. I am of the opinion that neither the average pupil nor the average teacher is at fault; but that the fault, if there is one, lies in expecting more than nature is ready to give. And I am also of the opinion that to demand more than nature is ready to give is more grievous than to demand less; the injury is fully as great and the expense is far greater. For some years I have had occasion to read and mark thousands of physics examination papers, written as a rule by pupils at the end of their physics courses, from high schools, parochial schools, and preparatory schools. I have written the questions myself, and have varied them not only to suit the general needs, but as well to test various phases of physics teaching; and have also continuously tested my own pupils, not only as classes but as individuals. From all this the conclusion has been persistently forced upon me that the average teacher asks too much of his pupils in physics; attempts to cover too many subjects or to pursue them too deeply. There is scarcely a subject mentioned in Mr. Perkins's article upon which I should expect in these examinations to get an entirely satisfactory discussion. Can it be that these thousands of pupils and the twoscore or more of teachers are all inefficient? Many of the subjects mentioned are fundamental, yet they are abstruse and beyond the clear conception of the pupils, and have little practical value. The opinion is slowly gaining that it is better to teach that potatoes in boiling water will not cook quicker by turning on more gas than to teach the exact meaning of moment of inertia. The one sticks, and is used through life; the other is evanescent, and is used only by the specialist.

As to the charge of incompetency, I think we must all plead guilty. Not because we have devoted less time or energy to preparation than the Latin teacher has; but because the subject demands more preparation both before and while teaching. The theoretical side of the subject is as broad as Latin, and is constantly changing, while Latin is at rest. At the same time the practical side requires the training of a machinist, a tinsmith, and an electrician, if no others. A thoroughly competent physics teacher should be able to do work in any of these lines as well as the most competent tradesman, because his work is constantly under the inspection of his pupils. For these reasons we are incompetent. If I were to select a year's work to aid me most in teaching, it would be at some trade, although I have had an aggregate of four or five years of practical work as a machinist, a tinsmith, a stationary engineer, an electrical engineer, and a blacksmith.

But, though in this sense incompetent, yet I think the average teacher of physics gives more for his salary than the average man in other professions or trades, not only because of the preparation required, but because of the work actually performed. In Chicago, the physics teacher receives about the same pay as the stone mason. I have worked in armature winding departments where some of the winders received more than I have ever earned as a teacher, although they had no technical knowledge whatever, and I found the work much less tiresome than teaching. That greater competency should not be expected of the ordinary physics teacher under present conditions is shown by the fact that many of them can and do receive more pay at other work for which they are not so well equipped. For some years before teaching I earned more than I ever expect to earn as a teacher, and that at work which, while it is of great value to me as a teacher, yet required no college training, and at work to which I could return at any time.

Therefore, on behalf of the teachers as well as the pupils, to the indictment as a whole I plead not guilty.

So far as the school authorities are concerned, I cannot speak from experience; I can only surmise, as a college teacher can only surmise in reference to the conditions of high-school teaching. Without venturing an opinion as to whether the fault lies with the school officials or with the people behind them, I feel that improvement would result if teachers were placed upon a merit system, and not a time-serving system, as fully as in commercial corporations, without a maximum salary limit; so that there would be tangible inducement for constant exertion and for remaining in the ranks. And this should extend to a consideration of work done outside of schools and colleges. Again referring to myself (for I feel that one's own experience is about all that is of value in such a discussion as this) the work which I have done on the farm, in stores, offices, and courts of law, has been fully as valuable to me as a teacher of physics as the work which I have done in schools and colleges. Other things being equal, one who has spent his life within the walls of schools and colleges as pupil and teacher is surely not as competent to train children to fight the battles of life as he who carries the scars of the warfare.

Finally, I do not think that "a disproportionate stress is put on the laboratory end." The mere fact that the average pupil pursues three other studies which are book studies only is sufficient warrant for homeopathic doses of such study in physics. But, if space would permit, there are many reasons which might be mentioned why laboratory work should not be lessened, even though the apparatus, the conditions, or the teacher may not be perfect.

E. J. Andrews,
Teacher of Physics, Waller High School,
Chicago, Ill., October 21, 1905.

A New Safety Lamp.

A new form of safety incandescent lamp for use in mines has been devised by M. Tommasi. It is intended to be used in mines where fire-damp occurs, also in powder works and localities which contain inflammable dust. Incandescent lamps do not always give a complete security in such cases. When the globe breaks, the filament burns in the air and may throw off glowing particles and also cause sparks which are sufficient to give an explosion. The new lamp avoids all contact of the filament with the air. The incandescent lamp is inclosed in a glass cylinder. The lower part of the cylinder is closed by the lamp-socket, while the upper part has a cap which contains a small stop-cock. The lamp-socket contains a small bellows which when filled out, causes two contacts to press together. The filling is done by blowing through the stop-cock from a rubber ball. Should the cylinder break, the air escapes and the bellows contracts, breaking the electric contact. When the lamp alone breaks, the partial vacuum produced within the cylinder also causes the bellows to collapse. In either case the current is cut off from the lamp and no damage can be done.