

telegraphy, the naval manœuvres of 1901, the naval budgets of great powers for 1902-3, and on modern battle-ships, including particularly the *Vittorio Emanuele*. The papers are all written by experts in their several departments and are as full of information as is an egg of meat.

Foreign naval powers are still increasing the magnitude and the offensive and defensive values of their battle-ships and cruisers and the big British and French navies especially are making progress with their 'submarines' and their 'submersibles.' Both report favorably on the types already constructed and indicate steady improvement. The former is testing the Holland craft. 'No. 1' is afloat and performs well. She can travel four hundred miles unexposed to fire. A 'periscope' permits a lookout being kept when completely submerged. The French *Triton* made a twenty-four hour trial, largely submerged, and during a part of the time in bad weather, and worked well. Many torpedo-boat destroyers are reported as attaining thirty knots on their contract trials. These vessels seem to be subject to large risk of accident.

In ordnance the tendency continues toward larger sizes of quick-firing guns and toward greater length for all classes of ordnance. In armor, the progress reported is in the direction of more efficient hardening and of a reduction in the thickness demanded to resist a stated impact of shot. In small arms, the small calibers persist and the 'automatic' system of continuous self-operation is being steadily perfected. A smokeless powder is now adapted for each class of ordnance, large and small, and this kind of explosive has become standard. The chemist is still seeking new and still more manageable and powerful compositions. Capped projectiles for heavy ordnance are successful, and a new device permits the production of a dense smoke at the point of explosion of the shell to confuse the enemy and disconcert his batteries. Torpedoes are still holding an important place in the field of investigation as well as in warfare, and there are no indications of the abandonment of this weapon.

Water-tube boilers, high steam-pressures

(fifteen to twenty atmospheres and upward), with triple and quadruple expansion engines, are the rule and triple screws are gaining ground under the stimulus of the example set by our own navy and the arguments of its Engineer-in-Chief, Admiral Melville. The steam-turbine is being steadily developed and reduced to useful service on a large scale in both the naval and the merchant service. Liquid fuels are being exploited, and coal-handling devices, for use at sea as well as in port, are being brought into practicable forms.

There has been 'a striking extension' of the use of electricity in the internal minor services of the naval vessels of all nations, for the distribution of light and in the operation of guns and of machinery generally. The alternating current does not seem as yet successful. Voltages are usually low, but with a tendency toward elevation above the usual standard, which is about 80 volts minimum. Voltages of 120 and upward have been employed with a tendency toward 200 as a maximum limit.

Wireless telegraphy has progressed wonderfully, particularly in its range of action. The system is still imperfect, but is constantly being brought into practicable and useful form. All nations are experimenting with one or another of five best-known systems.

Comparison of the type-ships of existing navies seems to be favorable to the naval engineering and architecture of the United States, as illustrated in its latest constructions; but it is evident that competition is developing sharply in all leading navies, and the outcome among those of the greater powers seems likely to prove to be almost as largely dependent upon the liberality permitted by the legislative department as upon the genius of engineers, constructors and combatant officers.

R. H. THURSTON.

SCIENTIFIC JOURNALS AND ARTICLES.

THE closing (October) number of volume 3 of the *Transactions* of the American Mathematical Society contains the following papers: 'On the groups of order p^m , which contain operators of order p^{m-2} ,' by G. A. Mil-

ler; 'On the circuits of plane curves,' by C. A. Scott; 'Note on the real inflexions of plane curves,' by C. A. Scott; 'La théorie des plaques élastiques planes,' by J. Hadamard; 'Covariants of systems of linear differential equations and applications to the theory of ruled surfaces,' by E. J. Wilczynski; 'On the rank, order and class of algebraic minimum curves,' by A. S. Gale; 'On superosculating quadric surfaces,' by H. Maschke; 'Algebraic transformations of a complex variable realized by linkages,' by A. Emch; 'On the determination of the distance between two points in space of m dimensions,' by H. F. Blichfeldt; 'A definition of abstract groups,' by E. H. Moore; notes and errata: volumes 1, 2, 3.

THE opening (October) number of volume 9 of the *Bulletin* of the American Mathematical Society contains: 'Some instructive examples in the calculus of variations,' by Oskar Bolza; 'On the sufficient conditions in the calculus of variations,' by E. R. Hedrick; 'Some recent books on mechanics,' by E. B. Wilson; 'On a new edition of Stolz's *Allgemeine Arithmetik*, with an account of Peano's definition of number,' by E. V. Huntington; 'Lazarus Fuchs,' by E. J. Wilczynski; 'Notes'; 'New Publications.' The November *Bulletin* contains: 'The Ninth Summer Meeting of the American Mathematical Society,' by Edward Kasner; 'The Meeting of Section A of the American Association for the Advancement of Science, Pittsburgh, Pa., June 28 to July 3, 1902,' by E. S. Crawley; 'Second report on recent progress in the theory of groups of finite order,' by G. A. Miller; 'Shorter Notices'; 'Notes'; 'New Publications.'

THE September number of the *Botanical Gazette* contains the following papers: Dr. E. B. Copeland begins an historical and critical discussion of 'The Rise of the Transpiration Stream,' based upon an extended series of experiments that he carried on at the Hull Botanical Laboratory. The paper will be noticed more fully upon its completion. Harley P. Chamder publishes a revision of *Nemophila*, a genus which has occasioned considerable difference of opinion among Californian botanists. The author defines eighteen species and

varieties, giving full discussion of critical points, synonymy, and citation of collections. Mr. W. C. Worsdell gives an account of his views concerning 'The Evolution of the Vascular Tissue of Plants,' beginning with the solid stele, which he thinks was derived from some bryophytic ancestry, and which is displayed among the most primitive ferns, and also in the juvenile stages of all ferns. The various stages in the evolution of the vascular tissue from this condition the author describes and illustrates. Professor Conway MacMillan suggests a classification of seeds in accordance with modern ideas of their structure and function. He gives general, structural, and genetic classifications. D. G. Fairchild describes *Mimosa pudica* as a weed in Ceylon, and reproduces a photograph of a large patch of it between Peradeniya and Colombo.

SHORTER ARTICLES.

ON THE STRUCTURE OF THE NUCLEUS.

1. HITHERTO the only irrefragable evidence showing that condensation is promoted by ionization, or in other words that negative ions are somewhat more active as condensation nuclei than positive ions, is the brilliant experiment devised by C. T. R. Wilson.* Nuclei are here produced by the X-rays in communicating condensation chambers, on the two sides of a vertical earthed metal plate, which receives electrical current normally on one side, through the ionized air, saturated with water vapor, and transmits the current in the same way and through the same medium on the other side. Necessarily there was an excess of negative ions on one side of the plate and an excess of positive ions on the other side. It was found, on producing condensation by exhaustion simultaneously on both sides under like conditions, that the fogs subsided on the positive side many times as rapidly as they did on the negative side, or that the negative ions are in correspondingly greater number. The effect is increasingly marked for smaller supersaturations.

2. On extending my work with shaken nuclei to solutions of non-conductors in non-conductors, such as naphthalene and of paraf-

* *Phil. Trans. Lond.*, Vol. 193, pp. 289-308, 1899.