Barrow-in-Furness. They will each measure 63 feet 4 inches in length, with a beam of 11 feet 9 inches and a displacement, when submerged, of 120 tons. The main engine will be of the gasoline type for surface propulsion and will be of 160 horse power. The fuel capacity will admit of a run of 400 knots without replenishing. The maximum surface speed will be 9 knots per hour. The main motor is of the electric waterproof type, capable of propelling the craft when submerged at 7 knots per hour with a storage battery capacity for four hours at this speed.

The vessels will be very substantially constructed. The plating and frames are of steel of sufficient strength to withstand water pressure at a maximum depth of 100 feet. For the purpose of stiffening the hull, and to insure safety in the event of collision, bulkheads are provided. The superstructure is built to admit of an above-water deck 31 feet in length when the vessel is light for surface running. The conning tower will be of armored steel with an outside diameter of 32 inches, and a minimum thickness of 4 inches, adequately provided with observation ports. The interior of the vessels will be lighted with electricity. Compressed air will be stored aboard, and ventilators provided for the circulation of the outside air throughout the vessel.

The armament will comprise one torpedo tube in the extreme forward end of the vessel, opening outboard 2 feet below the light water-line. The vessels will be equipped with five torpedoes each, measuring 11 feet 8 inches in length. The torpedoes are to be discharged while the vessel is in the following positions: At rest or during a run on surface; before or after submergence; while awash, either at rest or when running full speed; and while running full speed when submerged.

When it is desired to descend, the boat will be brought to an awash condition, with only the conning tower ports visible above the water, and will then dive at a gentle angle until the desired depth is attained, at which point the vessel will be brought to a horizontal position, either automatically or by manual power. It is anticipated that the first of these craft will be launched early in May.

THE NATIONAL ACADEMY OF SCIENCES.

BY MARCUS BENJAMIN, PH.D.

The regular annual meeting of the National Academy was held, as usual, in Washington city, on April 16, 17 and 18. After an absence of three years this distinguished body again convened in the National Museum, to the new lecture hall of which it was welcomed by Secretary Langley, thus happily dedicating to the cause of science the recently reconstructed hall.

The sudden death of Henry A. Rowland occurred early in the morning of the first meeting of the Academy, and it was with much feeling that Secretary Remsen announced the passing away of him who for a quarter of a century had been his colleague in the faculty of the Johns Hopkins University. For twenty years Rowland had been a member of the Academy, and his death was a cruel shock to many of his friends, who so well know the great value of his eminent contributions in physics.

During this session, which is the one at which the Academy transacts its business, the chair was held by Asaph Hall, the acting president. At the first meeting the committee on the Draper medal recommended that this distinction be conferred upon Sir William Huggins, of London, England, for his researches in astro-physics. This report received the approval of the Academy. Those who have previously received this honor are Samuel P. Langley, in 1885; Edward C. Pickering, in 1887; Henry A. Rowland, in 1889; H. C. Vogel, in 1892, and James E. Keeler, in 1899. It was also at this meeting that the following foreign associates were elected: A. Bornet, M. Cornu, J. Jannssen, and M. Loewy, of Paris, France; Sir Archibald Geikie, of London, England; and H. Kroniker, of Bonn, and Frederich Kohlrausch, of Berlin, Germany, all of whom have naturally attained unusual prominence in their several branches of science.

The meeting on Tuesday was largely devoted to the election of officers; and to the presidency of the Academy, made vacant by the resignation of Wolcott Gibbs, a year ago, Alexander Agassiz, of the Museum of Comparative Zoology, in Cambridge, Mass., was chosen. He had for many years been foreign secretary. Ira Remsen was elected to the resulting vacancy. Also the following additional members of the Council were chosen: John S. Billings, director of the New York Public Library; Henry P. Bowditch, of the Harvard Medical School; George J. Brush, former director of the Sheffield Scientific School; Arnold Hague, of the United States Geological Survey; Samuel P. Langley, secretary of the Smithsonian Institution; and Simon Newcomb, formerly of the United States Naval Observatory. Samuel P. Langley and Thomas C. Mendenhall were delegated to represent the Academy at the funeral of Henry A. Rowland.

The final business session of the Academy was devoted to the election of new members, and those who were so fortunate on this occasion as to receive the approval of the members were George Ferdinand Becker, who, since 1879, has been connected with the United States Geological Survey; James McKeen Cattell, who fills the chair of Psychology in Columbia University, and is the editor of Science; Eliakim Hastings Moore, Head Professor of Mathematics in the University of Chicago since 1896; Edward Leamington Nichols, who, since 1887, has held the chair of Physics in Cornell University; and Theophile Mitchell Prudden, Professor of Pathology in Columbia University and director of its histological laboratory.

During the afternoons sessions were held at which papers were read. They were, for the most part, highly technical, and only very brief descriptions of them can be given. The first was on "The Climatology of the Isthmus of Panama," by Henry L. Abbot. He compared the temperature and rainfall in a number of places in the tropics, and showed that the annual temperature in Panama was 79.1 deg. F. The average of the hottest month was 80.4 deg., and that of the coldest month 78 deg. F., thus showing that the temperature is equable, the difference being only 2.4 deg. He contended that under proper conditions it was quite possible to endure the climate on the isthmus, but after two or three years it was desirable to remove to a colder climate. Robert S. Woodward, of Columbia College, presented a technical paper on the "Effects of Secular Cooling and Meteoric Dust on the Length of the Terrestrial Day," showing by means of mathematical formulas, derived from recorded results, that in the course of several million years the length of the terrestrial day would be slightly reduced. "The Use of Formulæ in Demonstrating the Relations of the Life History of an Individual to the Evolution of Its Group," by Alpheus Hyatt, consisted of an exhibition of a series of charts showing how, by the use of formulas, the life history of very many of the mollusks could be determined at a glance. Incidentally, by the application of these formulas, he showed that individuals in different geological formations exhibited a development which naturally was an evidence in favor of evolution.

Edmund B. Wilson briefly offered an explanation of Artificial Parthenogenesis and its Relation to Normal Fertilization. His experiments had revealed some exceedingly interesting facts with relation to normal fertilization, and he presented tentatively a theory which explained how fertilization could be accomplished in certain magnesium solutions. Under the title of Simultaneous Volumetric and Electric Graduation of the Condensation Tube, Carl Barus showed how the computation necessary to express the co-ordinates of cloudy condensation in terms of the number of nuclei in action were explained. Two methods were investigated by Prof. Barus. The work was mathematical in character, and does not admit of full presentation without diagrams and formulas. John S. Billings presented a Table of Results of an Experimental Enquiry regarding the Nutritive Action of Alcohol, prepared by Prof. Wilbur O. Atwater, of Middletown, Conn. The title clearly indicates the nature of the paper, and it is not possible at this place to give the various results. Theodore Gill discussed the significance of the Dissimilar Limbs of the Ornithopodous Dinosaurs, which was of a highly technical character, and described his studies made on the skeletons of these early reptiles, which once populated the world. The Place of Mind in Nature and the Foundation of Mind, by John W. Powell, were philosophical presentations of the subject which they described, and form chapters in the scheme of philosophy to which this eminent anthropologist has devoted to recent years. Under the title of Conditions Affecting the Fertility of Sheep and the Sex of Their Offspring, Alexander Graham Bell described the peculiar experiences that he had observed in his flock of sheep in Nova Scotia. He found that the food given to the animals seemed to have a direct relation to the sex of their young. His paper was illustrated by curves on which he showed the proportion of males and females that had been born, and the different periods of their growth. The closing paper presented to the Academy was one by Samuel P. Langley, in which he showed by means of a long chart the infra-red portion of the spectrum which he had mapped out by means of the bolometer. It was simply a statement of results without any descriptions or explanations of what would ultimately be the result of his research. In connection with this he also presented to the Academy the first volume of the Annals of the Smithsonian Astro-Physical Observatory.

In closing, Acting President Hall formally announced the death of Henry A. Rowland and named Ira Remsen to prepare the biographical memoir. The preparation of a memoir on John G. Barnard was assigned to Henry L. Abbott. Arnold Hague, of Washington city, was chosen home secretary to fill the vacancy caused by the election of Ira Remsen to the place of foreign secretary. The Academy then adjourned to meet in Philadelphia on November 12, 1901.

THE ORDNANCE BOARD'S TEST OF THORITE.

As a result of the tests made by the Ordnance Board with thorite the class of ammonium-nitrate shell-fillers have been rejected for the use of the army artillery. In all, eighteen reports on thorite have now been made. The board finds that in eight tests made with 12, 7, and 5-inch shells thorite failed to explode uniformly; for after fragmentation much of the explosive was recovered.

A good filler should be completely burnt and break the shell into pieces neither too large nor too small. The fragmentation secured in the tests was in the main poor. A 12-inch armor-piercing shell charged with 36 pounds of compressed thorite, the pressure varying from 7,000 pounds at the point to 4,900 at the middle and 5,400 at the base, was buried in nine feet of sand. So bad was the fragmentation that only thirty-seven pieces were recovered, the smallest of which weighed one-half a pound and the largest 271 pounds. Over 30 pounds of explosive were undischarged. The most satisfactory of these fragmentation tests was made under the following conditions which could not be actually realized. The fuse was embedded 1½ inches in 36 pounds of thorite rammed in a 954-pound cast-steel armor-piercing shell. About 2,600 pieces were recovered, the largest of which weighed 31 pounds.

The explosive is not only unsatisfactory in its fragmentation, but also tends to pack in the point of the shell, without being ignited by the fuse. An unfused 12-inch armor-piercing shell, charged with thorite, was fired through 5¾ inches of tempered steel, with results not very encouraging. The explosive was driven forward, and so solidly compressed as to leave in the rear a clear space of over a foot, with some four inches of loose thorite. As a whole, the best results were secured with those shells which before fragmentation had passed through steel plates.

The experience of the board with mixtures of thorite and black powder is no more flattering than are the tests made with thorite alone. The entire ammonium-nitrate class of shell-fillers, it is considered, is not to be compared in efficiency with the explosives at present in use.

DEATH OF PROF. HENRY A. ROWLAND.

Prof. Henry A. Rowland died at Baltimore April 16, and by his death America has lost one of her most illustrious physicists. He was born at Honesdale, Pa., 1848, and graduated as a civil engineer at the Rensselaer Polytechnic Institute, at Troy, in 1870. His earliest work was on a railroad survey. He then taught for a time in Worcester University, where he became instructor in physics, and finally assistant professor. He spent a year in Europe about this time, studying under Helmholtz and examining physical laboratories. His reputation grew rapidly, and in 1876 he was tendered the chair of physics in the newly founded Johns Hopkins University at Baltimore, which he held at the time of his death. He was well known as an inventor, and his numerous devices include the multiplex telegraph instrument and a machine for making diffraction gratings. His investigations resulted in a large number of electric and optical discoveries and improvements, and some of the photographs which he succeeded in making of the solar spectrum were the finest ever secured. As a consulting engineer he was retained to direct many great works, such as the electrical plants at Niagara Falls. His work as a member of the Electrical Congress of Paris in 1881 brought him a decoration. He received the Rumford medal in 1884 for his researches on light and heat. He was the author of many papers, and was a member of many learned societies.

DEATH OF RICHARD P. ROTHWELL.

Richard P. Rothwell, a mining engineer, and the editor of our esteemed contemporary, The Engineering and Mining Journal, died in New York April 17. He was born in Canada in 1837. He was graduated from the Rensselaer Polytechnic Institute, at Troy, N. Y., in 1858, where he took a course in civil engineering. He afterward took a three years' course in the School of Mines, at Paris, and then entered a mining academy at Freiberg, Saxony. His active career commenced in a cable and wire rope manufactory in London. In 1864 he returned to America, where he followed the profession of mining in the Pennsylvania coal fields. At about this time he also invented some wire-rope-making machinery which is in use at the present time. He came to New York in 1873, and soon after became editor of The Engineering and Mining Journal, which position he held until his death. He was also editor of The Mineral Industry, a most important technical and statistical volume published annually. He had charge of the statistics of the gold and silver of the United States Census of 1890. He founded the American Institute of Mining Engineers, at Wilkesbarre, in 1871, and in 1882 became its president. He was a member of scientific societies, both at home and abroad.