SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845). ..... $3.00 a year
Scientific American Supplement (established 1876)..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878). ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 19, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PRESIDENT ROOSEVELT WOULD REORGANIZE THE NAVY DEPARTMENT.

In his annual message President Roosevelt says: "There is literally no excuse whatever for continuing the present Bureau organization of the navy. The Secretary must be supreme, and he should have as his official advisers a body of *line officers* who should themselves have the power to pass upon and co-ordinate all the work and all the proposals of the several Bureaus."

We have italicized the words "line officers" (sea-going officers), since it is to them exclusively that the President would intrust the all-important function of having the *last word* as to what kind of ships are to be built for our navy.

We do not hesitate to affirm that the designing of the modern battleship is the most perplexing and difficult problem in the whole field of constructive engineering, calling for a wider range of technical knowledge, a keener judgment, and a more just sense of proportion than is necessary in any of the practical arts of the day.

Under the present organization the work of designing a battleship is intrusted to several separate Bureaus, one of which is responsible for the steam machinery, another for the guns and armor, a third for the equipment, and the fourth, the Bureau of Construction, for the construction of the hull and the general design and arrangement of the ship as a whole. The final word as to the design at present rests in a Board on Construction, which is made up of the Chiefs of the four Bureaus above mentioned, and an additional officer from the sea-going branch of the service. The Chiefs of the Bureaus of Equipment, Ordnance, and Machinery are sea-going officers, so that in the composition of the Board there are already four sea-going officers to one of the Construction Corps; and now even he is to be eliminated.

Let us take a look at the duties of this gentleman, for whose continuance on the Board there is "literally no excuse whatever."

The size of a battleship, as determined by the total weight, or displacement, is set by Congress. This displacement might be called the capital with which the Bureaus have to work in getting out the ship. Each Bureau naturally desires to make that part of the ship for which it is responsible as effective as possible. The Ordnance Bureau wishes to clothe the ship with the heaviest armor and mount the largest possible number of heavy guns. The Steam Engineering Bureau would like to make her the fastest battleship afloat. The Bureau of Equipment would wish to make the ship a record-breaker in respect of the amount of coal and stores she can carry, and in the variety and convenience of the various details of her equipment. Each of these Departments will ask for a big slice out of that working capital of 16,000 or 20,000 tons which Congress has allowed.

Now, it is evident that the final design of the ship must be the work of the Bureau of Construction; for upon this Bureau falls the difficult task of harmonizing the various requisitions of the other Bureaus upon the total displacement of the ship, so that when completed she shall not exceed the limit of weight as imposed by Congress. This is by far the most difficult problem connected with the design. In fact, it is the very essence of the design, and it calls for the widest range of technical knowledge and skill. The hull must be made broad and full enough to give the requisite stability; yet fine enough in its lines to secure the desired speed. Thousands of tons of plating must be worked into the double bottom, and used up in the provision of that intricate system of sub-division which is a safeguard against the sinking of the ship by gun or torpedo. It occasionally happens that ships are run on the rocks, or into one another; the Naval Constructors must make provision to minimize the danger of sinking due to this. They must find out how high above the water they can carry the heavy guns and armor without endangering the stability of the ship. In their investigation, controlled always by the inexorable limit of predetermined displacement or weight, they will find that where the sea-going officers ask to have the guns mounted from 22 to 32 feet above the sea, they can be mounted only from 15 to 25 feet above the sea. Where a request is made for an armor belt reaching from 10 feet above to 7 feet below the water line, limitations of weight prevent them from making the armor belt higher than 4 feet above and lower than 5 feet below the water line unless they reduce its thickness; where a request has been made for engines corresponding to a speed of 20 knots and for a coal supply of 2500 tons, the constructor finds that the maximum possible weight that can be given to these elements necessitates reducing the speed to 19 knots and the coal supply to 2,000 tons; and, in addition to harmonizing these many conflicting demands, the Naval Constructor must see to it that the various concentrated weights of engines, magazines, heavy guns and enormously heavy turrets and barbettes, are so placed with respect to the hull, and, conversely, that the hull is so built with regard to these weights, that it shall not be unduly strained when the ship is being driven hard in heavy weather. Evidently, if there is any one man who is supremely necessary to the work of getting out a successful modern battleship, it is the Naval Constructor.

Yet this is the very man whom President Roosevelt would exclude from that body of "official advisers," who are to "have the power to pass upon and co-ordinate all the work and all the proposals of the several Bureaus."

The folly of this proposal will perhaps be more evident, if we apply Mr. Roosevelt's principle of selection to another highly specialized and very difficult branch of naval construction, that of yacht designing. Let us suppose that a determined assault was being made on the "America" cup; that a syndicate had been formed to bear the expense of building a challenger; and that the all-important question of the design of the yacht had come up for discussion. Let us suppose that the performance of the challenger in her preliminary trials had been so marvelous that the American syndicate approached Mr. Roosevelt under the conviction that he would be willing to advise them, in his private capacity, as to how best to proceed in the matter, particularly as to the composition of the Board of Design for getting out the plans of the defending yacht. Mr. Roosevelt, consistently with his naval policy, would doubtless suggest that a Board of Design be formed, composed, let us say, of Captains Charley Barr, Lem Miller, Rhodes and Hanson, with a Sandy Hook pilot thrown in to stiffen its salt water character; which Board should "have the power to pass upon and co-ordinate all the proposals of," let us say, Mr. Herreshoff, Mr. Gielow, and Mr. Crane, as to the size of the yacht, the ratio of her wetted surface to her sail area, the position of the center of her sail area with reference to the center of her buoyancy, and the various other troublesome, but unfortunately necessary minutiæ of design.

At the risk of laying ourselves open to a charge of temerity, or something worse, we venture to predict that the yachting syndicate, after expressing its sincere appreciation of the advice so tendered, would proceed to place a naval architect in full charge of the design; and we also dare to believe that when Congress takes up the work of reorganizing the Bureaus, it will place the Naval Constructors in charge of the design of our battleships, with the sea-going officers acting in a strictly suggestive and advisory capacity.

TRIBUTE TO A CIVILIAN INVENTOR

We have before us the Annual Report of Gen. Crozier, Chief of the Bureau of Ordnance of the Army, from which we learn that of the five 14-inch coast-defense guns provided for to date, four are to be built up of concentric cylinders assembled by shrinkage in accordance with the system heretofore in use, and the fifth is to be of the wire-wound type. We believe that the construction of these 14-inch guns is a mistake, and that before many years have passed it will be recognized as one of the greatest blunders ever committed in the development of modern artillery. This is not the first time that the SCIENTIFIC AMERICAN has expressed this conviction; for we criticised the design of these guns several years ago, when it was first made public. Progress in the construction of artillery during the intervening years, has all gone to prove the correctness of the position we then took. The 14-inch guns have a muzzle velocity of only a little over 2,000 feet per second; whereas the average velocity of the very latest designs of guns, in both the armies and the navies of the world, is over 3,000 feet per second. However, it is not of 14-inch guns that we wish to speak just now, but rather of the adoption of the wire-wound principle, which is to be used not merely in the construction of a 14-inch gun, but in that of a 6-inch rifle and a new 12-inch mortar. Now that the wire-wound principle has won its way to official recognition by the army, justice demands that mention should be made of the fact that the early and earnest advocacy, and the costly experimental work done by a private American citizen, has undoubtedly contributed more than any other single influence to the final official recognition of the wire-wound gun. We refer, of course, to the inventor of the Brown wire-wound gun, whose successive experimental pieces have formed, during the past dozen years, the subject of frequent illustration in the columns of the SCIENTIFIC AMERICAN.

It must be fully a decade and a half ago since Mr. Brown first demonstrated the possibilties of his system of wire-wound construction by producing and testing a rifle of 4-inch caliber, which, on test, withstood successfully a powder pressure and developed a muzzle velocity nearly 100 per cent greater than that of our army ordnance of that time. This was followed by a later experimental gun of 5 inches caliber, and by a 6-inch piece built under an appropriation from Congress, which aimed to secure a velocity of 3,800 feet per second, with correspondingly high chamber powder pressure. The 6-inch piece was built and brought to successful test, in spite of the not too friendly attitude of the officials of the Bureau of Ordnance. About the same time that Brown was building his 6-inch gun, the government constructed a 6-inch wire-wound piece upon the patented plans of the Chief of the Bureau of Ordnance, and these two guns were tested simultaneously at Sandy Hook Proving Ground. Both guns developed velocities and stood, without signs of failure, powder pressures far in excess of anything that had yet been achieved in any official tests of high-powered rifles, the Brown gun exceeding in these respects the results obtained by the Crozier wire-wound gun. An army board subsequently appointed to pass upon the merits of the Brown gun failed to recommend its adoption. We note, however, in the report of the Chief of Ordnance now before us that the design of a 6-inch wire-wrapped rifle, the interior ballistics of which are identical with those of the 6-inch rifle model of 1897, was completed during the past year, and that four 6-inch guns are to be constructed in accordance with this design. The principal difference between the Crozier and the Brown guns is that in the former the wire wrapping is wound upon an inner steel tube formed from a single piece of metal, whereas in the Brown gun, the inner tube is built up of a large number of convoluted sheets of very high compressive strength. There is no question that the intimate working of the metal which is possible when it is rolled into thin sheets of the kind used by Brown provides a tube of higher resisting quality than a tube made from a single forging, as used in the Crozier gun; and in building up this inner tube of separate elements of high compressive strength, Brown was merely extending the application of the principle which has led to the adoption of wire to give the necessary tangential or tensile strength to the gun. The built-up tube, however, has the disadvantage that it introduces additional complication into the manufacture of the gun; and it is certain that if a single solid tube can be produced which will present sufficient compressive strength to safely take the windings, the advantages lie with this form of construction. We presume that it was considerations of this character that led to the final rejection of the Brown system. The Crozier system, as adopted, is practically the same as that which has been used for many years in the British navy.

Very encouraging results have been obtained from experiments in the destruction of insects injurious to vegetation, by inoculating them with parasitic fungi. Many species of insects are subject to various fungous diseases. In a recent bulletin of the Portuguese Society of Natural Sciences, Pestana describes the method and the curious results of infecting the *Leconium hesperidum*, an insect pest of Portugal, with fungi of the genus *Sporotrichum*, which is parasitic on insects of numerous species. The development of the fungus commences in the interior of the insect, from the ventral surface of which the hypæ of the fungus then grow and form a layer between the insect and the plant. As the fungus continues to develop it forms a white sheet which often covers the insect completely and reduces it to an empty shell, which falls to the ground. The fungus draws all its nutriment from the insect and does not injure the plant. The fungus is first cultivated on potatoes, which are then converted into a paste, which is spattered on the plants, usually in spring. As all fungi need warmth and moisture for their development, the best time to apply the paste depends on local peculiarities of climate, as well as the habits of the insect which is the object of attack.