Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... $3 00
One copy, six months, postage included..... 1 50

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.00 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal or express money order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, APRIL 2, 1887.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 587.

For the Week Ending April 2, 1887.

Price 10 cents. For sale by all newsdealers.

SHAM FIGHTING SHAMS.

The sham sea fight now being arranged by the French naval authorities at Toulon will have an additional interest because of the controversy which followed a like engagement a year ago, when a Board of Admirals, acting as umpires, decided that the torpedo boats had won a victory over modern cruisers and great guns. The decision created no little indignation among the captains commanding the squadron engaged, not one of whom was willing to admit a successful attack on the part of the *flotte torpilleur*.

Last year's sham battle was brought on by an attempt by torpedo boats to destroy or disperse the squadron blockading Toulon, under cover of which several fast cruisers, detained in the port, were to make their way out. As the ships could not actually be blown up, nor shell nor shot be thrown from the land works or the shipping, certain rules were agreed upon to decide when a ship or torpedo boat had been successfully attacked; the Board of Admirals deciding that when a torpedo boat was sighted through the smoke at a distance of one hundred meters, and fired upon, she should thenceforth be considered disabled and out of the fight, while, on the other hand, should she be laid aboard without that the enemy saw her, the ship was her prize as though destroyed by a torpedo.

The engagement opened at 2 A. M., at the first sign of dawn, and by the aid of his electric search lights the enemy outside was beginning to get his ranges fairly in hand, when the smoke of his guns, added to that made by the protecting shore batteries, brought down an impenetrable cloud upon the surrounding waters, and the torpedo boats, having succeeded in getting the exact compass bearing, each one that of the enemy she had singled out, together with the set of the current, dashed boldly out to the attack. When the signals from the judges' station indicated that all hands were engaged the fast cruisers, waiting with steam up for a chance to escape, sped noiselessly out.

The French commanders insist that they should have been permitted to use torpedo boats to beat off the hostile torpedo boats; and, further than this, they say that even if the torpedo boat attack was successful, the fact should not have been made public, for that it only serves to dishearten the sailors, who, let them once believe in the effectiveness of torpedo boat attack and the vulnerability of their ship, and their efficiency in time of action is sure to be seriously lessened.

This view seems, also, to be shared by the English naval authorities, who last summer, at Milford Haven, arranged a naval battle with, apparently, the single purpose of showing the bluejackets how futile is the resistance of torpedo boats to modern ships. A great boom of logs supporting heavy chains was stretched across the mouth of the harbor, and inside, presumably to protect it, a fleet of torpedo boats were gathered. The big Polyphemus, under full head, made a dash for the boom, forced it below the surface, and rode over it. Then was affixed a torpedo which tore it apart, and the enemy, in column, sailed triumphantly in.

But supposing the torpedo boats had not been carefully cooped up inside by the boom, but permitted to go out to the attack, which is their purpose—if they have any—might they not have interfered somewhat seriously with the procession?

There is reason to believe that, when the time for real work comes, the torpedo boat will prove a great surprise to the sham fighters.

THE NEW GUNS FOR THE NAVY.

By the acts of Congress approved August 3, 1886, and March 3, 1887, the sum of $3,120,362 is available for armament of the new vessels of the United States Navy, the monitors, cruisers, and others. The acquisition of the largest and most powerful guns made is contemplated in the granting of these appropriations. The question arises, therefore, What type of gun should be chosen? If we look abroad for a model, the heavy artillery of England, Germany, or France at once are suggested. The works of Armstrong and of Krupp, and the French establishments at Ruelle, St. Chamond, and Le Creusot, present themselves as the great gun factories of the world. Their names seem to guarantee the quality of their product. Basing their qualifications largely on the material used by these producers, the authorities of this country have called for steel of certain definite strength and ductility. The tendency is inevitably to be guided by European practice.

But criticism of this method of dealing with the question is not wanting. Facts that seem undeniable are cited which go to prove that the construction of large guns is not yet perfected. If this is true, it would suggest a field for independent work by the ordnance authorities of this country. We hardly seem justified in following blindly the lead of foreign constructors. The successful gun of the future may yet be an American production.

Many of Krupp's guns are known to have failed in war use. In the British House of Lords on April 30, 1876, the following statement was made by the Duke of Cambridge, Commander in Chief of the British Army: "Out of seventy heavy guns employed against the southwest of Paris (by the Germans), thirty-six were disabled during the first fortnight of the bombardment by the effect of their own fire." It is said that during the Franco-Prussian war two hundred Krupp guns burst, and that the German commanders thought that a week's further resistance by the French would have silenced the batteries bombarding Paris, as the attacking guns would have become disabled by their own discharges. The Italian government has rejected two of Krupp's 100-ton guns, after trying them at Spezia.

From France, similar accounts are received of the behavior of their ordnance under more recent trials. On June 4, 1884, a 24-centimeter (9 45-100 inches) steel gun burst at Havre on the fifth round. The breech was driven backward into an earthwork at the rear, while a portion weighing several tons was driven forward, and fell into the water. Other French guns cracked near the muzzle, and had to be reduced in length. It is reported, also, that during the past year several steel guns have failed, and produced disastrous accidents in their explosions.

In England failures have been numerous. A million of pounds sterling is annually spent upon artillery. Yet *Engineering*, one of the leading English technical journals, speaking of the English artillery says: "After all this, our guns are inferior to those of other nations, and are nearly as dangerous to those who fire them as to the enemy." In 1886 the English were making five 110-ton guns, eighteen 66-ton guns, and six 43 ton guns, in the words of *Engineering*, "all on the same plan as the gun which recently failed on the Collingwood with little more than half its proper charge of powder."

In last March, in the House of Commons, the following facts were cited: To one ship orders had been sent that her guns should only be fired under reduced charges; on another ship, out of nine guns, eight were unserviceable; an 80-ton gun had been sent home from Gibraltar to be repaired; a 9-inch 18-ton gun burst at Woolwich in testing powder; 135 guns were made on one plan, and seven of these burst, requiring a lower rating of charge and reduced initial velocity for the remainder. In a letter to the London *Times* last year, Capt. Robert H. Armit referred to the disabling of all of the 38-ton guns on the Ajax, and ended his letter by stating that "there does not exist a sound gun in the service." This was only one of his letters. So far had he gone in his condemnation, that an injunction was applied for by the makers of the guns, to restrain him, which relief was refused by the court, his criticisms being held to be "privileged communications."

These are some of the lessons furnished by foreign practice. They all possess one peculiarity: they teach us how "not to do it." But we cannot say that a successful and final type of heavy gun has yet been developed. The built-up guns are subjected to strains, molecular and mechanical, that tend to their ultimate disorganization. The powder heats the metal from the interior, expanding the tube and inner rings the most. These expand, not only radically, but longitudinally. On cooling, great resistance is offered to contraction by friction, so that a permanent injury is caused in many cases. The continual expansion and shrinkage have an inevitable tendency to disorganize the whole piece. The theory of the strength of a gun teaches that the metal nearest the bore does the most work in resisting the effect of the discharge. The useful effect of the metal, according to Professor Barlow, varies inversely with the square of its distance from the longitudinal axis of the piece. Thus, the outer layers do comparatively little, and should be, if anything, the softer and more expansible metal. To be of any effect. these layers should be in intimate contact with the inner. This statement would indicate a source of weakness in re-enforced guns. A ring shrunk on may be in such a state of tension as to be ready to part, yet its connection with the tube or ring below it is not as intimate as if it were part of the same metal.

As remedies for these evils, different cures have been suggested. Soft steel of low tensile strength is advocated by one engineer. Such steel is incapable of taking a temper, and is really wrought iron. It is naturally free from many of the defects of the higher steels. The latter crack more readily, and have not the lead-like toughness of the mildermetal. The lower tenacity called for seems a defect, but it is used as the index of the quality. A tough, weldable metal is inevitably of lower tenacity, and in defining this the other qualities go with it. A more radical remedy is proposed by a second engineer. He advocates the abandonment of all steel and the adoption of cast iron. This sounds like a step backward. Yet he fortifies his position with so many instances of what cast iron guns have done, that it is hard to resist the conclusion that they are at least worthy of a more extended trial. Their rifling may need special study, as the wearing of the bands has been one of their weak points. Other details may have to be worked up. But when it is considered that an integral piece is obtained at a minimum cost, the subject seems worthy of trial.

Some aluminum compounds could well be experi-