stem to stern; it is strongly arched in the athwartship direction, having a curve of about 4 feet. At the middle line this deck is about 1 foot below water, at the sides it is about 5 feet below. It forms a roof or shelter to the bold space situated below it, and in the space thus protected are placed the vitals of the ship—magazines, shell rooms, engines, boilers. etc.

Minute water tight subdivision of the bold space below the protective deck, and of the space between it and the main deck, is effected by means of transverse and longitudinal bulkheads and of horizontal flats or platforms. Magazines, shell-rooms, etc., are also converted into separate water-tight compartments. All openings in the protective deck are trunked up by water tight steel casings to the height of the main deck, and surrounded by cellular coffer-dams, which can be packed with canvas, oakum, or other material which would readily check the inflow of water if, in action, the trunk casings were shot through. This coffer-dam protection resembles that long used by the Admiralty constructors in vessels of the central citadel type; and another feature in the Esmeralda in which Admiralty practice has been imitated is in the use of cork, packed in cellular spaces, as a safeguard to her buoyancy, stability, and trim in case the sides in the water line region should be riddled in action. The steel deck is intended to be chiefly useful in protecting from shell fire the vital parts situated below it, and this protection is greatly increased by the conversion of the spaces between the main and lower decks into coal bunkers.

She has twin screw propellers driven by two independent sets of machinery. The engines are horizontal, and on the two-cylinder compound principle. The cylinders are 41 inches and 82 inches in diameter, and the stroke is 36 inches.

The armament is exceptionally heavy and powerful for a ship of such moderate size; and the mountings are of a very novel character, representing some of the latest products of the famous Elswick factory. It includes two 25 ton 10 inch breech-loading guns, six 4 ton 6 inch breech-loading guns; two rapid fire 6 pounders, of Captain Noble's design, and a number of machine guns. The 25 ton guns are mounted as bow and stern chasers, and have an arc of training of about 240 degrees—120 degrees on each side of the keel line. They are carried on central pivot mountings, and fire over a "glacis" formed by the ends of the upper deck. The engraving illustrates the nature of the mountings. On the rear of each slide is a strong steel screen, protecting the captain of the gun; and within the shelter of this screen are placed the hydraulic and other gear by which the gun is trained, moved in or out, elevated, and depressed. Hydraulic mechanism, of Elswick design and manufacture, is employed for these heavy guns, and used for loading as well as working them. A very few men thus suffice, and these are well protected from rifle and machine gun fire.

One important feature in the arrangement is the strong steel loading station built in the rear of each gun. This is really a large steel house, within which are the upper ends of steel tubes, extending down to the magazines and shell rooms. By means of hydraulic hoists the projectiles and cartridges are lifted through the tubes into the loading stations, being sheltered in their transit.

Having reached the loading station, the gun is laid fore and aft, and run in on the slide, being elevated for the purpose of loading. After the breech piece has been withdrawn, the projectile and powder charge are rammed home; and throughout the operations the powder is protected from rifles and machine guns. With large charges exceeding 2 cwt. of powder for the 10 inch guns, this is a matter of great importance. The penetrative power of these 10 inch guns is represented by 21 inches of iron armor; and both of them can be fought on either broadside, as well as being used for chasers.

On each broadside there are also three 6 inch 80 pounders, carried on central pivot automatic carriages, and having a horizontal range of training of about 130 degrees.

The Esmeralda has also a very good auxiliary armament with which to deal blows upon an enemy similar to those against which her men are exceptionally well protected.

We are indebted to the *Engineer* and the *Graphic* for these particulars and for our illustrations.

White Bricks.

M. Hignette, in the *Bulletin technologique des Ecoles nationales d' Arts et Metiers*, describes a new ceramic product from the waste sands of glass factories, which often accumulate in immense quantities so as to occasion great embarrassment. The sand is subjected to an immense hydraulic pressure, and then baked in furnaces at a high temperature, so as to produce blocks of various forms and dimensions, of a uniform white color, which are composed of almost pure silex. The crushing load is from 370 to 450 kilometers per square centimeter. The bricks, when plunged in chlorhydric and sulphuric acids, show no trace of alteration. The product has remarkable solidity and tenacity; it is not affected by the heaviest frosts or by the action of sun or rain; it resists very high temperatures, provided no flux is present; it is very light, its specific gravity being only 1·5; it is of a fine white color, which will make it sought for many architectural effects in combination with bricks or stones of other colors.

WORKERS in bleacheries where chlorine is largely used are singularly exempt from all germ diseases, but suffer from special ailments induced by inhaling that gas.

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 20
One copy six months postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal 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 news dealers 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, 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, NOVEMBER 22, 1884.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 464,

For the Week ending November 22, 1884.

Price 10 cents. For sale by all newsdealers

GRINDING REAMERS.

Every machinist knows the tendency of reamers to chatter and leave flutings. The most careful handling could not always prevent it. For a remedy the scores or flutings of the reamers have been made of uneven numbers, so that a space should oppose a tooth; and sometimes a "slashed" or spiral tooth has been cut instead of a straight one. But no remedy has heretofore been found that is so effectual as careful using and a very light scraping chip.

In a large establishment for the manufacture of hand and machine tools, some experiments have been made with reamers with a result of nearly, if not entirely, removing this tendency to chatter. The remedy is in grinding the flutes or teeth on their face or cutting side, so that they present a sharper angle to the work, and cut rather than scrape.

After the reamer has been fluted in the milling machine or the crank planer, and hardened and tempered, it is submitted to the action of a narrow, round-faced emery or corundum wheel, that cuts under the straight face of the flute and projects its head forward, making a more cutting angle. Trials on very hard charcoal iron castings seem to prove the advantage of this after-grinding. This test was proved on a hole for a taper fit. The finished steel pin was placed in the reamed hole, and driven to seat by a Babbitt metal hammer. When driven back there was not a mark of the reamer's work, although the pin had been oiled to show the marks if any there were. Lampblacking the reamed hole and then driving or pushing in a plug of wood turned and covered with white paper gave a clear smut without any corrugations. In use the reamer cut so freely that no forcing was necessary.

WHAT THE DOCTORS SAY ABOUT BICYCLE RIDING.

Those who work the pedals of the graceful bicycle will, unhappily, find little to commend their favorite exercise in the columns of the medical journals. From time to time there have appeared the results of inquiries of the medical faculty into the effect produced upon the body by continued bicycling; and though a verdict may scarcely be said to have been rendered, the evidence presented proved, in some cases, sufficiently convincing to condemn the practice. The latest opinion on the subject is contained in a paper contributed to the London *Lancet* by Dr. S. A. Straban, of Northampton. Neither Dr. Straban nor those who preceded him on the subject condemn bicycling altogether; but when indulged in constantly and especially when the course traversed is rough or hilly, they agree that it leads to serious disorders. In the case of growing boys, Dr. Straban declares that the amount of pressure upon the perineum directly affects the prostate, the muscles of the bulb, and indeed the whole generative system. "The pelvis," he says, "is flexed upon the thighs or rolled forward. This rolling forward of the pelvis is slight in easy riding, and very marked in fast riding and hill climbing. Now, when the body and pelvis are bent forward, the ischial tuberosities are raised from the saddle, and the whole weight of the body, save what is transmitted to the pedal by the extended leg, is thrown upon the perineum."

This results, he says, in irritation and congestion of the prostate and surrounding parts, tends to exhaust and atrophy the delicate muscles of the perineum, and leads to early impotence. Many cases could be cited where races have become almost totally impotent from immoderate equitation, as the Tartars, and partially so from the same cause, as the Indians. Like others who have written on the subject, Dr. Straban speaks of the "disease of the Scythians," but doesn't tell us just what it was. We know that they were a warlike race and continually in the saddle, and can only conclude that be means this constant perineal pressure reduced them to the wretched condition in which Hippocrates tells us be found them. Hippocrates says: "Their bodies are gross and fleshy; the joints are loose and yielding; the belly flabby; they have but little hair, and all closely resemble one another." Yet bicycling is said to be ten times as severe on the perineum as riding.

THE EADS SHIP RAILWAY.

The working model of Captain James B. Eads' plan for the Atlantic and Pacific ship railway, now in process of construction across the Isthmus of Tehuantepec, has been brought from London, and is now on exhibition in this city, in the basement of the Mutual Life Insurance building, Nassau and Liberty Streets. As a specimen of fine mechanical work this model is quite remarkable, and probably surpasses anything of the kind heretofore constructed.

It represents the hydraulic lifting dock, by which the largest ships are quickly lifted out of water; the railway cradle and truck, by which the great vessels are transported across the country; and the hydraulic turn table, by which truck and ship are rapidly revolved to meet any required changes of direction in the line of travel of the railway.

The gigantic size of the cradle truck that bears the ship overland forbids the employment of curves of a less radius than twenty miles; but by means of the hydraulic turn table, which is simply a great float, the largest vessel may be turned, switched off to pass other vessels, and run upon any desired diverging track, thus obviating the necessity of curves in the railway track itself.

The Tehuantepec Ship Railway will be 134 miles in length. It commences on the Atlantic side at Minatitlan, and will terminate on the Pacific side probably at Salina Cruz.

The working model now shown is made to a scale of three-quarters of an inch to a foot, and occupies a length of