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(Illustrated articles are marked with an asterisk.)

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For the Week Ending May 10, 1890.

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TORPEDO BOATS.

One of the most satisfactory of the new additions to the United States navy is the torpedo boat Cushing, of which a full description, with illustrations, was given in the SCIENTIFIC AMERICAN of February 1 last.

This boat lately sailed from Rhode Island, where she was built, to Washington. The little ship is satisfactory as a first example, and shows that the government can, and has, after long trial, produced one torpedo boat that is nearly up to the best standards of its class. Other governments have scores of torpedo boats. The United States has now built one. The ice is broken. Let us hope that hundreds of others, even better than the Cushing, will soon be constructed. They are wanted in all our harbors to assist defense.

The Cushing lately sailed from Newport to New York, driven at the highest speed they could get from her, and made the voyage in three minutes less than seven hours, at an average velocity of 19¼ knots per hour. This is superior performance, and indicates an excellence of construction in the mechanism and vessel that is very promising for the future.

On her trial trip she developed 22½ knots per hour. The contract called for 22 knots for three hours.

The Cushing is 138 feet long over all, and she draws five feet three inches of water. Her depth from the crown of the deck amidships to the keelson is ten feet, and her breadth of beam fifteen feet. Her displacement when loaded with ten tons of coal amounted to 117 tons. She can carry thirty-nine tons of coal, with which she could steam 3,000 miles at ten knots per hour. Economy of space was one of the chief objects in view on the part of her builders. Every cubic foot is utilized. She has eleven compartments and ten water-tight bulkheads. There are no doors connecting the compartments. The lower decks fore and aft are entered only by hatchways. She has fuel bunkers all along her sides, abreast of her engines. Her only other protection is her pumping machinery. She can pump 100 tons of water in seven minutes, 870 tons per hour, and her own weight in less than ten minutes. If she should have a shot hole nine inches in diameter through her engine room compartment, her pumping capacity would enable her to keep free from water.

When equipped, she will carry a torpedo tube on each bow and a torpedo gun amidships, and will thus be able to launch three torpedoes at once. She will carry five rapid-fire one-pounder cannons, and will have a search light.

She is built with twin screws and quadruple expansion engines. There are more than three miles of tubes in her boiler and more than one mile in her condenser. It is estimated that on her official trial trip she developed more than 1,700 horse power. The diameter of her turning circle is only 250 feet. She can be propelled astern as well as forward, and has made over seventeen miles an hour while going in that way. The tubular boilers of the Cushing are of English design, such as are used in the fastest British torpedo boats.

The success of the Cushing and her presence in Washington, where members of Congress can witness her maneuvers, will, we hope, lead them to authorize the construction without delay of a better and faster class, such, for example, as the flock of torpedo boats possessed by the Italian government, among which are the Aquila, Sparviero, Nibbio, Falko, Aoltoio, etc. These boats are 13 feet longer than the Cushing and have a little greater engine power. On their three hours' trials three of them developed respectively 26·2, 26·6, 26·8 knots, the fastest being over 4 knots quicker than the Cushing. During some of the trials a speed at the rate of 28 knots per hour was attained. The Italian navy has several torpedo boats of smaller dimensions than the Cushing, some of which run at 22½ knots per hour. A guaranteed speed of 26½ knots is required by the Russian government for torpedo boats lately ordered. These fast boats are built at Elbing, Prussia.

SHIPS AND GUNS NEEDED FOR DEFENSE.

A recent number of the New York *Herald* gives at considerable length a showing of the insecure condition of the American coast cities in respect to naval attack by foreign enemies. Reports of opinions by naval and military officers are also given, the general purport of which is that at present, and for many years to come at the rate of progress now being made, our principal seaport cities are likely to remain exposed to easy capture by any determined enemy having under its control a few superior vessels of war. The *Herald* gives a pictorial representation showing the helpless situation the city of New York would be in, supposing a hostile fleet should approach only as near the metropolis as Flushing Bay, 8½ miles from the City Hall and Post Office. The picture represents the ruins of the government edifice, as a result of a hit by a single shell from a great gun. New York, Brooklyn, and adjacent cities would be at the mercy of such a fleet. At present there are no forts, no guns, no ships, and few available means at command of the government of power sufficient to prevent the coming in of hostile war ships to the position mentioned. What is true of New York is equally true of all the principal cities on our seaboard. Portland, Me., with its splendid harbor, would be an easy prey to an enemy. Modern war ships might lie at anchor, out of range of the present old guns and fortifications, and shell all parts of the city.

Portland is the strategic key to the military occupation of all Maine and the greater part of New Hampshire, and is necessary as a winter port to the Province of Quebec. Between hostile powers, whichever one has Portland has practically all the country between the lower St. Lawrence and the Atlantic seaboard east of Portland as tributary dependencies.

In case of war between the United States and Great Britain, the capture of this city would be among the first achievements aimed at. Its capture would put the invaders effectually in possession of the whole territory, to use as a base of operations and supplies.

In the present state of its defenses Portland could easily be captured by an invasion from the sea, but could never be recaptured by forces from the land. The loss of this portion would be well nigh fatal to American supremacy in New England, for with the fall of Portland would fall in due time Boston also.

Boston is equally defenseless. So are Baltimore Charleston, Savannah, New Orleans.

Colonel J. A. Smith holds that it pays to build forts we do not use, simply because the building of them removes the need to use them. The nation that is not defended is the one that needs defenses most, and when the need arises, it is most likely to come suddenly. If by building forts and ships of war the country can avoid a war, the money that they cost is well spent. Few will dissent from the correctness of this proposition.

As to modern fortifications, such as the construction of first-class steel defenses, we believe Congress has so far done nothing. Bnt in respect to war ships some progress has been made. We have now in the Mediterranean a fleet of four steamers, not very fast and not formidable, but still creditable ships. Three other better vessels are nearly ready, and a few on the stocks. The strongest fighter of these—the Texas—built on English plans, it was found, after construction was well begun, would probably not float, owing to excessive weight, and work was stopped. But the most recent conclusion is that she will float, and her completion is advised.

The Board of Bureau Chiefs of the Navy Department have finally recommended a few minor changes in the plans of the vessel, but, on the whole, have made no material reduction in the weights, thus practically acknowledging that the original calculations were correct. The principal changes made are in the location of the heavy guns and a reduction of the space for stores. As originally designed, the guns were raised only eighteen inches above the decks. On account of the liability of injury to the deck when these great guns are fired, the board concluded to raise them to three feet above the deck. It the end it may be found desirable to reduce by an inch or so the thickness of her armor, so as to provide more stores and more men. The work of construction can continue, however, without further delay.

Future of the Electric Motor.

Joseph Wetzler, in his article in *Scribner's* on the "Electric Railway of To-day," concludes by making the following prediction: "With the advantages of the electric railway so clearly pointed out, and so unquestionably demonstrated in actual practice, it would not be unsafe to hazard the opinion that, in ten years, at the farthest, there will not be a horse railway in operation, at least in our own country. The horse will then be once more returned to his legitimate field of labor, and the street car passenger will be transported at an increased speed, and with all the comforts of easy riding, in cars propelled and lighted by electricity; while it is by no means improbable that, with further work on the line indicated, the passenger may step aboard a train in New York at ten in the morning and eat a five o'clock dinner in Chicago on the same day. Enough has indeed been accomplished to show that electricity is destined to be one of the most powerful factors entering into our social conditions, and that the ease of distribution and convenience of power afforded by it must bring forth changes in the social order which are even now hardly realized."

Good Advice.

Don't sign, says a contemporary. But such a caution as this seems hardly necessary to any person in the full possession of his faculties. Yet it is astonishing how many people there are, including good business men, who attach their signature to papers or documents whose contents might have a serious bearing upon themselves or their affairs, with scarcely a glance at their contents. Carelessness in failing to acquaint themselves with the contents of a paper before signing it has worked incalculable harm to thousands of well intentioned people. Then read all papers carefully before you sign them, particularly those that express or imply anything in the nature of a contract or a legal obligation.

New Mode of Mounting Guns.

A successful trial of Sir W. G. Armstrong, Mitchell & Co.'s new mode of mounting guns to be fired *en barbette* recently took place off the Isle of Wight, on board her Majesty's screw gunboat Handy, a vessel specially appropriated for gun trials. Particular importance attached to the proceedings on this occasion, the invention to be tested being designed to meet a defect which has been much felt in regard to the existing method of mounting heavy guns in barbette ships. Several novel features are found in the principal design, the total result being practically a new departture in naval gunnery. The gun not only returns automatically into the firing position after each discharge according to the Vavasseur recoil system, but is capable of being elevated so as to fire at angles up to 40°, or double that allowed by any previous mounting for such a gun, the caliber of the piece in this instance being 9·2 inches, and the weight 22 tons. The carriage on which the gun is mounted is also fitted with a steel shield, 6 inches thick, which is attached to the mounting and trains with it. The construction is such that the port through which the gun fires is completely filled by the gun at all angles of elevation, thus preventing the entry of projectiles or splinters. The mounting is intended for use in barbette batteries on the upper deck, and no similar carriage has hitherto been provided with any shield or screen capable of resisting the fire of anything more than machine guns, whereas the shield now devised will effectually protect the gun and gunners from all rapid-firing guns at present in use in the service. The elevated fire is valuable as affording the means of attacking coast batteries placed on high ground at short range. At present, elevated land batteries protecting a narrow passage or harbor can fire down on ships attempting to pass them without being open to attack themselves. At the trial which took place on March 29, fifteen rounds were fired at angles ranging up to the maximum of 40 degrees with perfect success in every respect.

Specimens of the Coco-de-mer.

Two specimens of Gordon's "forbidden fruit," the curious double cocoanut of the Seychelles, were brought to the Pall Mall *Budget* office a few days ago by Mr. J. Troubridge Critchell, who had just received the nuts from the Mauritius. The fruit of the coco-de-mer has a peculiar interest to the many admirers of the late General Gordon, who firmly held to the idea that the Seychelles were the Garden of Eden, and that this unique vegetable growth was the cause of the world's depravity, against which Gordon fought so bravely. The nut weighs twenty pounds, and measures twenty-five inches across. The palm on which it grows (*Lodoicea Seychellarum*) is one hundred feet in height, and is only to be found on this tiny group of islands. Hundreds of years before the Seychelles were discovered, these nuts were washed up on the Maldive Islands, and the wiseacres of those days told the people that this seaborne fruit had grown on a submarine tree, and that it had a mysterious power of counteracting poisons. Hence the name—coco-de-mer. It is probable that Gordon met with allusions to this wonderful nut in Arabic MSS., and afterward visiting the Seychelles, was struck by the beautiful and isolated group of islands and their double cocoanuts.

Tuberculosis in Sleeping Cars.

The plush, velvet, and silk hangings must go. Seats must be covered with smooth leather that can be washed off, carpets give place to rugs, to be shaken in the open air at the end of every trip—better still, abolished for hardwood floors; the curtain abomination must make way for screens of wood or leather, the blankets of invalids' beds be subjected to steam at a high temperature, mattresses covered with oiled silk, or rubber cloth that may be washed off, and, above all things, invalids provided with separate compartments shut off from the rest of the car, with the same care which is taken to exclude the far less offensive or dangerous smoke of tobacco, cuspidors half filled with water, and consumptive travelers provided with sputum cups which may be emptied from the car. It is not necessary to say here that the sole and only danger lies in the sputum. The destruction of the sputum abolishes the disease. When the patient learns that he protects himself in this way as much as others—protects himself from the auto-infection, from the infection of the sound part of his own lungs—he will not protest against such measures.—*Dr. I. W. Whitaker, in the American Lancet.*

Length of Great Bridges.

A comparison between the Forth and other great bridges is as follows:

	Length. Feet.	Greatest Span. Feet.
Forth Bridge	8,091	1,710
Tay Bridge	10,780	245
Niagara Bridge	808	808
Landore Bridge	1,760	110
Crumlin Bridge	1,800	150
Britannia Bridge	1,511	460
Brooklyn Bridge	5,862	1,600

Agricultural Products of the Philippines.

The United States consul at Manila says that the principal products of the Philippines are hemp, coffee, rice, tobacco, corn, and fruits. The cultivation of hemp is a very simple operation, and as it yields a large revenue, it is not surprising that it is a popular occupation among the people. This staple is the product of a species of plantain which grows wild on the Pacific slopes of the volcanic elevations of the Philippine islands, particularly the southern ones. Under cultivation the tree attains a height of 15 or 20 feet, with a trunk from 8 to 12 inches in diameter. In its green state it is crisp and juicy, and can be readily cut down with an ordinary carving knife. The preparation of the hemp for market is very simple. When the tree has properly matured, it is cut down and divided into long strips, which are shredded under a large knife kept in the proper position by a rude lever. This separates the juice and the spongy matter from the fiber, and the latter is spread out in the sun to dry, after which it is packed in bales of about 240 lb. for shipment. There are a large number of plantations owned by natives, as well as by Spaniards and mestizos, where the trees are set out in regular rows, and well cared for. The cultivation of the coffee tree has been followed to some extent for the past thirty years, but interest in this branch of cultivation has been renewed during the past four or five years, and it is expected that its export will increase annually. There is no way of ascertaining the area of land occupied by coffee trees nor the amount of coffee annually produced, as the trees are scattered in various parts of the archipelago. The largest plantations are in the province of Batangas, in the island of Luzon, but many of the natives have a few trees in their front yards, under the shade of the plantains, that may yield four or five bushels of coffee berries. The increase in production has been marked within the past few years. In 1887, a little over 5,387 tons were exported; in 1888, about 7,501 tons. Although rice is the native's principal article of food, there is not enough of it produced in the archipelago for local consumption, and more than 70,000 tons are imported annually. The tobacco industry in the Philippines employs a large amount of capital and a vast number of hands. The best tobacco comes from the provinces of Cogayan and Isabella on the island of Luzon, the average annual yield from these being from 60,000 tons to 100,000. Tobacco is also grown in the provinces of North and South Ilocos, Abra, Lepanto, Nueva Exija, and Union, all on the island of Luzon, and on the islands of Cebu and Panay. The tobacco produced in the former provinces is called *Igorrotes*, while that from Cebu and Panay is designated *Visayas*.

In cultivating, the earth is well plowed and harrowed and the seed sown in September. About six weeks later the young plants are transplanted about two feet apart, and the field is kept free from weeds, and otherwise carefully attended to until February, when the plants are almost ripe. The crop is gathered in March and April. It is then made up into "hands" of one hundred leaves each, the leaves of each hand being fastened together at the stem ends with strips of bamboo fiber. These hands are then hung up in rows upon bamboo poles under long sheds, which are open on all sides, and when they are almost dry they are piled up on the ground and allowed to ferment. The leaves are then dried again and packed into bales for shipment to Manila, where they are repacked and pressed into bales for export, or sent to the factories to be converted into cigars and cigarettes. It is not sold by weight at the plantation, but by the *fardo*, which contains forty hands.

All the tobacco manufactured in the Philippines is made into cigars and cigarettes. The tobacco is classified at the plantation into first, second, third, fourth, fifth, and sixth grades, according to the size and quality of the leaves. In Manila there are twelve large tobacco factories, one of which, La Flor de Isabela, the factory of the Compania General, manufactures seventy-five brands of cigars, ten brands of cheroots, six grades of cut tobacco, and eight brands of cigarettes. These twelve factories give employment to about 11,000 persons. Besides these there are numerous small factories owned by natives and Chinese. Corn holds a very unimportant place among the agricultural products of the Philippines, although it is cultivated to some extent. All the corn produced is that known as maize or Indian corn. The method of cultivation is similar to that followed in more advanced countries, but the implements used are of a very primitive character. As a rule, the land is plowed with a sharpened stick drawn by a buffalo, after which a heavy wooden frame, about four feet square, with long wooden teeth on the under side, is drawn over the ground to break the lumps. The corn is then hoed by hand, and all that is necessary thereafter is to keep the weeds down. No manure nor fertilizer of any kind is used.

No attention is given to fruit culture, and mangoes, bananas, apples, guavas, and numerous other native fruits grow without cultivaton, and are gathered by the natives in the hills and even within the limits of the cities and towns, who bring them to Manila and sell them in the streets and markets. Consul Webb says that no attempt has ever been made to export any of these fruits except a few mangoes, which are sent every year to Hong Kong and other neighboring ports, although it is quite probable that under a proper system of cultivation, grafting, etc., some remarkably good fruit might be developed that could be preserved or canned, and sold at a great profit in Europe and the United States.

Manufacture of "Compressed Yeast."

In a thesis presented to the school of pharmacy of the University of Wisconsin, Mr. Alfred J. M. Lasche describes how compressed yeast is made in various parts of the United States. The thesis is printed in the *Pharmaceutische Rundschau* of New York. In regard to the preparation of the mash, it is stated that 3,130 lb. of ground corn are mixed with 4,500 gallons of water. This mixture is heated to 190° F. (to swell the starch, and thereby facilitate its inversion) and subsequently cooled to 154° F., then 1,920 lb. of ground rye and 550 lb. of ground malt are added, the malt being specially employed for the amount of diastase it contains, and is indispensable in the converting process. This mixture is then allowed to stand one hour, and is finally cooled to 80° F. The proportions of the different grains are of course largely a matter of opinion, and the various yeast manufacturers have different working formulas.

When the mash has cooled to 80° F. it is drawn off into another tub, and one gallon of concentrated sulphuric acid is added, in order to dissolve all remaining starch, dextrin, and glutinous matter, and to convert them into grape sugar. Finally, a quantity of compressed yeast is added to start the fermentation. This yeast settles to the bottom of the tub, but as soon as fermentation has started (usually in half an hour), and carbonic acid is being generated, the current of the latter gradually carries the yeast to the top of the liquid. It remains there, covered by a layer of the chaffy parts of the grain, until the yeast has accumulated in a sufficiently large quantity, and the current of carbonic acid has become strong enough, when it eventually breaks this film of chaffy particles, and collects on top of it in the form of foam. This goes on until all the nutritive matter has been assimilated. The foam, containing all the yeast, rises about two feet above the top of the liquid, dependent on the size of the tub, and when no more effervescence is noticeable, fermentation is complete.

Immediately after fermentation has ceased the foam is drawn off by means of troughs, and run, together with a fresh supply of water, into a revolving, six-sided and declining cylinder, lined with a sufficiently fine strainer. During this step of the process nearly all the chaffy remnants of the grain are separated, and the liquid, containing the yeast plant in suspension, is allowed to flow into a basin, whence, by means of a trough, it finally flows into a large tub.

The product in this tub is prevented from further fermentation by the addition of a sufficient quantity of ice. The yeast is now allowed to settle, the supernatant liquid drawn off, and the residue repeatedly washed to free it from all mechanical impurities.

When sufficiently cleansed, it is run into a press by means of a steam pump. The press is constructed of a column of iron frames, both sides of each frame being covered with a very fine straining cloth, and all the parts fitting tightly into each other. The yeast having been pumped into such a press, the water is separated from it by means of the strainer, and carried off through a waste pipe.

The yeast, now compressed, is taken out in the form of large cakes, and in this condition it is brought into commerce.

Arithmetical.

Briefly stated, the rule of least common multiple is as follows: Continue dividing the numbers in question by the least measure which is common to two or more of them, until there are left no other two numbers which are divisible, without a remainder, by a quantity greater than unity. Then the product of the divisors and the remaining numbers will give the least common multiple, thus:

2) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
2) 1, 1, 3, 2, 5, 3, 7, 4, 9, 5,
3) 1, 1, 3, 1, 5, 3, 7, 2, 9, 5,
5) 1, 1, 1, 1, 5, 1, 7, 2, 3, 5,
1, 1, 1, 1, 1, 1, 7, 2, 3, 1,

$2 \times 2 \times 3 \times 5 \times 7 \times 2 \times 3 = 2520$ = the number which is divisible without a remainder by the first ten numerals.—*H. P. Turner, in Eng. Mech.*

MR. DENMAN THOMPSON, the father and chief actor in the comedy of the "Old Homestead," which has been played steadily for so many months in this city, is an inventor. He has recently patented a railroad truck, the object of which is to prevent disaster from derailment or to lessen the peril of railroad travel. He has a handsome model which is on exhibition at the Westminster Hotel, where the inventor resides.