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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.

A 75,000 HORSE POWER TURBINE PLANT.

The great power station which is being erected at Chelsea, London, for the operation of the District Railway system, possesses special interest because of the fact that it will be the first large electrical power station to be operated entirely by steam turbines. The plant will consist of ten turbines, each of 7,500 horse power, with an overload capacity of 50 per cent above the normal rating. The turbines, which are being supplied by the British Westinghouse Company, will be of the Parsons type with Westinghouse modifications. Each turbine will be direct-connected to a three-phase generator of 5,500 kilowatts running at a speed of 1,000 revolutions per minute. There will be only four field-magnet poles, and current will be produced at 11,000 volts potential. The dynamos and the turbines are being built, part of them at the works of the American Westinghouse Company at Pittsburgh, and part at the new works of the British company at Manchester. As a result of the high speed of revolution, and the consequent small number of field magnet poles required, the dynamos will be only about 9 feet in diameter; whereas, if reciprocating engines, of the type used at the Metropolitan Elevated Company's power station in this city, were used, running at 75 revolutions per minute, the diameter of the generators would have to be not less than 32 feet.

PERMANENCE OF STEEL FRAMEWORK IN TALL BUILDINGS.

The construction of the Rapid Transit Subway has necessitated the pulling down of a twelve-story skeleton steel building at the corner of Broadway and Forty-second Street, which was erected early in 1899. Its removal has given an opportunity to determine how far the methods adopted for the prevention of rusting or oxidation of the steel of these buildings are successful. Of course, the period of time during which the steel has been incased, three years, is very limited; but it is sufficiently lengthy to afford at least some indications of what may take place during the lapse of centuries. At the time of erection the steel work was given two coats of paint composed of carbon and linseed oil. The columns and girders were incased either in rectangular shells of brick, or with red brick and terra cotta; if with the latter, the spaces between the inclosing material and the steel work were filled in with brick and cement mortar. After the recent removal of the brickwork and terra cotta, the steel was found to be in first-class condition and showed no signs of decay. In the few spots where there was a slight evidence of oxidation, the rust had been on the columns, apparently, at the time they were put up, or it was due to some abrasion of the protecting coat of paint. It is interesting to note that the outside columns supporting the outer walls of the building were found to be in just as good shape as those in the interior of the building. Although, as we have said, the period of test was a brief one, it is considered by architects to have been long enough to establish the thoroughly reliable nature of the standard methods of protection adopted in this form of building.

THE CHANGES IN THE CROTON DAM.

It was to be expected that when the present Chief Engineer of the Aqueduct Commission proposed to make a radical change in the plans of the partly completed Croton Dam, his action would provoke more or less criticism. The vast importance of this great work, the standing and acknowledged professional ability of the former engineer, Mr. Fteley, who is responsible for the original design of the dam, and the fact that the radical changes proposed would involve the tearing down of a considerable portion of the completed structure, combined to produce a feeling of astonishment that any such fundamental reconstruction should now be proposed. However, after giving careful consideration to the reasons assigned for the proposed changes, and making a personal investigation at the dam, the SCIENTIFIC AMERICAN came

to the conclusion that so far from having needlessly delayed the completion of the Croton Dam, Mr. Hill, the chief engineer, has not only added greatly to the stability and appearance of the structure, but has prevented the incorporation of a feature in the design which, in all likelihood, would have brought about the ultimate collapse of the dam. To say the least, it was a delicate task to propose a change which would look like an indirect censure of the plans of a distinguished predecessor; and it was a daring task when such changes were certain to provoke a storm of angry opposition from the citizens, who had already grown weary of the prolonged delay in the completion of this much-needed work. While we question altogether the judgment, we can fully understand that it was the best of motives which prompted the Merchants' Association of New York to criticize both the present Chief Engineer of the Aqueduct Commissioners and the Commissioners themselves for the delay of the dam. At the same time it is distinctly fortunate that the present Mayor of New York was able to take a clear grasp of the situation, and so far from removing the Commissioners, as the Merchants' Association demanded, did not hesitate to indorse their work, especially as concerns the proposed changes.

Mr. Fteley, who designed the original structure, substituted an earth dam for a solid masonry dam on the southern end of the structure, for reasons of economy. That he himself was at one time sensible to the risks which led his successor to condemn the earth dam, is shown by the following extract from a report on the great Quaker Bridge Dam, for which the present dam was afterward substituted, made by him as Consulting Engineer to the Aqueduct Commissioners, as far back as July 25, 1887, in which he says:

"An earth dam, with a core of masonry, was also considered. In such structures, the thrusts exerted by the earth against the center wall, during construction and at the different stages of the water surface, when filling or emptying the adjacent basin, are unknown or, at the best, very uncertain; if the wall became fractured under their action, or allowed the water, in places, to pass through, the leaks, under such a considerable and unusual pressure, would endanger the stability of the earth embankment. Moreover, the authorities agree that this kind of structure is not safe to adopt beyond a certain limit of height; and it was thought unwise to attempt an experiment, which owing to the importance of the interests involved, was not justified by the saving in expense which might have been effected by its adoption.

"In this case, where the welfare of New York is concerned, and where the consequences of a possible disaster, with 30,000,000,000 gallons of water behind the dam, may well be imagined, we must deal with certainties: we have before us many successful instances of masonry dams, although of less magnitude, and the proposed structure can be so proportioned and constructed in masonry as to stand effectually the great pressure to which it is to be subjected."

It was in practically the same terms that the present Chief Engineer of the Commission recommended that a revision of the Croton Dam plans be made, to the extent of substituting masonry for earth, and we think that the above quotation from a report of the original designer of the dam itself should silence forever all criticisms that might suggest that the change in the plans was made from any other motive than that of securing the most durable and perfect structure possible.

WARSHIP CONSTRUCTION IN PRIVATE AND GOVERNMENT SHIPYARDS.

BY OUR LONDON CORRESPONDENT.

In view of the experiments of the British Admiralty department, now in progress, to ascertain whether a private shipyard can build warships with greater speed than the government shipbuilding yards, the results in this direction in other countries afford interesting comparisons. In Germany and France battleship construction in both the private and state yards is very and unnecessarily protracted. And this delay constitutes a grave national danger which, it would seem, the respective governments do not adequately appreciate. In England, where, on the other hand, such work is carried out with all possible expedition, it has now become an axiom that "Great Britain can afford to wait until the Admiralty know the designs and efficiency of the projected vessels of other (European) nations before she commences to build a new vessel to excel them." In the case of the German battleship "Kaiser Karl der Grosse," a vessel 377 feet 4 inches in length and of 11,500 tons displacement, with four 9.4-inch guns and eighteen 5.9-inch guns, and with engines of 13,000 i. h. p., capable of developing a speed of 18 knots, she was erected in the private shipyard of Messrs. Blohm & Voss at Hamburg, and no less than 40 months and 5 days elapsed from the laying of the keel until delivered to the government. Even the Krupp firm, notwithstanding its modern and extensive equipment, are not much

faster, since they occupied 35 months in building the "Zaehringen." With respect to the Imperial dockyards, they are quite as slow, since it was nearly four years before the "Wittelsbach," a similar vessel to the "Kaiser Karl der Grosse," was ready for sea. In France a similar state of affairs exists, but in this case the delay is more attributable to the uncertainty and hesitancy of the Naval Department, since the French government have a peculiar way of suddenly stopping work upon the construction of one vessel and directing operations upon another ship. But in the case of the three new battleships "Democratie," "Justice," and "Verité," which are each to be of 18,000 horse power, it is calculated that they will occupy four years in building. What is the result of this protracted construction? These three French battleships are of tremendous power, but progress in naval affairs and armaments is so rapid that by the time they are in commission they will be somewhat out of date.

In considering the practice in England, we find that although the government is comparatively slow in construction, everything is being done by the Admiralty to decrease the time occupied in building. The private shipyards, when they have a vessel in hand, crowd the workmen upon it, and get it off the ways as quickly as possible. The recent cases of the Chilean battleships "Libertad" and "Constitucion," and the new type of torpedo destroyer "Erne," offer striking examples of the speed with which battleship construction is carried out. The two first named, notwithstanding their large dimensions and displacement, were launched 10 months after the signing of the contracts, while the builders actually undertook to have the vessels complete and ready for use within 18 months; and if the speed of building with which they were commenced had been maintained, the contract time would have been shortened by one month. To build and equip a first-class modern battleship such as these Chilean war vessels, ready for action, within 17 months is a commendable achievement. In the instance of the torpedo boat destroyer "Erne," a record in quick construction was accomplished. This vessel was launched 7 months after the signing of the contract, and will be handed over to the English Admiralty 6 months below the contract time. Even in the government dockyards quick construction is the chief desideratum, though in this case the speed is not so great as in the private shipyards. But the English Admiralty are determined to cut down the time for building to the minimum, and they have now inaugurated a new system of decentralization, by which there is a superintendent for naval contracts. Speed in construction is the continual demand of the government, and it is furthermore a great national demand. For the battleship costing \$5,000,000 upward, when launched, to be out of date, owing to the long time occupied in its construction, is a result which, in the interest of the citizens and the defenses of any country, should be remedied at all costs.

"SHAMROCK III"

BY OUR GLASGOW CORRESPONDENT.

It seems to be inevitable that the building of yachts intended for "America" Cup racing should be attended, year by year, by the circulation of a crop of extraordinary stories regarding the appearance of the yachts, and the wonders which they may be expected to perform. The building of the boats now under construction has run to the usual accompaniment, and the British yacht has received, if anything, the larger share of the attention of the resourceful inventors of these rumors. Anyone who has been led by these stories to the expectation of some sensational development in the boat built at Dumbarton to carry Sir Thomas Lipton's third "America" Cup challenge, may be counted foredoomed to disappointment, for the yacht which has been evolved by Mr. William Pife, Jr., differs so little from recent challengers and defenders that it requires the trained eye of a practical yachtsman to identify the developments.

Such changes of type as have been made are, however, none the less important because they are unsensational. In the recent contests which have been sailed for this much-coveted trophy there has been a marked leveling of the abilities of the opposing yachts, and it has come to be recognized on both sides of the Atlantic that a runaway victory for either side is not among the things which can fairly be expected. The last contest, that sailed between Columbia and the Watson challenger, "Shamrock II.," was admitted on all hands to be the closest match ever made for Cup honors, and it would therefore have been a policy for Designer Pife, when called upon to build another Cup racer, to have ignored the developments already made and to have struck out in the direction of experiments of unknown value. This course, if it should, of itself, have been sufficient to discountenance the rumors regarding the sensational developments to be expected in the Scottish boat.

As a matter of fact the designer of "Shamrock

recognized the coming match as one in which the victory is likely to be gained by seconds and minutes, and the boat which he has produced shows that his line of action has been in recognizing and strengthening the weaknesses of the two previous challengers rather than in striving after a marked degree of originality. Generally speaking, it may be said that the chief novelty in the design of "Shamrock III," lies in the fact that stiffness and great sail-carrying power, which have been the characteristic of each Cup challenger since and including "Valkyrie III," have been treated on this occasion as a matter of secondary importance. All yacht designing is largely a matter of compromise. If a stiff, powerful boat is the main object of the designer, then the soft flow of the lines which give ease of driving must be sacrificed to some extent. In "Valkyrie III," "Shamrock I," and in less degree, in "Shamrock II," the design was controlled by a desire to produce such a hull as would stand up well to the immense pyramid of canvas which it was proposed to use for driving. In the latest boat the controlling feature of the design has been altered, and Fife has apparently directed his energies first to the posed to use for driving. In the latest boats the conditions of weather. He has therefore given "Shamrock III" a round fullness of body which makes her stand out from the list of challengers as a yacht of marked individuality. The fin-keel type of underbody is naturally retained, but the hull of the boat is drawn so well down that the fin is made much shallower than usual. It is, in short, less of a fin and more of a keel than has been seen on any Cup racer in recent years. The draught has also been cut down to a considerable extent, and the new craft will float in two feet of water less than was necessary to keep the Watson boat off the bottom.

These changes mean naturally a certain loss of initial stability, and to partly compensate for this the beam, as compared with that of "Shamrock II," has been slightly increased. The full round head which was characteristic of the Watson boat—and helped greatly to her undoing when she met a head sea—has no place in the Fife model. From the point of greatest beam the bow is carried forward in an easy sweep which gives an entrance cleaner than on any of the previous "Shamrocks." The excessive thinning down of the flanks, which was also a noticeable feature of the previous challenger, has also been avoided, and the beam of the boat is carried well out into the counter. In profile the yacht has fewer peculiarities. The bow is shorter and sharper than usual, and rises at an angle that should keep the decks moderately free from water in anything less than a heavy sea. The sheer is peculiar, and looks ungraceful to eyes accustomed to the low waist and the rise fore and aft to which yachts are usually sheered. The rail of "Shamrock III" is practically level.

In the construction of the boat Messrs. Denny Brothers have produced an interesting bit of work, but the interest lies mainly in the details and the quality of the workmanship rather than in the introduction of any new principles. In the matter of material, the boat might be regarded as a retrogression, for the manganese bronze with which the last Cup yacht was plated is discarded in this instance for nickel-steel, such as is largely used in the construction of launches and torpedo boats. The builders, on whose advice this was done, are, however, convinced that this is a step in the right direction. The difficulty of working the manganese bronze and the extra thickness necessary to make up for the doubtful hold of the seams, etc., more than compensated, in their opinion, for the superior smoothness and other advantageous qualities of the alloy. The present yacht is plated from keel to rail with nickel-steel. The plating used in closing in the underbody, where a little extra weight is of little account, is fairly stout, but from the waterline up, where every pound tells against the stability of the boat, the plating is so thin that it is difficult to understand how a satisfactory bedding has been got for the countersunk heads of the rivets. The only aluminium used in the vessel has been put into the decks, whose plates are composed of an alloy which is mainly this light, but perishable metal. Taken as a whole, and allowing for the weight saved by the use of thinner metals, the shell of the boat is lighter than that of "Shamrock II," and works out at a figure very close to that of the first Fife challenger.

In a yacht of this type the spars are always deserving of special attention, as much from their great size as from the ingenuity displayed in the effort to secure the maximum of strength and rigidity with the minimum of weight. In this, Fife had the experience of the last challenger to guide him, and he has made few departures of note. The mast, gaff, and boom are of steel, the bowsprit being solid wood, and the lighter spars of hollow wood. The mast follows the idea carried out in the second spar of this kind fitted to "Shamrock II," in being mainmast and topmast in one unbroken length. The reason for this is the saving of weight and windage as compared with

the ordinary main and topmast, and the saving of weight and complication of gear as compared with the Herreshoff system of telescoping spars. All the steel spars are constructed on the same principle, a framework of light angle steel being first laid down, and bound and strengthened by a series of short straps zigzagging across the diameter of the spar. The complete skeleton is then closed by light steel sheets bent to shape and riveted.

On this occasion there has been abundance of time for the performance of the work; every detail was subjected to searching inspection, and the result is a boat that, whatever her sailing qualities may prove, should at least have none of the weaknesses which helped to mar the career of the second "Shamrock."

THE SECOND EAST RIVER RAPID TRANSIT TUNNEL TO BROOKLYN.

Plans recently submitted to the Rapid Transit Commission by their Chief Engineer for the improvement of traveling facilities in Brooklyn include the construction of a second East River tunnel from Nassau and Orange Streets, Brooklyn, to Maiden Lane, in Manhattan. The tunnel will terminate at a station near William Street, from which point two lines will be run, one across Manhattan to West Street at the foot of Cortlandt Street, and another line below William Street and diagonally beneath the Brooklyn Bridge structure to Park Row, whence it will proceed by way of Center and Grand Streets, to the Manhattan terminus of the Williamsburg Bridge. Here connection will be made between the subway tracks and the tracks which pass over the bridge. It will be seen that this second line will provide a loop for the Brooklyn railways by way of the new tunnel and the Williamsburg Bridge.

Mr. Parsons also recommends removing the elevated trains from the Brooklyn Bridge, sending them across the East River by the new route, and transferring the trolley cars from the roadways to the bridge railroad tracks, thereby restoring the roadways to the exclusive use of vehicles. It is also proposed to connect the two bridges by adding two tracks to the Second Avenue Railroad, and building a new branch of the elevated system down Delancey Street to the Williamsburg Bridge. If these suggestions are carried out, Brooklyn and Manhattan will be connected by three bridges carrying six elevated tracks and ten surface tracks, and by two tunnels carrying four tracks. The report also recommends for Brooklyn a new subway system and a development of the elevated railroad system. From Flatbush and Atlantic Avenues, the terminus of the tunnel now under construction, it is proposed to build a four-track subway to the Prospect Park plaza, with a loop at the plaza, and from this loop to carry a three-track line easterly below Eastern Parkway and East New York. Another proposed extension is to run from Flatbush and Atlantic Avenues below Fourth Avenue to Fort Hamilton. In addition to these extensions of the subway system, the report proposes no less than nine new elevated lines or extensions of existing elevated lines. The cost of these improvements exclusive of abutment damages will be about \$52,000,000; \$31,000,000 being for the subway system and \$21,000,000 for the elevated system extensions.

SPICES—PURE AND OTHERWISE.

BY A. S. ATKINSON, M.D.

Spices properly used have their value in helping digestion and stimulating the flow of the gastric and pancreatic juices, and at the same time they tempt the jaded appetite to a better relish of good, wholesome foods. But spices are not always what they are sold for; neither are they always as wholesome and harmless as they should be. The tendency to adulterate extends to nearly all our foods, and unfortunately a good many people in buying cheap foods are not getting all they bargained for.

When adulterations are wholesome or harmless, possibly the deception is not so bad, especially if we cannot distinguish by taste the genuine from the artificial. Naturally dealers and manufacturers in adulterated foods try to select harmless articles to mix with their adulterated goods. Whatever the nature of the material used for adulterating, it is always cheaper than the genuine goods. It is usually some woody substance, which when ground fine enough will pass muster without being easily detected. Thus in such spices as cloves, cinnamon, mace, allspice, nutmeg, mustard, and ginger, there are many such materials as ground cornmeal, parched wheat, peas, beans, and coffee beans, which can easily be mixed with them without changing the general appearance or even taste beyond lessening the strength. As some people like chicory in their coffee, so some people might prefer adulterated ginger and mustard to the full strength of the genuine article. If the adulteration is to be done, however, it is much more desirable that it should be done at home than in the store.

Ginger, for instance, is frequently adulterated with

pepper, mustard hulls, and turmeric. These give nearly as sharp a taste to the mixture as pure ginger would, and the effect is that the adulterated spice frequently passes unchallenged. Cinnamon has quite a variety of materials used for cheapening its retail cost. Cassia, arrowroot, mustard hulls, charcoal, burnt shells and cracker dust are all frequently ground to swell the bulk of the spice. Then in cloves we have some of these same materials, and such other articles as clove stems and hulls ground up, allspice, peas, wheat, and even mineral colors. Nutmegs, since the days of the first Yankee nutmegs made in Connecticut of white birch colored to resemble the natural ones, have been susceptible to considerable adulteration, and starch, cereals, mustard, peas, and other roasted articles go to make up ground nutmegs. Of course, whole nutmegs are hard to imitate, but even these are sometimes sold as genuine when they are nothing but wild, flavorless nutmegs.

Pepper has its weight increased with the addition of such cheap and harmless substances as bran, peas, rice, corn, charcoal, mustard hulls, sago, arrowroot, and coconut shells. None of these add any spicy flavor to the combination but they serve to enhance the profits of the maker. If one had the time to separate these different articles of adulteration and examine them carefully through a microscope, he would easily see the deception practised upon him. A good many dealers will tell you that harmless adulteration like this is liked by many people. They prefer the mixtures and blends which they put up, and therefore it does no harm. It is a good deal like coffee and tea blends which dealers mix for their customers, using cheap grades with the high grades, and then selling the results at the highest prices. This may be partly true, but no deception can be practised continually without causing some danger.

For instance, some spices act as a special poison to many people. The mere touch of ginger in one person's food is sufficient to cause nausea and great suffering. Cinnamon to another acts like a mild but quick poison, and mustard in any form will cause another to break out in red, prickling spots. All these spices when mixed together, or adulterated one with another, might be the contributing cause to a person's illness and death. For instance, the person using pepper may be easily affected by mustard, and if the pepper is adulterated with ground mustard hulls the damage is done. Ginger is sometimes mixed with mustard, and the result in using these two together might develop strong symptoms of poisoning.

One cannot afford to take into the system anything under a disguised name. The modern man and woman of intelligence have studied their diet sufficiently to know what disagrees with them, and they do not care to have anything smuggled into their stomachs under some fraudulent name. To many the chances of harm from such a source appear very remote indeed, and they discard them from serious consideration; but to others it is a matter which seems not so slight. It makes a difference whether one is in delicate health or strong and robust in flesh. The former cannot take risks that the latter might daily face in his eating with perfect impunity.

SCIENCE NOTES.

A civil war record of the height of Indiana soldiers shows that out of 118,254 there were 15,047 5 feet, 10 inches tall; 8,706 5 feet, 11 inches; 6,679 6 feet tall; 2,614 6 feet, 1 inch; 1,357 6 feet, 2 inches; 406 6 feet, 3 inches; and 330 over 6 feet, 3 inches. Commenting on these statistics, Dr. Gould, Actuary of the United States Sanitary Commission, writes: "It is evident from our statistics that the Indiana men are the tallest of the natives of the United States, and these latter the tallest of all civilized countries."

Silk is known to be the secretion of two glands of the silkworm alongside of the digestive canal. These glands, which consist of tubes in numerous coils, terminate in the spinning-wart, and open in a common orifice from which the secretion, of the consistency of honey, issues forth, promptly hardening into a thread on exposure to the air. Usually the silk is colorless on leaving the body of the silkworm, but sometimes it is straw yellow or greenish. There has been a dispute of long standing between the savants as regards the origin of this coloration. Some claimed that the larva itself produced the color, others ascribed it to impurities which it acquired upon secretion, and still others were of the opinion that the green color of the leaves of the mulberry tree was the cause of the coloring. The last-named opinion seems to be the correct one. Latterly, Levrat and Conte fed silkworms on mulberry leaves which had been saturated with non-poisonous aniline red and aniline blue. The result was that not only the silkworms turned red or blue, but they also secreted silk of the respective colors. Injections of the above-named dyestuffs into the anal organ of the silkworm produced the same result.—Die Seide.