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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.

BROADWAY TUNNEL CONTROVERSY.

The contractor for the Rapid Transit subway has himself to thank for the bitter opposition which is developing against the construction of a subway below Broadway. This opposition comes from the property holders, and it is prompted by the bitter experience of those merchants whose property has lain along the route of the subway which is now under construction. It is undeniable that the opening up of the streets and obstruction of the sidewalks incident to this work has wrought irreparable injury to the business interests affected. Now it was realized at the outset that a certain measure of inconvenience lasting for a considerable time was inevitable, and nothing could be finer than the patience with which the merchants and the general public submitted to these discomforts during the first two years of subway construction without a word of complaint. Unfortunately, the contractor for the subway has been so persistently blind to his own interests as to trade upon this complaisance, and instead of fulfilling the moral obligation that was upon him to close up the work as it was completed, and clear the streets at the earliest opportunity, he has permitted the work of cleaning up to drag along for months, and in some cases for years, longer than was necessary, and has shown a most callous indifference to the interests that were so vitally affected.

The vigorous protest which is being made against the construction of a tunnel beneath Broadway is perfectly natural; and it is a thousand pities that the contractor who started out by winning golden opinions because of the speed with which the work was commenced, should have aroused such opposition. Several of the daily papers have now combined in a campaign of opposition to a Broadway route, and one of them has come out boldly with the suggestion that the tunnel shall not be built near the surface by the "cut-and-cover" method, but that following the example of London it shall be built 60 to 80 feet below street level, with a view to avoiding interruption of street traffic during construction. Now, it may be said right here, and once and for all, that this proposition is utterly impossible of execution for the reason that for a rapid transit system to fulfill the first object of its existence, it is necessary that it should lie close to the surface and be accessible without the use of elevators. A deep-tunnel road can only be reached by elevators, and the latter, because of their limited capacity, would prove to be a hindrance to that rapid and easy flow of traffic which is the very essence of modern rapid transit. As a matter of fact, there is already a congestion at the elevators in the London service, and it has been proved that the capacity of these deep-level roads is limited by the capacity of the elevators that serve them. The rapid transit system in New York must be accessible with as little delay at stations as possible, and short of a street surface system, there is none so easily accessible as a subway that lies immediately beneath the street grade. The deep-tunnel system, therefore, may be eliminated from the problem at once and forever. They are a necessity in London; they would be a nuisance in New York.

It is a principle well recognized in our municipal improvements that the convenience of the few must ever be sacrificed to the great need of the many. The temporary derangement of traffic and loss of trade to the merchants during subway construction is deplorable; but in view of the enormous benefits ultimately to be conferred upon the city at large, it must be endured as best it may. Furthermore, the public may rest assured that if a high-level subway should be constructed beneath Broadway, there will be no recurrence of the inexcusable delay and inconvenience that has been experienced during the past two years. When the first contract for the road was let, the Rapid Transit Commissioners were not in a position to dictate hard-

and-fast terms to the contractors as to the length of time that the streets should remain open, and as to the absolute freedom of these streets from the storage of the supplies of material while construction was going on. The public must bear in mind that it was extremely difficult to secure a contractor who was willing to undertake this work under any conditions, and had the Commissioners laid it down that no material should be stored in the adjacent streets, that no derricks, compressing engines, or steam engines should be erected on the streets, it would have been quite impossible to let the contract. Now, however, with the experience gained, both by the engineers and contractors, it is possible to lay out the work and execute it with far less interference with public convenience than was possible four years ago. Thus, the contract that has been let for lower Broadway specifies that the work is not to be commenced until the whole of the necessary structural material is stored in the yards of the contractors either in this city or within easy reach of the work. Not only is the steel to be so stored, but the paving blocks and excavated material, as they are taken up, are to be carted away and stored until such time as the contractors are prepared to restore the streets to their former condition. No derricks will be permitted to be erected at street grade, but a platform will be built above the streets, resting on posts placed at the curb line, from which the whole of the work of hoisting excavated material and lowering structural steel, etc., will be carried on. While there will be a certain measure of inconvenience, it will be slight in comparison with that which has attended the work now nearing completion.

Agitation against a subway beneath Broadway is in any case premature, for the Rapid Transit Commission has not as yet decided on this route and, indeed, it is inclined to look with considerable favor upon the alternative route down Seventh Avenue. Among other reasons for this is the growing conviction that the first level beneath Broadway may be needed for other purposes. The time is approaching when it may be necessary to place the trolley car tracks in a subway, leaving the street surface entirely for vehicular traffic. This was done in Boston with most gratifying results, the congestion being at once relieved, and both the trolley car and vehicular traffic greatly accelerated. We would suggest to the merchants who may be affected by future developments, that the present case is not one for the lawyer, but for the engineer. The Rapid Transit Commission has given abundant proof that it has nothing but the interests of New York city as a whole at heart, and the merchants would do well if they selected some well-known engineer of wide experience and mature judgment, who, with their interests specially in mind, should investigate the whole question from an engineer's point of view, and then confer with the Rapid Transit Commission's engineers to determine what solution of the problem will best meet the interests of the city at large, and of the Broadway merchants in particular.

A DAY WITH THE "SHAMROCKS."

BY THE YACHTING EXPERT OF THE SCIENTIFIC AMERICAN.

In the closing days of the long series of tuning-up trials of "Shamrock III." off Sandy Hook, our yachting expert was invited by Sir Thomas Lipton to witness from the "Erin" a windward and leeward race between "Shamrock I." and the challenger. The kind courtesy thus extended proved to be particularly opportune for the reason that the conditions of wind and sea were just those which have prevailed on the large majority of the days when cup contests have taken place over the classic Sandy Hook course. There was a light but steady southeasterly breeze of from 6 to 8 knots strength which, except for the inevitable westerling, as the day wore on, held fairly true throughout the race. Furthermore, the weather conditions were exactly those for which the challenger has been designed, and under which, when she has been in her proper trim, she has shown a marked superiority over "Shamrock I." The course was laid out ten miles to windward and return, and, in spite of a slight shift of the wind as the boats were nearing the outer mark, the first ten miles were sailed dead into the wind's eye, while the last leg, owing to a still further shift of the wind to the westward, was converted in the latter part of the run into a broad reach. In view of the unprecedented gains made by the new boat it should be carefully borne in mind that the two boats were equally favored by such changes in the strength and direction of the wind as took place; for, although the wind softened as "Shamrock I." turned the outer mark, it freshened considerably just as she crossed the finish line and thus enabled "Shamrock I." to cover the intervening three miles between herself and the line in much quicker time than she would otherwise have done. At the start the challenger crossed the line a few seconds after the gun, while the older boat by crossing nearly two minutes later secured a perfectly clear wind throughout the whole ten-mile beat to windward. From the very first the challenger began to show her weatherly qualities, lying somewhat closer than the older

boat and footing considerably faster. Although the wind was so light that the lee rail of "Shamrock III." was at all times from a foot to 18 inches from the water, the small wetted surface, correct balance, and perfectly fitting sails of the boat got in their work to such good effect that the ten miles was covered in a little over an hour and a half, or at a speed of 8½ knots per hour through the water for the 13½ knots of distance that was actually covered. "Shamrock I.," in spite of the fact that she carried her largest club topsail as against the smallest club topsail which was carried on the challenger, was quite unable to hold her, and when the new boat turned the outer mark with an actual lead of 18 minutes and 2 seconds the old boat was fully 2 miles dead to leeward. The wind softened somewhat at this time, but an allowance of a couple of minutes would be ample to cover this disadvantage. As it was the challenger beat the old boat at the rate (unprecedented considering the strength and steadiness of the wind) of 1 minute and 48 seconds a mile. Even if we make the liberal allowance of 3 minutes for the lightening of the wind in the last two miles of the old boat's journey to the outer mark, there is still a credit of over a minute and a half a mile for "Shamrock III." In the homeward journey she added 4 minutes and 28 seconds to her lead, making a total gain for 20 miles of 22 minutes and 30 seconds. Had the whole 30-mile course been covered under the prevailing conditions, she would have won by 34 minutes and would have beaten the old boat to the outer mark by nearly half an hour. The full significance of these figures will be appreciated when we remember that the challenger was traveling at a speed which would have carried her over the 30-mile course nearly half an hour within the time limit of five hours in which the cup races must be finished.

During the last board to the outer mark the "Erin" was steered directly in the wake of the challenger and an excellent opportunity was afforded to study the set of her sails and the action of the boat through the water at the particular speed of 8 to 9 knots at which she was going. Regarding the former it was noticeable that for the light wind that prevailed the sheets were trimmed in very close, the main boom particularly being brought in until it was nearly amidships. The wake was surprisingly clean, and there was no visible evidence of drag, although, of course, that was scarcely to be looked for until higher speeds were reached. The convex lines of the boat seemed to be well adapted to taking the head seas which she encountered, and in this respect she showed to great advantage over "Shamrock II." which, with her flatter sections, pounded considerably harder than the new boat. It is pretty generally supposed that in "Shamrock III." Mr. Fife has designed a boat for light weather and the roll of the sea that is usually encountered off Sandy Hook, and it must be admitted that in this particular test she showed herself to be admirably adapted to these very conditions. As would be expected from her deep, round under-water body and her unusually large displacement, the scending and rolling of the boat were slow and rhythmical, and at no time did she show any of that tendency to slat the wind out of her sails which is one of the fatal weaknesses of the more shoal and beamy scow type of vessel. Mr. Iselin has stated that the only conditions under which he fears the "Shamrock" as a competitor are those of a light wind and a short sea; and certainly, the behavior of the challenger in this particular race and the effectual way in which she smothered her older sister would augur that the "Reliance" will meet a most formidable competitor whenever these conditions exist. Indeed, we are satisfied that the general estimate of the press that the defending yacht will score a sweeping victory of "three straight" in the coming contest is not borne out by a comparison of the actual performances of the rival craft. Any question as to whether the older boat was sailed to win was set at rest when her manager came aboard the "Erin;" for we have his assurance that on this, as on every occasion, everything was done to get the best speed out of the yacht. It simply was "not the old boat's weather."

In conversation with Mr. Fife subsequently of the race, we incidentally learned a fact regarding the tuning-up of the challenger which possesses great scientific interest, as proving how completely yacht designing had been emancipated from the rule-of-thumb methods of an earlier day. Mr. Fife informed us that the somewhat irregular performance of the yacht during the series of tuning-up trials of the past few weeks was due to the fact that several changes were made from time to time in the amount and trim of the loose ballast carried on the boat, with a view to the possible improvement of her speed. As the various combinations were tried it began to be evident that the best conditions for speed were those under which the boat was launched and under which she did such good work during her earliest trials on the Clyde; so true was this that in this last trial, in which she beat the old boat more decisively than ever before, every piece of ballast had been restored to the

identical position which was allotted it on the original plans from which the boat was built. One could not ask for a more conclusive tribute to the accuracy of the scientific method of design than this.

While we are satisfied that the general belief that "Reliance" is certain to take every race is quite unwarranted by the facts, it must be remembered that the performance of "Shamrock" on this particular occasion can never be repeated in the stronger winds, that is, in any strength of wind that will drive the boat at a speed above that critical point at which wave-making due to big displacement becomes a more serious speed factor than reduced skin friction due to a limited area of wetted surface. Whether "Reliance" can beat "Shamrock III." in a wind of under 8 knots strength will only be known when the boats line up in a light sailing breeze off Sandy Hook; but her tuning-up trials would indicate that she will fail to do it. That she will leave her when the wind freshens to 12 knots and the bigger displacement of "Shamrock" begins to tell against the challenger is probable, but by no means certain; while in a wind of from 15 to 20 knots strength or over the more powerful and lighter-displacement "Reliance" should have the race in hand from the moment the two boats cross the line.

PRESENT STATUS OF AMERICAN SHIPBUILDING.

Very little of an encouraging nature concerning shipbuilding or the American merchant marine in the foreign trade of the United States is to be noted in this year's Blue Book of American Shipping, which is just from the press. Rather, indeed, is foreign shipping still dwindling, since no new vessels have been ordered for this service. The Blue Book is a statistical publication and also a directory well known in shipping and shipbuilding circles throughout the country. It contains as an introduction a careful review of prevailing conditions, the most surprising of which is that not a single contract has been let in the United States for a vessel for the foreign trade of the United States during the past two years. It is a curious anomaly that a country whose exports are unrivaled among the nations of the earth has not ordered the construction of a single ship in two years to carry away its freight. Could any one thing demonstrate more clearly than this the need of government aid for shipping? Why is this feature of our trade neglected? The ability to make things to export is aided by a tariff. Why not the carrier itself? Space in a ship is a commodity. It is something made to sell. The statistics of our export trade would be vastly enriched if there could be added to them the freight earned in transporting the manufactured products.

Except on the Great Lakes, where the industry is a special one protected by the coasting regulations, there is little encouraging to report regarding shipbuilding in the United States. During the fiscal year ended June 30 last, 1,536 vessels, of 456,076 gross tons, were built in the United States, compared with 1,657 vessels, of 473,981 gross tons, for the previous fiscal year. Vessels now under construction indicate a further lessened output for the coming fiscal year. The principal decrease for the past year has been in steel steamers built on the great lakes, which number 41, of 131,660 tons, compared with 52, of 161,797 tons, for the preceding year. The previous year was the one of greatest output in the lake district. On the seaboard only 18 ocean steel steamers, of 101,471 gross tons, were built—and this was the largest output of this type in our history. Nor were these all for oversea trade. Far from it. Only five of them can properly be credited to that service—the "Finland" for the Red Star Line, the "Massachusetts," "Mississippi" and "Maine" for the Atlantic Transport Line, and the "Siberia" for the Pacific Mail Steamship Company. The Red Star and Atlantic Transport lines are now controlled by the International Mercantile Marine Company. All these ships were ordered over two years ago, and there have been no new orders to fill the plans left vacant on the stocks. A few contracts have been received by the coast shipyards for some splendid vessels for the coastwise service. These include a side-wheel passenger steamer and a freight steamer for the Fall River Line, the former to cost \$1,000,000 and the latter \$400,000, and both to be built by the Fore River Ship and Engine Company, Quincy, Mass.; a 400-foot passenger and freight steamer for the Mallory Line, of New York, and a similar vessel for the Ocean Steamship Company, of Savannah, both to be built at the Roach Shipyard, Chester, Pa.; a 300-foot steamer for the Clyde Line, to be built by the Cramps, of Philadelphia; a steamer for the Eastern Steamship Company, to be about 350 feet long; two steamers for the Ericsson Line, each 203 feet long, all to be built by the Harlan & Hollingsworth Company, Wilmington, Del.; and four dredges for government service to be built by the Maryland Steel Company, Sparrow's Point, Md. These embrace all that are of any importance.

It might be pertinent to state, since so many laymen

appear to be ignorant of it, that the coastwise trade of the United States and the foreign trade are two different things. The coastwise trade, meaning trade between United States ports, is a protected trade. Vessels of other flags may not engage in it. The past four years have marked a distinct wave of prosperity in shipbuilding for the coastwise trade; but the crest appears to have been reached, since new orders are not forthcoming.

Since the Spanish-American war naval contracts have been well distributed among the coast shipbuilders. During the year contracts for four battleships, two armored cruisers, and two gunboats have been given to them. Contracts for two more battleships are about to be given, and in addition the New York navy yard is building one battleship. Forty-one warships are at present under construction, representing a displacement of 338,948 tons, a total horse power of 415,500, and a cost for hulls and machinery of \$90,314,516.

During the year the United States Shipbuilding Company was formed to take over the plants of the Union Iron Works, San Francisco; the Bath Iron Works and Hyde Windlass Company, Bath, Me.; the Eastern Shipbuilding Company, New London, Conn.; the Harlan & Hollingsworth Company, Wilmington, Del.; the Crescent Shipyard, Elizabethport, N. J.; the Canda Manufacturing Company, Carteret, N. J., and Samuel L. Moore & Sons, Elizabethport, N. J. Later the plant of the Bethlehem Steel Company was added, Mr. Charles M. Schwab transferring it to the shipbuilding company, though retaining an issue of \$10,000,000 in bonds as an exclusive lien upon the property. In addition he received \$20,000,000 in stock, equally divided between preferred and common. It was soon found that the shipbuilding company was capitalized far beyond its tangible assets and earning power, though the subsidiary plants themselves were in a thoroughly healthy condition. The inevitable result was failure to meet the fixed charges upon its sheaves of securities, and the court was under the necessity of nominating a receiver for it. The unfortunate plight of this company is no reflection whatever upon shipbuilding as a thoroughly sound and excellent business; it is merely another evidence of the folly of supposing that values are created by artificial means. A plant is worth no more than it can earn.

A forecast of shipbuilding on the great lakes does not show many orders in abeyance. A year ago the shipyards were filled up with orders for a full year ahead. But that is not the case now. The lake shipyards, broadly speaking, are now well up with their work. If they had to do so they could probably turn out all orders on hand within six months. Those best informed, however, do not take a dubious view of things on the Great Lakes. The industry, as stated before, is special; the ships are not like other ships; the shipping is not like other shipping; the freight carried is not so miscellaneous as oversea freight, but is confined to a few items in bulk. These items are likely to continue to be moved for years in a constantly ascending scale and ships will continue to be built to carry them. Moreover, a fair part of the existing tonnage on the lakes is wooden; it is old and decaying and must eventually be replaced by new and more modern carriers. Thus the permanence of shipbuilding on the lakes is assured for many years to come, although the number of orders for the coming year will fall considerably short of the business of any of the past three years.

THE NINTH INTERNATIONAL GEOLOGICAL CONGRESS.

The Ninth International Geological Congress is to hold its sessions in Vienna from the 20th to the 27th of this month, and the convention promises to be one of the most interesting in the history of the organization. The number of excursions offered in connection with the congress is very large. There were eight given before the sessions in Vienna began: In the palæozoic region of central Bohemia; in the cretaceous areas of Bohemia; to the hot springs (Carlsbad, etc.) and the regions of eruptive rocks in the north of Bohemia, and to the district about Brünn in Moravia; to the coal region of Ostrau and the environs of Cracovie and Wieliczka in Moravia; to the oil district of Galicia; to the region of the Carpathian "Klippers" and of the Tatra; to the environs of Salzburg and Salzkammergut, and to the palæozoic and tertiary terranes of Styria. The duration of these excursions was from eight to fourteen days and all were conducted by Austrian geologists who had made special studies in the regions concerned.

Seven minor excursions to places of geological interest in the vicinity of Vienna were on the programme for days during intervals in the meetings, while twelve extended excursions, likewise under the leadership of experts, are offered to the members of the congress for the weeks immediately succeeding the closing of the business sessions. The latter are to Buda-Pesth and to the Danube region in Hungary below the capital, to the Dolomites of the Tyrol, to the

basin of the Adige in the Tyrol, to the western portion of the Hohe Tauern, to the central portion of the Hohe Tauern region, to Predazzo and Monzoni, to the Carnic and the Julian Alps, to the glacial beds of the Austrian Alps, to the glaciers of the Adige, to Dalmatia, and to Bosnia and Herzegovina. All of the extended excursions are intended primarily for the benefit of the members who are making special studies of similar regions in their own countries, hence the number of those who can participate in a stated excursion is limited to enable the conductor to give personal attention to all.

The themes set for general discussion in the meetings of the congress are those which are of world-wide interest to geologists. Saturday, August 22, will be devoted to the consideration of the crystalline schists; Monday, to the cliffs and faults produced by the action of mountain-making forces, while on Wednesday there will be given a series of lectures on the geology of the Balkan peninsula, which presents many interesting problems in the science. The other sessions of the congress will be given up to lectures and discussions of various topics of general interest.

PROF. BARNARD'S OBSERVATIONS OF THE WHITE SPOT ON SATURN.

BY MARY PROCTOR.

In the SCIENTIFIC AMERICAN for August 1, 1903, a clipping taken from an article by W. F. Denning, in Nature, concerning the white spot on Saturn, refers briefly to Prof. E. E. Barnard's observations, which were as follows:

Prof. Barnard had observed Saturn frequently for some twenty-five years, but had never seen any marking by which the rotation period of the planet could be determined; that is, he had never seen any definite spot whose motion could be detected. On June 15 a large white spot was visible, following the central meridian of the planet, but daylight did not permit an observation of its transit across the central meridian of Saturn.

On the morning of June 24, it was again observed with the 40-inch telescope (at the Yerkes Observatory), and its transit carefully determined to be at 3h. 42m. central standard time. The spot was strikingly distinct, and lay some three seconds of arc north of the Saturnian equator. Its motion was very noticeable during the time it was under observation.

It has been subsequently observed, and seems not to be so noticeable as at the first observation. Prof. Barnard hopes to obtain a good set of observations of it, for a redetermination of the rotation period of Saturn. These spots on the planet are rare, the last conspicuous one of the kind having been observed by Prof. Hall at Washington, in 1876, from which he determined the period of Saturn, which had not been determined since the time of the elder Herschel.

Since 1876, faint spots have been reported by several observers, for which periods approximating to that determined by Hall were obtained, but they were too elusive for general observation. In *Astronomische Nachrichten*, No. 388, we are informed that upon receiving the announcement of Prof. Barnard's observations of the white spot, Hartwig at Bamberg, Germany, made observations of it on June 26, when it transited at 14h. 20m., Bamberg mean time.

Later observations by Prof. Barnard prove that the period of the planet Saturn is 10h. and 39m., which is 25m. longer than the period derived by Hall from the white spot of 1876.

A NEW GOLD DISTRICT.

In the Lake Arkell district, 120 miles from White Horse, and 20 miles from the Yukon River, new placer mines are being worked, which promise to be fully as rich as the Klondike region. Prospectors were rushing to the country before the original discoverers had succeeded in staking out two or three claims. It is said that surface dirt yields 15 cents to the pan. Every man who can leave is joining the rush from Dawson, White Horse, and Skagway.

THE CURRENT SUPPLEMENT.

The process invented by the late Dr. Ludwig Mond for manufacturing illuminating and power gas from coal slack is described in the opening article of the current SUPPLEMENT No. 1441. Another technological article of interest bears the title "Manufactured Marble." In the last number of the SUPPLEMENT the contact process of manufacturing sulphuric acid was historically considered. In the present number the actual manufacturing process is described. George C. Husman tells how unfermented grape juice can be made at home, and how it should be used. Inventors will doubtless read with interest the article bearing the title "The 'State of the Art' in Patent Cases." Charles Richards Dodge tells something of the volcano of Colima. The manufacture and employment of gas from heavy oil in Germany is fully described. Dr. Emmell reviews the present methods of producing bronze colors.